A NATURAL HISTORY OF THE

BRITISH LEPIDOPTERA

A TEXT-BOOK FOR STUDENTS AND COLLECTORS

BY

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PREFACE.

If the volume under consideration be presented to my brother lepidopterists with even more misgivings than any of its predecessors, it is not because less work has been devoted to the preparation of its contents, but rather that the group dealt with is so little known and scarcely at all understood, that one feels oneself to be treading on treacherous ground at every step forward that one attempts to take to reach the light, which one knows should show somewhere out of the mass of new and old facts that we have here collected together.

An early interest in the group was somewhat stimulated by Mr. South's "Contributions" to *The Entomologist*, and, in 1887, a commencement was made to collect together the details already published on the British species of the group. These rough notes were printed in *The Young Naturalist*, and later, in 1895, were collected in book form, and published by Mr. J. E. Robson, under the ambitious title "*The Pterophorina of Britain: A Monograph*," but so crude were the notes, so superficial the treatment, so apparent our ignorance of the superfamily, and so marvellously abundant the misprints and errors scattered throughout the little work, that no sooner was it finished, and *The Natural History of the British Lepidoptera* contemplated, than the help of Dr. T. A. Chapman and Mr. A. W. Bacot was sought, fresh material was collected, the life-histories were, as opportunity offered, studied *ab ovo*, and preparation for a new volume on the superfamily was commenced. It was intended that this volume should have comprised Volume II of the series, but so slow was our progress, so difficult the work, and so hopeless seemed our efforts to form any satisfactory conclusions as to the relationships of the various Alucitid groups, that it was not till fully ten years had elapsed, that we felt in a position to commence to formulate our ignorance in the pages of Volume V.

It is, therefore, 20 years since the earliest contributions towards the material for this volume just finished, and its successor, should it ever be completed, were collected, yet, at the completion of this volume, all one can honestly say is that one feels one is just a little more fit to commence it than was the case two years ago. Our excuses for not destroying what has been done and commencing again are twofold—(1) That if we waited till we knew that we knew our subject, nothing would ever be written, knowledge would be lost, and progress impossible. (2) That at the later stage of again finishing, we should be, in our recognition of our appalling ignorance, exactly where we stand to-day. Friends must, therefore, believe us when we say that no student of the Palæarctic Alucitides can be more painfully aware, when he has carefully studied our book, than we ourselves are, of the many lapses, blanks, possible errors and doubtful conclusions, that it must contain. Still we hope that all will agree that it is an honest attempt to bring together whatever is known of this interesting superfamily, so far as the species dealt with are concerned, and that, from the details here offered, someone, less distracted by the accumulation of detail, and with a wider grip of general principles, will be able to suggest some advance with regard to the phyletic relationships of the genera and species with which we have here attempted to deal.

We have, here and there, in seeking for facts by means of which to explain some of the difficulties presented by the species of our British fauna, been compelled to study material from foreign countries, but, as has already been noticed in our account of other groups, we have, in Britain, representative species of almost all the main Palæarctic groups, *e.g.*, *bennetii* among the Agdistids, *lithodactyla* among the Oidæmatophorids, *paludum* among the Buckleriids, and so on. This is, perhaps, not altogether an unmixed evil, for, although it tempts the purely British collector a little out of the narrow path to which he strangely loves to confine himself, it allows one, on the other hand, to strike out a little as it were, and formulate some general suggestions that may prove of some small value as a foundation for similar work outside our own, and comprising at least the whole of the Palæarctic, Alucitid fauna.

There are many points in this volume to which the collector, apart from the biological student, will possibly take objection. The mere necessary insistence on the proper name for the group, the treatment of the Agdistids from the larval and pupal standpoints, the cutting up of the superfamily into small natural groups of similar structure, the creation of many new genera to represent these groups, and other similar points will afford sufficient food for the criticism of the dilettanti apart from the serious student. But who will say that our treatment of the Agdistids is not necessary, unless we be prepared to go on for ever assuming that the Agdistids form a little genus of closely-allied species, that only a few specialists ever try to separate, because of their superficial similarity in the imaginal stage. This method is perhaps simple, but it is not scientific, and we trust that someone, well placed for a study of this interesting little group, will soon give us a well-digested summary of the species contained therein, on a sound phyletic basis. Even the Platyptiliids are not at all so homogeneous as their imagines would lead one to believe, and *Eucnemidophorus* and *Amblyptilia*, characteristic Platyptiliids in their imaginal stages, present structural features in the pupal and larval stages, that are not at all easy to understand, and make their real relationship to each other and the remaining Platyptiliids, a matter of more than ordinary difficulty to explain with satisfaction. The Stenoptiliids, too, the species of which form a very homogeneous little group *inter se*, with very distinct Platyptiliid characteristics, are very difficult to locate on phylogenetic grounds with the remaining Platyptiliid sections. The Oxyptiliids, however, present the greatest difficulties of all, difficulties that are not lessened by our comparative (often absolute) ignorance of the structural features of the early stages of some fairly common species. Here we find species, *e.g.*, *distans* and *laetus* so similar in the imaginal stages, that the eye refuses to separate them, yet so different in their larvæ and pupæ, that ordinarily one would be justified in placing them in different genera. We have, in our account of *Oxyptilus parvidactyla*, the life-history of which is published for the first time in Britain, utilised, not only British larval and pupal material, but also similar material from the south of France; yet, an indication of difference in the character of the larval tubercles, leads us to suspect that this supposed southern *parvidactyla* is referable to the so-called var. *marginellus*, and that the latter is possibly a distinct species, as Zeller half-a-century ago surmised. We also found, from a study of the early stages, a wide difference between *Capperia* (*heterodactyla*) and *Oxyptilus* (*parvidactyla*) in spite of the similarity of the imagines in everything but size; whilst a study of the ♂ genital organs shows a great separation between *Buckleria paludum* and *Stangeia siceliota*, two species, often, on the strength of the similarity of their wing-structure, placed in the same genus. Of *O. pilosellae* we know practically nothing, and we have never yet been able to tell, by breeding, whether the insect we get in Britain is really the same that Zeller reared from *Hieracium*. Chapman's discoveries of great differences in the ♂ genital organs of the otherwise almost inseparable species of *Marasmarcha* are most striking, and open up quite new ground in the specific determination of what have hitherto been considered of little more than doubtful local races. Distinct differences in the ♂ genital organs of *Amblyptilia cosmodactyla*, Hb. (*acanthodactyla*, Tr.), and *A. punctidactyla*, Haw. (*acanthadactyla*, Hb.), of *Gillmeria pallidactyla* and *G. ochrodactyla*, leave no manner of doubt of the specific distinctness of these erstwhile dubious pairs of species, whilst, on the other hand, the almost complete similarity of these organs in *Adkinia zophodactyla*, *A. coprodactylus* and *A.* var. *pneumonanthes*, makes one, in a small degree, somewhat less certain of their specific distinctness, yet the comparative ease with which one discriminates the imagines of these species leaves one in no real doubt that they are abundantly separate.

We may here note that, since this volume has been completed, Mr. G. F. Mathew has discovered *Adkinia graphodactyla* var. *pneumonanthes* to be a British species. About this species, *quâ* species, *i.e.*, as *graphodactyla*, there is very grave doubt, and it is not easy to say certainly what was *graphodactyla*, Tr. The original description was made from specimens bred from larvæ found feeding on *Gentiana lutea*, taken by Freyer in the Bavarian Alps, the only species since bred from this plant being certain gigantic Adkinias reared by Chapman from larvæ found thereon at Larche, in the Basses-Alps. Later larvæ, taken by Freyer, near Augsburg, on *Gentiana verna*, were possibly those of *coprodactylus*, and not *graphodactyla* to which they were referred. Frey's *graphodactyla*, now in the British Museum collection, are apparently first brood *pneumonanthes*, his *plagiodactylus* being merely specimens of the second brood. Specimens sent from Staudinger and Bang-Haas to Chapman, as *graphodactyla*, are certainly *pneumonanthes*, but Chapman has a doubtful specimen from the "Barrett collection," labelled as coming from Zeller, that may be the original species, and Hofmann states, in his *Deutsch. Pterophorinen*, that he has bred it from *Gentiana asclepiadea*. Still, it seems necessary here to mention that, to us at present, *graphodactyla*, as apart from *pneumonanthes*, is somewhat of a myth.

There have been, undoubtedly, two masters in this group, whose work stands unrivalled, and far beyond that of any other workers. These are Zeller and O. Hofmann. The work done by these two men may be taken as a sound basis for all future work. Test it as deeply as one will, one is struck with its sterling excellence, and one particularly wonders how, with the scanty material at hand, Zeller always came so straightly and directly at the truth, and how Hofmann's keenness accurately detected phylogenetic affinities, as it were, by instinct.

For ourselves, there is little to be said. Such value as this volume presents is particularly due to those two earnest collaborators, who, for the past nine or ten years, have patiently worked away at the life-histories of such species as have incidentally come to hand. More recently, Mr. A. Sich has done good service in the same direction, whilst it is also to his further kindness, and that of Mr. Stanley Edwards, that the work that has been published by foreign lepidopterists has been made much more directly and easily accessible. Mr. E. Bankes and Mr. J. Ovenden have done splendid service in collecting material in the field, and the former has, in addition, most carefully and conscientiously read proofs, and attempted to keep us in the right path, where stumbling was easy, during the course of the work through press, indicating and clearing up many doubtful points where our own information was at fault. To Mr. Gillmer we owe our "distribution lists" for Germany and Austria, and which, *pace* our critics, we still believe have an important duty to perform. Our ignorance of the distribution of almost all the species dealt with, even in Britain, is amazing, and one can only say that, on the continent, it is still, as a rule, much worse. In France, Spain, Italy, Russia, and the south-eastern corner of Europe, one can safely assert that nothing really is known of the distribution of the Alucitids. It is true that here and there limited lists of species are recorded as occurring in certain restricted districts of France and Italy, and that Nolcken has noted those of the Baltic provinces, but no approximately complete details are available for any of these countries. Chapman has discovered *Capperia heterodactyla* and many other hitherto unrecorded species in Spain, we have ourselves found many species, including *C. distans*, etc., in southern France, and Zeller found an excellent "plume" fauna in limited parts of Italy, but we want someone now to do for France, Spain, Italy, Austria, Russia, and the various countries of the Balkan peninsula, what Frey long since did for Switzerland, Wallengren for Scandinavia, Crombrugghe de Picquendaele for Belgium, Snellen for the Netherlands, etc., though the lists of the first and last of these might now well be brought up to date. On the whole, it may be said that we have a fair knowledge of the "plumes" of central and north-western Europe, but the south-western, southern, and eastern districts of the continent still remain largely an "unknown" land, that cannot be well, or at all completely, worked by those English and German "trippers" who, like ourselves, spend a day or two here and there, in the short summer holidays, enjoying the beauties and picking up the treasures, that only a native lepidopterist can collect satisfactorily, successfully, and really well. But even the "trippers" do not help all they might, for many, even now, do not add "plumes" to the "larger fry" they so diligently bring together in their summer "bag."

This volume contains only the Platyptiliid branch of the "plumes," so that our account of the Alucitid branch of the "plume" phylum still remains unpublished. We have a large amount of material that, with our limited leisure, will take some considerable time to arrange, work up, and see through the press. In the meantime, we should be glad of any and every detail bearing on the species yet to be worked out. With regard to the publication of these less known groups, another difficulty faces us. Our subscription list does not increase, and, in spite of all our labour, it would appear that such detailed studies as ours are so worthless as not to be of sufficient value to pay the printer and binder for producing them. Many friends praise our work, borrow the volumes, use them as books of reference, but fail to support the undertaking sufficiently to make it clear expenses. Are there no large provincial libraries in which our lepidopterists are sufficiently interested to see the work placed ?

For the two " general " chapters with which this volume opens, we have chosen the subjects of "Hybridisation" and "Mongrelisation" in lepidoptera. These subjects have so close a bearing on the question of "Species" that we make no excuse for bringing forward, into an easily accessible form, the greater part of the matter already published on these subjects. The wide interest now being taken in the broad principles of "variation," "fixation of forms," "species-development," "heredity," etc., is enough to make chapters of this kind of more than passing interest, and to give them considerable value in the eyes of the biologist, as well as the lepidopterist, pure and simple. We do not claim to have exhausted the recorded accounts, but we have obtained all that were known and available to us at the time they were written and printed (now so long ago as October, 1905). In order to include some more recently recorded facts we have added an " Addendum " to our earlier chapter on " Hybridisation."

For the compilation of the " Synopsis of Contents " and the "Index" we are indebted to the great kindness of Mr. H. J. Turner, who at once responded to our request for help in this direction, whilst for the plates illustrating some of the structural details we are again indebted to the great generosity of Dr. T. A. Chapman, who, in addition, has given us sufficient copies of a chromo-lithograph plate, illustrating the early stages of *Buckleria paludum*, to supply each of our original subscribers with a copy.

That the volume will obtain as satisfactory a reception from, and prove as useful to, scientific lepidopterists as its predecessors, and that the work will help forward, on scientific lines, our favourite study, is the earnest wish of the author.

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ALUCITIDES.

BRITISH LEPIDOPTERA.

CHAPTER I.

HYBRIDISATION IN LEPIDOPTERA.

The subject of hybridism is one of the most interesting of the experimental branches of biological work that entomological science presents. The fixity of specific forms in nature within the limits of specific variation, the specialisation of their various habits, the regularity with which ♂ s select the ♀ s of their own kind for purposes of procreation, however many and closely-allied may be the number of other species on the same ground, and the rarity of crosspairing in nature, so far as observation has gone, between forms believed to have specific rank, have resulted in the purity of specific forms, and the expectation of finding such to be a fixed point in the study of a species in the wild state.

It is true, however, that, in nature, one or two groups, of which the Anthrocerids are the best known to us, are supposed not to maintain this purity of strain, and the consideration of hybridism between the species in question becomes somewhat involved owing to the fact that one occasionally (frequently compared with the rarity of the occurrence in other groups) finds wild insects believed to belong to different species paired, and, in confinement, well-defined species have been successfully crossed and intercrossed, some at least having been proved to be freely fertile *inter se*. In spite of this, however, the finding of any examples in nature that cannot at once be referred to a known species, is an exceedingly rare occurrence, and one suspects that Standfuss' acceptation of a wide range of hybridism in this group in nature (*Handbuch*, etc., pp. 55-56) is quite unwarranted; at any rate, it is absolutely contrary to our experience (although we have occasionally found instances of cross-pairing) which bears out absolutely Oberthür's statement (*Bull. Soc. Ent. de France*, 1897, p. 257) that out of above 6000 picked Anthrocerids in his collection, he has only two that might be possibly hybrid forms, and these he doubts. Our experience is similar, and, apart from a possible hybrid origin of *Anthrocera hippocrepidis*, Stphs. (*stephensi*, Dupont) (*Ent. Rec.*, ix., pp. 103-107), we have only seen a single specimen that could possibly be a hybrid, out of some thousands captured. With Oberthür we believe wild Anthrocerid hybrids to be exceedingly rare, and, before accepting any general statements to the contrary, should require exact data and absolutely reliable evidence.

Some thirty years ago it was accepted as an article of entomological faith that, even if hybrids of first-crosses were obtained, the hybrids were sterile and unable to produce further progeny, yet, at the time, few facts could be brought forward in support of the general belief, although vague statements like that of House, concerning *Smerinthus* hybr. *hybridus* (quoted *anteà*, iii., p. 449) were freely stated and accepted. House asserted that some examples of this hybrid bred by him appeared "to be as nearly intermediate between the sexes as between the species, and evidently to partake of the nature of both sexes," etc., yet one, when examined critically by Westwood, was pronounced to be a ♂; certainly those in our own collection (bred by Kirk) consist of four ♂s and one ♀. Pierce, too, examined the genitalia of the hybrids bred by Bacot, and found that the apparently ♂ specimens possessed distinctly ♂ organs (*anteà*, iii., p. 390). In spite of this, experiments on a large scale have shown that the impression, on the whole, was a fairly correct one, although it has been proved, especially in the case of ♂ hybrids, to be incorrect in many cases. Some of the earliest experiments showing that certain hybrids were more or less fertile, *inter se*, were discounted by the superficial criticism that, if the progeny was fertile, then the species crossed were not truly distinct specific forms, *e.g.*, Wallace, in 1866, recorded (*Ent. Mo. Mag.*, ii., p. 240) that *Philosamia cynthia* and *ricini* (=*lunula*), although differing remarkably in all their stages, feeding on very different plants, and natives of different countries, would hybridise freely, the hybrids being not only fertile among themselves, but also with either of their original parents. Watson, repeating the facts of the fertility of hybrid *P. cynthia* and *P. lunula* (*ricini*), asserts (*Entom.*, xxvi., p. 174) that *lunula* (=*ricini*) "is merely the Burmese local polyvoltine, or many-brooded, variety of the common *cynthia*," thus reducing *lunula* (*ricini*) to varietal rank, and follows this up with the extreme statement that "it is quite the rule for hybrids to be infertile," that he "only knew of one hybrid moth depositing ova," and that he "very much doubted that these, if fertilised, could produce larvæ." Watson would evidently, from his further statements (*op. cit.*, p. 173), make the fact of a ♀ hybrid moth producing ova, and a ♂ hybrid spermatozoa, the sole test of distinctness in the parent species. If "the absence or presence of eggs in ♀ hybrids conclusively proved," as he says they should, "the *bona fides* of the parents to rank as species or varieties," we should by this time find it necessary to reduce *Philosamia cynthia* and *P. lunula*, *Saturnia pavonia*, *S. spini* and *S. pyri*, *Clostera pigra*, *C. curtula* and *C. anachoreta*, *Anthrocera lonicerae* and *A. trifolii*, *Tephrosia crepuscularia* and *T. bistortata*, &c., to varietal rank, which might not meet with general approval.

The older naturalists considered that hybrids had been specially endowed with sterility in order to prevent their confusion, and it is clear to the most casual observer that, had the various species been able to cross freely, they could not maintain their distinctness, especially when several close allies are localised in a restricted space. The failure of such species to cross is, however, dependent on many things, of which actual inability to pair is probably rarely, if ever, the most important, for there are occasional records of pairing not only between closely allied, but also between most distantly related, species, even those belonging to different superfamilies, between which it would be idle to suppose that hybrid progeny could result. From our British magazines we cull the following records of actual crosspairings found in nature—*Euchloë cardamines* ♂ × *Bapta taminata* ♀ (*Entom.*, xxi., p. 188), *Dryas paphia* ♂ × *Zephyrus quercûs* ♀ (*Entom.*, xxvii., p. 26), *Attacus cecropia* ♂ × *Sphinx ligustri* ♀ (*Entom.*, xix., p. 136), *Hybernia marginaria* ♂ × *Taeniocampa pulverulenta* ♀ (*op. cit.*, xxix., p. 166), *Epinephele ianira* ♂ × *Aglais urticae* ♀ (*Ent. Mo. Mag.*, vi., p. 95), *Aglais urticae* ♂ × *Epinephele ianira* ♀ (*Entom.*, xxxiii., p. 224), *Eurytela hiarbas* ♂ × *Neptis agatha* ♀ (*op. cit.*, xxxv., p. 242), *Hybernia marginaria* ♂ × *Tephrosia bistortata* ♀ (*op. cit.*, xviii., p. 150), *Epinephele ianira* ♂ × *Enodia hyperanthus* ♀ (*op. cit.*, xix., p. 230), *Porthetria dispar* ♂ × *Lymantria monacha* ♀ (*Ent. Wk. Int.*, viii., p. 141), *Spilosoma fuliginosa* ♂ × *Arctia caia* ♀ (*Entom.*, xxx., p. 24), *Hybernia marginaria* ♂ × *Nyssia hispidaria* ♀ (*Ent. Rec.*, iv., p. 156), *Orrhodia vaccinii* ♂ × *Miselia oxyacanthae* ♀ (*Entom.*, xxi., p. 188), *Charaeas graminis* ♂ × *Noctua xanthographa* ♀ (*Ent. Rec.*, ii., p. 201), *Xylophasia monoglypha* ♂ × *Hadena trifolii* ♀ (*Entom.*, xxi., p. 282), *Taeniocampa stabilis* ♂ × *T. gothica** ♀ (twice) (*op. cit.*, xxi., p. 158 ; xxix., p. 166), *Noctua c-nigrum* ♂ × *N. xanthographa* ♀ (*op. cit.*, xxxi., p. 279), *Taeniocampa stabilis* ♂ × *T. munda* ♀ (*Ent. Rec.*, viii., p. 36), *Colias hyale* ♂ × *C.* var. *helice* ♀ (*Ent. Mo. Mag.*, xxii., p. 168). Standfuss records (*Handbuch*, &c., p. 59) many others, of which some are also very peculiar. Thus we find—*Noctua baia* ♂ × *Leucania pallens* ♀, *Hybernia marginaria* ♂ × *Orrhodia vaccinii* ♀, *Porthetria dispar* ♂ × *Pieris brassicae* ♀, *Pieris napi* ♂ × *P. brassicae* ♀ (*teste* Caradja), *Polyommatus corydon* ♂ × *P. damon* ♀ (Wiskott), *Rusticus* var. *argulus* ♂ × *R. lycidas* ♀ (*teste* Schulz), *Melitaea athalia* ♂ × *M. deione* ♀, *M. parthenie* ♂ × *M. deione* ♀ (*teste* Caradja), *M. didyma* ♂ × *M. aurinia* ♀ (*teste* Honegger), *M. dictynna* ♂ × *M. athalia* ♀, *M. athalia* ♂ × *M. parthenie* ♀ (*teste* Standfuss), &c. The close alliance of some of these Melitæas makes one feel that one would like to have seen the paired specimens. On the whole, however, one is forced to the conclusion that pairing between very closely allied species in nature is exceedingly rare. Further pairings noted by Standfuss are—*Syntomis phegea* ♂ × *Anthrocera filipendulae* ♀, *Syntomis phegea* ♂ × *Anthrocera carniolica* ♀ † (*teste* Turati), *Adscita statices* ♂ × *Rhagades globulariae* ♀ (*teste* Standfuss), *Dendrolimus pini* ♂ × *Lymantria monacha* ♀ (*teste* Donitz), *Orthosia pistacina* ♂ × *Miselia oxyacanthae* ♀ (*Ent. Nach.*, 1878, p. 20) ; Oberthür notes having seen (see *anteà*, i.,

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* The reciprocal cross of the species, *viz.*, *Taeniocampa gothica* ♂ × *stabilis* ♀, has resulted in fertile ova and larvæ (*Ent. Record*, xvii., pp. 160-161).

† One of the most remarkable records is that made (*Soc. Ent.*, xviii., p. 121) by Doleschall, in which he makes the astounding statement that, in August 1891, he captured a ♂ *Syntomis phegea* and ♀ *Anthrocera purpuralis*, *in cop.*, kept the pair alive and obtained ova, from which larvæ in due course resulted ; that finally he bred a ♂ imago which differed in no way from the ♂ of *S. phegea*. We have already criticised (*Ent. Rec.*, xiv., p. 353) this record, and pointed out the only possible explanation, *viz.*, that the sexes were the opposite of those named, the *phegea* being ♀, and further, that it had already been fertilised by a ♂ of its own species. The fertilisation of a ♀ Anthrocerid by a ♂ Arctiid, belonging as they do to entirely different lepidopterological stirpes, appears to us to be absolutely impossible.

p. 387) *Anthrocera filipendulae* paired with a *Procris*. Pairings that have been effected in confinement, even if the eggs have proved infertile, will be dealt with in connection with our notes on the various superfamilies.

It would appear that, in confinement, closely allied species belonging to certain groups pair more readily than those belonging to others, and the production of hybrid progeny from such has been frequently recorded. To what extent actual alliance between the parents is required to produce fertile ova, and subsequent progeny, is not known, but hybrid progeny has thus far only been produced between quite closely allied species; the most distant that have produced fertile eggs and subsequent larvæ (which, however, did not produce imagines), appear to be *Saturnia pavonia* ♂ × *Graëllsia isabellae* ♀. Pairings like that of *Attacus* (*Platysamia*) *cecropia* ♂ × *Sphinx ligustri* ♀ (*Entom.*, xix., p. 136) are foredoomed to failure. It may be well to note here that the question of infertility (which Darwin calls sterility) between two distinct species when first crossed, appears to us to belong to an entirely different class of biological phenomena from the sterility of hybrids, the product of such a cross.

We may assume as a fact, that the organs of reproduction (external and internal) of any two pure species with which a cross is attempted, are normally perfect anatomically and functionally, and that the female is primarily capable of laying her normal number of eggs. That she should not lay her normal number of eggs if the ♂ of another species pair with her, suggests that such pairing has adversely affected her ability to lay all the eggs that she otherwise would have laid. There is some evidence tending to suggest that certain ♀ s have had their egg-laying power decreased by cross-pairing, although most lay their ordinary quantum of eggs. Again, capable as the eggs are of being fertilised given suitable spermatozoa, and capable as the spermatozoa may be of fertilising given suitable ova, it is certain that the eggs laid by a ♀ crossed by a ♂ of another species, are frequently wholly, or in great part, infertile, among all but the most closely allied species. It is advisable, however, not to too hastily assume that attempted crossings are ineffectual, and the experience of Standfuss illustrates the difficulty of drawing conclusions from an insufficient number of experiments or trials. Reference to his account (*Handbuch*, &c., pp. 60-61) of the crossing of *Malacosoma neustria* ♂ × *franconica* ♀, shows that, of 24 trials made, the results gave every transition between complete absence of issue, and the deposition of eggs normal in numbers and in fertility, failure being, in some instances, according to Standfuss, plainly due to inadaptability of the genital apparatus.* Again, in 1894, Caradja obtained six crossings of *Spilosoma mendica* ♂ × *luctuosa* ♀; all the ♀ s laid good batches of eggs, but whilst five of them were infertile, the sixth, consisting of 335 eggs, produced 141 larvæ (the eggs first laid being those that hatched). Chapman, too, obtained (*Ent. Rec.*, ii., p. 83) readily enough at the first trial, fertile eggs of *Amphidasys strataria* × *betularia*, yet all his later attempts failed. Similarly, in the Tephrosiid hybrids (*Trans. Ent. Soc. Lond.*, pp. 17-42) it was found that the intercrossings

* This explanation, considering that some pairings produced the normal number of fertile eggs, clearly involves the assumption of considerable variation in the genital apparatus, of which, however, Standfuss gives no evidence.

of two species (*Tephrosia crepuscularia* and *T. bistortata*) might result in every possible intermediate stage of fertility, from complete sterility to the production of the full number of fertilised eggs. These extreme results may even happen when dealing with different individuals of the same brood. Failure, therefore, in a few individual cases must not be taken as proving that any particular cross is infertile, and it is, at any rate, clear from this, that many trials are necessary before it can be assumed that any cross is positively infertile. Standfuss found the usual range of fertility in *Malacosoma neustria* × *franconica* to extend from 0 to 50 per cent. of the eggs, but the most successful pairing produced 90 per cent. He believes that absolute impossibility to obtain fertile eggs only occurs when the pairing is between sexes belonging to widely different genera, *e.g.*, *Smerinthus* and *Sphinx*, *Syntomis** and *Zygaena* (*Anthrocera*), *Dimorpha* (*Endromis*) and *Aglia*, *Aglia* and *Saturnia*. In such cases he considers failure to be inevitable.

Failure to obtain fertile eggs by crossing two species really may occur between very closely allied species, if they have specialised greatly away from each other in some particular character, and the reason for failure may be very different in different cases. That species of comparatively distant affinities may produce fertile ova is proved, as we have already pointed out, by Standfuss' results with *Saturnia pavonia* ♂ and *Graëllsia isabellae* ♀, from which crossing he reared larvæ to the second moult. Some of the reasons for failure that occur to us are: (1) Unsuitability of the genital organs to allow effective pairing. (2) The failure of the spermatozoa to be deposited in the receptacula seminis. (3) The inability of the spermatozoa to enter the micropyle of the egg. (4) The unsuitability of the protoplasmic elements (spermatozoa and germ) to combine to form an embryo. (5) The inability of the embryonic structures to blend, owing to the great difference in the structures. (6) A want of synchronism in the sequence of time at which the various embryonic changes in development occur. Or, as Standfuss summarises the reasons of failure, they must be sought in (1) External morphological or anatomical conditions, (2) Microscopic histological structure, (3) Molecular differences.

When the greater part of a batch of eggs is fertilised by the spermatozoa of another species, and the eggs undergo a certain amount of development, it follows that the failure to produce a living larva does not lie in the functional inability of the spermatozoa, but to some one or other of the other causes noted. In some cases, the embryonic development ceases in the early stages of growth, in others, it goes on and the embryo is developed into a larva, and yet none, or only a few, of the latter may hatch. This imperfect development appears, of course, to be primarily due to the fact that the conditions of the egg are unsuitable to the development of the embryo, which has only one-half the constitution and nature of the ♀ parent (that laid the egg), that of the ♂ parent being possibly entirely different, and hence leading to the early death of the embryo. In the case of the larva becoming fully formed in the egg, failure to hatch may be due to (1) The embryo

* *Syntomis* and *Anthrocera*, in spite of the similarity of wing-markings, are exceedingly distant from one another. The former belongs to our Noctuo-Hepialid ("upright-egged") stirps, the latter to the Sphingo-Micropterygid ("flat-egged") stirps.

being too weak to eat its way out of the egg, (2) The eggshell being too thick (or otherwise unsuitable) for the jaws of the hybrid larva to work on. These are, of course, physical conditions, quite independent of the phenomena that one has to consider when the eggs of actual hybrids are proved to be sterile, for, in this case, the reasons adduced above must be largely inadmissible, and one suspects that actual weakness of the embryo is generally the prevailing cause.

Recent experiments have gone to prove that the external reproductive organs of hybrids are usually perfect in structure, especially those of the ♂ s (see *anteà*, vol. iii., p. 390), although, compared with pure species, there is certainly a great tendency to an admixture of imperfectly developed ♂ and ♀ sexual organs internally, producing what is known as gynandromorphism, especially in specimens which are largely in external structure and appearance ♀ s. Such specimens are, of course, alike in true species and hybrids, necessarily sterile. We are still, however, much in the dark as to how far the sexual organs themselves are functionally impotent, as Darwin avers, when perfect in structure, but it is quite clear that they are not so to anything like the extent assumed by the older biologists, and that ♂ hybrids are frequently, abundantly and freely fertile with ♀ s of either parent species, *e.g.*, *Saturnia* hybr. *emiliae** ♂ × *pyri* ♀ ; *S.* hybr. *emiliae* ♂ × *pavonia* ♀ ; *S.* hybr. *bornemanni* ♂ × *pavonia* ♀ ; *S.* hybr. *bornemanni* ♂ × *pyri* ♀ ; *S.* hybr. *bornemanni* ♂ × *spini* ♀ ; *S.* hybr. *standfussi* ♂ × *pavonia* ♀ ; *S.* hybr. *schaufussi* ♂ × *pavonia* ♀ ; *Anthrocera* hybr. *fletcheri* ♂ × *lonicerae* ♀ ; *A.* hybr. *fletcheri* ♂ × *trifolii* ♀ ; *A.* hybr. *worthingi* ♂ × *lonicerae* ♀ ; *A.* hybr. *worthingi* ♂ × *trifolii* ♀ ; *A.* hybr. *complexa* ♂ × *trifolii* ♀ ; *Clostera* hybr. *raeschkei* ♂ × *anachoreta* ♀ ; *C.* hybr. *difficilis* ♂ × *curtula* ♀ ; *C.* hybr. *facilis* ♂ × *anachoreta* ♀ . Female hybrids, too, are occasionally fertile when crossed with a ♂ of one of the parent species, *e.g.*, *Spilosoma* hybr. *viertli* ♀ × *mendica* ♂ ; *S.* hybr. *hilaris* ♀ × *mendica* ♂ ; *Antheraea* hybr. *perny-yama* ♀ × *pernyi* ♂ ; *Anthrocera* hybr. *fletcheri* ♀ × *lonicerae* ♂ ; *A.* hybr. *fletcheri* ♀ × *trifolii* ♂ ; *A.* hybr. *worthingi* ♀ × *lonicerae* ♂ ; *A.* hybr. *complexa* ♀ × *lonicerae* ♂ ; *Saturnia* hybr. *schaufussi* ♀ × *pavonia* ♂ ; *Tephrosia* hybr. *ridingi-suffusa* ♀ × *crepuscularia* ♂ , and this may be so even when the hybrids are not apparently fertile *inter se*. On the other hand, some hybrids are fertile *inter se*, *e.g.*, *Anthrocera* hybr. *worthingi* ; *A.* hybr. *fletcheri* ; *Philosamia* hybr. *wallacei* ; *Saturnia* hybr. *schaufussi* ; *Clostera* hybr. *prima* ; *C.* hybr. *inversa* ; *Tephrosia* hybr. *ridingi* : *T.* hybr. *ridingi-suffusa* ; *Spilosoma* hybr. *seileri* ; *S.* hybr. *hilaris*.

Very few ♂ s and ♀ s of related hybrids have been crossed, but *Anthrocera* hybr. *worthingi* and *A.* hybr. *fletcheri* and *Tephrosia* hybr. *bacoti-suffusa* and *T.* hybr. *ridingi-suffusa*, are quite fertile *inter se*, and *Saturnia* hybr. *bornemanni* ♂ × hybr. *schaufussi* ♀ has been successfully reared to the imaginal state, all of which goes to prove that hybrids are not necessarily, and by the mere fact of their being hybrids, sterile, but that ♀ hybrids appear to be much more frequently functionally impotent than ♂ s. Recent evidence bearing on the subject goes far to suggest that the sterility of first crosses, and hybrids of allied species, is due

* We are inclined to disagree with this form of nomenclature, adopted first by Standfuss and other entomologists, since it tends to obscure the ancestry of the forms dealt with, and so, to make the names intelligible, we have added a complete list of the hybrids mentioned, with their parentage, at the end of this chapter.

rather to difference of function or difference of habit in the parent species, than to any marked difference of structure in the genital organs brought about by natural selection for the purpose of keeping the species separate. To this extent, recent experiment supports Darwin that sterility, so far as it exists, has not been effected through natural selection ; that such sterility is, however, at all so general as was supposed by Darwin, is, as already noted, much open to question. Experiments on hybridising lepidoptera, also, tend to prove that, contrary to Darwin's conclusion, it is the ♀ element that is more liable to be affected than the ♂, many ♂ hybrids being functional when their ♀ s appear to be absolutely sterile.

The difference in the fertility of the various hybrids that have been reared by various experiments, *e.g.*, the absolute fertility of *Anthrocera* hybr. *fletcheri*, and its reciprocal cross, *A.* hybr. *worthingi*, compared with the absolute sterility of *Biston* hybr. *pilzii* and its reciprocal *B.* hybr. *hünii* or *Smerinthus* hybr. *hybridus* and its reciprocal *S.* hybr. *inversa*, is explained by Standfuss as being due to the varying degrees of physiological divergence between the parents of the hybrid, *i.e.*, that the different pairs of species are related to each other in very varying degrees. Concerning this he points out that, beginning with pairs of species with which crossings may be effected, without, however, the capacity of producing offspring, and with such degree of relationship that hybrid offspring could be obtained, but apparently without sufficient vital energy to maintain life, *e.g.*, *Malacosoma castrensis* × *franconica*, *Saturnia pavonia* × *isabellae*, there existed many steps to a higher and higher physiological affinity between the various pairs of species, on which experiments had so far been made, until, at last, although not to a very high degree, hybrids were found capable of reproduction, *e.g.*, *Drepana* hybr. *rebeli*, *Clostera* hybr. *prima*, *C.* hybr. *inversa*. In other cases, the ♂ hybrid has been found capable of fertilising a female of one or other of the parent forms, *e.g.*, *Saturnia bornemanni* ♂ × *pavonia* ♀, *S. emiliae* ♂ × *pyri* ♀, *C.* hybr. *raeschkei* ♂ × *anachoreta* ♀, etc., whilst, in still rarer cases, the ♀ hybrid has been fertilised by a male of one or other of the parent forms, *e.g.*, *Antheraea perny-yama* ♀ × *pernyi* ♂, *Saturnia schaufussi* ♀ × *pavonia* ♂. Beyond this stage we reach the few cases of absolutely fertile hybrids such as *Anthrocera* hybr. *worthingi*, *A.* hybr. *fletcheri*, *Philosamia* hybr. *wallacei*, *Clostera* hybr. *prima*, *Tephrosia* hybr. *ridingi* whose ability to continue their own kind appears in confinement only to be limited, as in the case of pure species, to the exigencies of in-breeding and similar adverse circumstances. Standfuss concludes from his experiments that "a lengthy period of existence, phylogenetically speaking, of the divergence between nearly related types, is in no way connected with the higher degree of difference on the lines of biological, physiognomical and physiological characters, between pairs of species which have been divergent for a less period even when nearly related groups of species are in question. The long separated *Saturnia pavonia* and *S. spini* are, in most of their characters, less separated from each other than the later formed *S. pyri* from either of them."

The comparative impotence of ♀ hybrids compared with ♂ hybrids appears to be largely due, as already noted, to gynandromorphism, which manifests itself largely in the intermixture of ♂ sexual elements among the more or less normally or abnormally developed ♀ sexual organs. Pierce has shown by dissection (*anteà*, vol. iii., p. 390; *Ent. Rec.*, x., pl. iii., fig. 4) that the male sexual organs of *Smerinthus* hybr. *hybridus* are quite normal in structure, although differing from those of either parent, thus supporting the examination made by Westwood (*anteà*, vol. iii., p. 452), whilst those of the ♀ exhibited (mixed up with the ♀ lobes) the rudimentary and partially developed organs of the ♂, the whole apparatus being much smaller than that of the parents (*Ent. Rec.*, x., p. 189). Although ova were discovered in the body, the specimen appeared to be quite incapable of reproduction (Pierce, *anteà*, vol. iii., p. 453; see also general references to this matter, vol. iii., pp. 449-453). Among the Malacosomas, too, Standfuss states (*anteà*, vol. ii., p. 525) that the dozen imagines bred of *Malacosoma* hybr. *schaufussi* "are all ♀ s, or, to speak more correctly, a form with the external appearance of ♀ s; some of these hybrids were crippled, and the body of one, on being opened, was found to contain the rudiments of an ovipositor and an extraordinarily developed mass of fat (a quite unusual occurrence in Lachneid ♀ s)." On the other hand, Bacot, in 1901 and 1902, bred both sexes of *M.* hybr. *schaufussi*, though with an overwhelming preponderance of ♀ s, *viz.*, 6 ♂ s and 44 ♀ s (in 1901), and 6 ♂ s and 16 ♀ s (in 1902), the ♂ s of 1901 very uniform in appearance with pale fore- and dark hindwings, the ♀ s also very uniform, dark umber-brown in colour with narrow pale transverse lines on the forewings. The ♂ s of 1902, on the other hand, were not only different from those of 1901, but also varied *inter se*, similarly, of the ♀ s, only about one-half were of the 1901 type, the others tending to lose, or having entirely lost, the transverse bars. Although the sexes were apparently distinct and the ♂ s of *schaufussi* paired with ♀ *castrensis* and ♀ *neustria*, the eggs proved infertile. Pairings between ♂ and ♀ *schaufussi* also were obtained, but the hybrid ♀ s laid no eggs, so that both sexes were apparently functionally impotent. A similar case in which the external organs of the hybrids appear to be well-formed, but the ♂ s as well as ♀ s fail functionally, is that recorded by Oberthür (*Bull. Soc. Ent. France*, 1897, p. 259), in which pairings of ♂ *Biston* hybr. *pilzii* were obtained with ♀ *pilzii* and ♀ *hirtarius*, and of ♂ *Biston* hybr. *hünii* with ♀ *pomonarius* and ♀ *pilzii*. This sort of evidence is, however, very unsatisfactory. Much more to the point is Standfuss' information with regard to the Saturniid hybrids. Of some 4000 hybrids bred, he observes (*Entom.*, xxxiv., p. 11) that he reared only two gynandromorphous primary hybrids, one a *Saturnia* hybr. *emiliae*, the other a *S.* hybr. *bornemanni*. On the other hand, of 282 secondary hybrids reared, 27 were gynandromorphic and he concludes that "the percentage of gynandromorphic specimens among primary hybrids is infinitesimal compared with the occurrence among secondary hybrids." He concludes that "the degree of fertility of a form stands in direct connection with the percentage ef gynandromorphic individuals in its offspring; the greater the fertility the smaller the percentage of gynandromorphic forms and *vice versa*, whilst the degeneration and malformation of the egg-germs, which these gynandromorphous forms have been shown by anatomical investigation to possess, are directly connected with the appearance of secondary sexual characters in male individuals, and *vice versa;* the occurrence of secondary male characters in female individuals has long been known to be a fact." A full summary has already been given (*anteà*, vol. iii., p. 302) of the gynandromorphic hybrids among the Saturniids, and it is to be noted that, although ♂ hybrids among the Saturniids have frequently fertilised ♀ s of either parent form, very few ♀ hybrids have ever been fertilised either by ♂ s of their own kind or of their respective parent forms. Anatomical investigation into the structure of ♂ and ♀ hybrids is still much needed.

So much for the questions of infertility and sterility in first crosses, and the hybrids arising therefrom. The difficulties of hybrids reaching maturity do not, however, end with the successful hatching of the hybrid larva. The larva, compounded as it is of the differing anatomical, physiological, morphological, and molecular conditions and peculiarities belonging to two distinct species, having in each case highly specialised larvæ of their own, with differing constitutions, habits, and maybe foodplants, may find itself unable to deal satisfactorily with the foodplant of either parent, may find its alimentary system so far disturbed as to be unable to satisfactorily digest these foodplants, may find its habits so complex that, whilst the half inherited from one parent tends to make it hybernate as larva, that inherited from the other parent tends to make it hybernate as pupa; may find its mixed habits, exposing it to the attacks of foes from which the habit of either parent alone would protect it. Hence there may be many difficulties in bringing the larva to maturity, and, when this has been done, it is often found that the time of emergence of the imago has been greatly hastened or retarded, agreeing with that of neither parent, and hence tending to its isolation and rapid extermination. On the other hand, when the hybrid follows the habits of one of the parents, and emerges with the progeny of one of them, there is no doubt that, if functionally active, it would cross therewith, and that its progeny would show little trace of the hybrid origin of the other of its parents. This leads us to note Darwin's statement that "in hybrids, the external conditions have remained the same, but the organisation has been disturbed by two distinct structures and constitutions, including, of course, the reproductive systems, having been blended into one." To the first part of this statement, our remarks above will show that we take great objection. External conditions have not remained the same; the whole environment is altered; the new organism has to choose between two foodplants or two sets of foodplants, and, in natural hybrids, this choice is practically non-existent, for the ♀ parent will naturally lay her eggs on her own foodplant, and any hereditary tendency in the larva to insist on the foodplant of the ♂ parent spells death. It has also to choose between two entirely different sets of habits, and may choose some intermediate condition that is unavailable, &c. As to the combination of two organisations, we are quite of Darwin's opinion, that "it is scarcely possible that two organisations should be compounded into one, without some disturbance occurring, in the development, or periodical action, or mutual relations, of the different parts and organs one to another or to the conditions of life. When hybrids are able to breed *inter se*, they transmit to their offspring from generation to generation the same compounded organisation, and hence we need not be surprised that their sterility, though in some degree variable, does not diminish; it is even apt to increase, this being generally the result, as before explained, of too close interbreeding. It must, however, be owned that we cannot understand, on the above or any other similar view, several facts with respect to the assumed sterility of hybrids, *e.g.*, the unequal fertility of hybrids produced from reciprocal crosses, or the "increased sterility in those hybrids which occasionally and exceptionally resemble closely either pure parent." We have no facts among the recorded experiments relating to hybrid lepidoptera to show that the latter statement is true, but, as to the unequal fertility of reciprocal crosses, it is amply illustrated by the ease with which fertile eggs of *Smerinthus* hybr. *hybridus* (*ocellata* ♂ × *populi* ♀) are obtained compared with the difficulty of obtaining those of *Amorpha* hybr. *inversa* (*populi* ♂ × *ocellata* ♀). Bacot offers (*Ent. Rec.*, x., p. 190) two possible explanations of the peculiarities as noticed in these hybrids; (1) The small size of the eggs of *Smerinthus ocellata* would prevent, or prematurely stop, the development of the embryonic larva (if the ♂ parent were *Amorpha populi* a species which produces a much larger embryonic larva). (2) The ♀ being the more conservative sex, has a larger portion of ancestral determinants than the ♂; so that, when the more progressive ♂ of the less specialised species (*Smerinthus ocellata*) pairs with the conservative ♀ of the more highly developed species (*Amorpha populi*), the cross is between individuals that are more nearly related as regards the constituents of the germ-plasm than would be the case were the sexes reversed, and there is, therefore, a far greater likelihood of fertile ova resulting.

One of the most remarkable facts relating to hybridity is the tendency observed for the hybrid imagines to emerge more quickly than either of the parent species. We have illustrated this point at length with regard to *Smerinthus* hybr. *hybridus* (*anteà*, iii., p. 459), the imagines of which largely emerge in the autumn, after a pupal period of about three weeks*. Püngeler notes (Standfuss' *Handbuch*, etc., p. 56) a similar result in *Fumea* hybr. *püngeleri* and *F.* hybr. *inversa*, stating that males only were bred, and that these emerged in the autumn without the larvæ hybernating, whilst the pure larvæ of both species (*F. casta* and *F. affinis*) hybernated, some of those of *F. affinis*, indeed, going over two winters. The same peculiarity is well illustrated by Standfuss (*Entom.*, xxxiv., pp. 78-80), who, in the spring of 1897, crossed *Clostera curtula* ♂ × *anachoreta* ♀, and the fertile eggs, hatching simultaneously, produced larvæ, the greater number of which rapidly attained full growth, pupated and produced imagines (hybr. *raeschkei*) before the end of June—all ♂ s, whilst the smaller number fed on slowly. In the meantime, the ♂ *raeschkei* paired with ♀ *C. anachoreta*, and, by the beginning of August, had produced another generation of imagines—again all ♂ s (hybr. *facilis*). These in turn were paired with ♀ *C. anachoreta*, and the larvæ of this cross were feeding contemporaneously with the spring larvæ (their grand-aunts), two of which finally pupated on August 21st and 23rd, and produced imagines in October. In the meantime, the larvæ of the early August cross (*facilis* × *anachoreta*) fed up, pupated, and later in the autumn produced imagines —yet again all ♂ s (hybr. *approximata*). Relative to this, Standfuss

* Newman (of Bexley) reared many *S.* hybr. *hybridus* in 1901 and 1902. Certain individuals of these are noted by Adkin and Clark (*Proc. Sth. Lond. Ent. Soc.*, 1902, pp. 110-111) as emerging from pupæ of the year, whilst, on the other hand, Adkin records another example (*op. cit.*, 1903, p. 70) that emerged July 10th, 1903, from a larva reared in 1901, the pupal stage having lasted one year and eleven months.

writes: "The fact that, in the experiments undertaken, the male Closterid hybrids develop much more quickly than their sister females, and that the male hybrid immediately produces (when crossed with a pure ♀) a large third generation of males, indicates a progressive developmental tendency, which is further confirmed by other facts. . . . On the other hand, with regard to the ♀s of the Closterid hybrids, they endeavour to return to the original simple state of one brood per year (for this was certainly the primitive condition)." As bearing on the point now under review, *i.e.*, the different action of hybridism on the two sexes of the resultant progeny, so far as relates to the length of the early stages, we may note that, when Standfuss bred *Drepana* hybr. *rebeli*, the ♂ and ♀ hybrids emerged together, whilst with the reciprocal cross, *D.* hybr. *zurichi*, the ♂s developed at once, and produced imagines, whilst the females hybernated as pupæ. This difference was already foreshadowed during pupation, for, whilst the ♂ larvæ only bent round a small portion of the edge of the leaf, and fixed themselves in the same by a few short threads on the surface, and changed to pupæ in the more or less open pockets thus formed, those of the ♀s, on the other hand, rolled a large portion of the leaf sharply round, beginning at the edge, and closed over the so-formed pocket with numerous strong silk threads, with the exception of a small opening to allow the larva egress, and then gnawed this puparium loose from the rest of the leaf, so that it fell into the sleeve, and then fastened up the opening. In this manner, the pupa was better protected against many dangers than if it fell, in late autumn, with the rest of the leaves. Standfuss further notes (*Entom.*, xxxiv., p. 78) that the ♂ larvæ of *Clostera* hybr. *prima* developed much more rapidly than the ♀ larvæ, so much so that he would have got no pairings had he not artificially exposed the ♂ imagines to a low temperature, and so kept them in a torpid state for some weeks, until the ♀s emerged. A parallel fact was noted with regard to *C.* hybr. *inversa*, although the interval of time between the emergence of the ♂s and ♀s was much less. Strangely enough, Newman records an exactly opposite result (*Proc. Sth. Lond. Ent. Soc.*, 1899, p. 110) for a large brood of larvæ of *Clostera* hybr. *prima*, which fed up rapidly, and of which about 240 pupated, one-half—117 ♀s and 3 ♂s—emerging at the end of August, the quickest being only 32 days from the hatching of egg to imago, the rest of the pupæ going over the winter, the imagines emerging the next spring. Bacot's experiments (1900-1902) in breeding *Malacosoma* hybr. *schaufussi* gave a similar result to that of Newman, for he records (*Proc. Ent. Soc. Lond.*, 1902, p. vii) that his last females emerged in 1901, a good three weeks before the earliest male, and thus prevented pairings between the hybrids, the female larvæ having fed up at an unprecedentedly rapid rate, and emerging not only earlier than the ♂ hybrids, but much sooner than either sex of the parent forms. In 1902, another experiment (*op. cit.*, p. xxv) based on the same species, produced an almost exactly similar result. On the other hand, the larvæ of *Amphidasys* hybr. *herefordi* (*Ent. Rec.*, ii., p. 83) showed great variation in the rate of feeding up, and in the length of the pupal stage. Some half-dozen of these larvæ missed a moult, pupated early, and produced imagines the same autumn, whilst the rest developed into pupæ which went over the winter, one attempting to go over a second winter. So marked was the result of the hybridisation on the

Tephrosiids bred by Bacot and Riding, that they lost all regularity as to the time of emergence and became continuously brooded, *i.e.*, all the crosses paired, producing progeny, which again paired, and so on. Even the influence of *T. crepuscularia* (*biundularia*), one of the most regularly single-brooded species in England, was unable to prevent this, the broods emerging almost entirely, whilst they appeared capable of going on indefinitely so long as food could be provided for the larvæ (*Trans. Ent. Soc. Lond.*, 1898, pp. 39-40).

It would appear that, in reciprocal crossings, the sex condition of the hybrids depends on the predominating influence exerted by one of the parents. In the Tephrosiid hybrids (*Trans. Ent. Soc. Lond.*, 1898, pp. 17 *et seq.*) it was found that certain crossings produced almost entirely male offspring. This occurred in the only four fertile crossings obtained in which *Tephrosia crepuscularia* (or its ab. *delamerensis*) was the male and *T. bistortata* the female parent; two broods of this parentage bred by Riding produced 60♂s and one ill-developed ♀; a third brood bred by Bacot, 58 ♂s and no female; a fourth brood, bred by Riding 38 ♂s and no ♀. On the other hand, in the reciprocal cross, in which *T. bistortata* was the ♂, and *T. crepuscularia* the ♀, parent, a fair share of ♀s was the result. We have no details as to the exact proportion of ♀s to ♂s in *Smerinthus* hybr. *hybridus*, but the percentage must be a very small one, and Newman informs us that, of a very large number of this hybrid bred during the last few years, only 3 or 4 ♀s have appeared, *i.e.*, only about one per cent., and of these he notes that, though the antennæ are of ♀ form, the body is not so with regard to size, there appearing to be no ova present in them. The great rarity of the reciprocal cross, *Amorpha* hybr. *inversa*, makes it difficult to draw any comparison, although Standfuss goes so far (*Handbuch*, etc., p. 63) as to say that the offspring thereof consists of both sexes in normal proportions (but we doubt the records, not Standfuss' own, on which this statement is based) [see *Ent. Rec.*, xiv., p. 191, also *anteà*, vol. iii., pp. 395-6], but the broods of *S.* hybr. *fringsi* (analogous with *S.* hybr. *hybridus*) gave 5 ♀s against 45 ♂s, and those of *A.* hybr. *metis* (analogous with *A.* hybr. *inversa*), gave only 6 imagines—all ♂s. As in *A.* hybr. *metis*, *Calasymbolus* hybr. *interfaunus* has also *S. ocellata* for the ♀ parent, and in this also the 12 specimens bred were all ♂s. The facts relating to the Malacosomid hybrids are also interesting. Of *Malacosoma* hybr. *caradjae* in which *neustria* is the ♂ and *franconica* the ♀ parent, ♂s only have been reared, whilst of *Malacosoma* hybr. *schaufussi*, in which also *neustria* is the ♂ parent, but *castrensis* the ♀, an abundance of ♀s have been rapidly produced, whilst the ♂s have been very few in number and reared from slow-feeding and weak larvæ. Püngeler's results with *Fumea casta* ♂ × *affinis* ♀, and its reciprocal cross, *F. affinis* ♂ × *casta* ♀, throw no light on the subject, both giving only ♂s, ♀s being quite absent from both crossings. Much experimental work is wanted in this direction.

As to the degree of superficial appearance, and, to a certain extent also the habits, of hybrids to the parent forms, two so-called laws have been formulated by Standfuss (*Handbuch*, &c.) as follows:—

(1) In reciprocal pairing the male is able to transmit the characters of the species in a higher degree than the female.

(2) The final extent of approximation towards the male parent depends on

the relative phylogenetic age of the two species; the older being able to transmit its properties, whether of structure or habit, better than the younger.

With regard to these, Standfuss shows that, in crossing *Saturnia pavonia* ♂ with *S. pyri* ♀, the resulting imago is by more than two-thirds of its external appearance *S. pavonia*, and by less than one-third *S. pyri*. Its habits and functions correspond with its external aspect. It prefers to fly by day, like *S. pavonia* ♂, and pairs easily with the ♀ of that species, from 43 to 62 per cent. of the eggs being fertile. On the other hand, it does not pair readily with *S. pyri*, and the resulting eggs, in an average of nine cases, gave only one larva out of 180. Similarly, *S. pavonia* ♂, when paired with *S. spini* ♀, gives a form of which, in the perfect state, about two-thirds of the external aspect belong to the type of *S. spini*. The ♂ flies by night. After crossing with *S. pavonia* ♀ the resulting eggs were only fertile to the extent of 16 to 22 per cent., while the crossing with *S. spini* ♀, though not easily brought about, in consequence of their diverse times of appearance, yielded eggs of which from 94 to 98 per cent. were fertile. So that the ♂ *S. pavonia* (considered the middle species phylogenetically) is able to influence the issue of the relatively gigantic *S. pyri* ♀ (considered the youngest phylogenetically) much more than it can that of *S. spini* ♀ (considered the oldest phylogenetically). Again the issue of *S. spini* ♂ × *S. pavonia* ♀ is much nearer *S. spini* than is that of *S. pavonia* ♂ × *S. spini* ♀, which shows that the older-established species (*spini*) is more effective than the younger (*pavonia*), and the sexual prepotency of the ♂ *S. pavonia* counts far less than the specific prepotency of the ♀ *S. spini*. The greatest effect is produced when the two influences concur, as in the hybrid *S. spini* ♂ × *S. pavonia* ♀, the male parent being also the oldest phylogenetically. This rule as to the prepotency of the phylogenetically older species is, as Dixey says, probably only another expression of the fact so clearly established by Darwin (*Animals and Plants under Domestication*, 1868, ii., p. 254) that hybridisation frequently leads to reversion. It is significant that Standfuss considers the hybrid form *S.* hybr. *emiliae* (*pavonia* × *pyri*) as partly reproducing an ancestral stage in the history of *S. pavonia* rather than the form of that species now existing. Kaye also observes (*Proc. Sth. Lond. Ent. Soc.*, 1902, p. 117) that, in *Amorpha* hybr. *metis* and *Smerinthus* hybr. *hybridus*, the prepotency of the ♂ was noticeable. Detailed observation on a larger number of specimens is, however, desirable.

Some of the Tephrosiid hybrids (*Trans. Ent. Soc. Lond.*, 1898, pp. 17 *et seq.*) did not altogether appear to bear out the first of these rules, but this may have possibly been due to the disturbing influence of using an aberrative form (*delamerensis*) instead of the more stable typical form of *crepuscularia* (*biundularia*). On the other hand, those reciprocal broods, in which this disturbing influence was eliminated, *viz.*, *T. bistortata* × *crepuscularia* and *T. crepuscularia* × *bistortata* showed distinctly in the first cross a great tendency to the *bistortata* form, and, in the second, a less distinct tendency in the same direction, thus bearing out Standfuss' further suggestion that *bistortata*, assumed on various grounds to be the phylogenetically older species, is more dominant in stamping its characters on the progeny. It may be, of course, that *T. bistortata* is merely a predominant species, more active in its vital functions, and more ready to respond to environmental influences, although the local variation of *T. crepuscularia* renders the latter scarcely probable. At any rate the dominating influence of *T. bistortata* on the progeny is most marked.

As further tending to support his position, Standfuss notes (*Entom.*, xxxiv., p. 80) that his experiments in hybridising *Clostera pigra*, *C. curtula* and *C. anachoreta* support most strongly the view that the characters of the oldest species phylogenetically are most impressed upon the offspring, *i.e.*, that the physiognomical aspect of the hybrid will be mainly influenced by the phylogenetically oldest species. On various grounds, he assumes *C. pigra*, *C. curtula* and *C. anachoreta* to stand in this order phylogenetically, and he states (*Entom.*, xxxiv., pp. 82-3) that, in the crossings of *C. pigra* ♂ × *curtula* ♀ and *C. curtula* ♂ × *pigra* ♀, the progeny of both are nearer to *C. pigra*, whilst, in the reciprocal crossings, *C. curtula* ♂ × *anachoreta* ♀ and *C. anachoreta* ♂ × *curtula* ♀, the progeny are nearer the phylogenetically older form *curtula* than the younger *anachoreta*, but in a subordinate manner the influence of the male prevails in the aspect of these reciprocal hybrids. Contrary to Standfuss' opinion, Adkin notes (*Proc. South Lond. Ent. Soc.*, 1902, p. 110) that many specimens of both *C.* hybr. *prima* (*curtula* ♂ × *pigra* ♀) and *C.* hybr. *inversa* (*pigra* ♂ × *curtula* ♀) in his possession more nearly resembled in each case the ♀ parent than the ♂, while the markings showed the cross parentage; and Fletcher, who reared imagines of *C. pigra* ♂ × *curtula* ♀ from pupæ obtained from Newman, states that the progeny was scarcely different from pure bred *C. curtula*.

As bearing on the question of the influence of the ♂ parent, we may note that in *A.* hybr. *worthingi* (*lonicerae* ♂ × *trifolii* ♀) there is a strong tendency to resemble the mother, although when several of a brood are seen together the influence of both parents is very marked; this is especially noticeable in the blotching of the spots of the forewings, a very common character in *trifolii* and a very rare one in *lonicerae*. Fletcher's experiments tend to prove not so much that the ♂ influences most the progeny, as that a particular species (*trifolii*) does it; it may be that this is explicable on the assumption that *trifolii* is, compared with *lonicerae*, the older species phylogenetically, an assumption that we are not altogether inclined to support, *trifolii* being even now in a state of flux with regard to its species-forming power, and *lonicerae* one of the most fixed and constant in the Anthrocerid fauna, and maintaining its fixity under a variety of conditions of environment, latitude and altitude.

It is now generally accepted that increase in the number of species is due either (1) To the modification of an existent species by changed environment; or (2) To the splitting up of a species into more than one by various changed conditions acting on the original species. The early separation of these forms gives us what are known as local races, the impress of the different conditions to which they are subjected developing a divergence of habit, form, colour, or other outward conditions accompanied by modified anatomical or physiological (functional) changes. When these diverging forms have become quite isolated we call them species, and, by the time this stage has been reached, the forms are usually so divergent that they do not cross and produce offspring that are fertile *inter se*, not, perhaps, so much from an absolute inability to thus produce fertile progeny, as from the great difficulty, owing to changed habits, etc., of the forms ever coming in contact sufficiently to allow it. When the change of habit is accompanied by a morphological or functional change, and when the forms have been further isolated by the loss of the most closely allied individuals, the anatomical and functional differences existing between the species may be so great as to absolutely prevent crossing or the production of fertile offspring. If it be accepted that species have thus been formed by the slow accumulation of differences in habit, accompanied with an ever-increasing difference in anatomy and function, then the ease or difficulty of hybridising allied species may indicate the actual amount of difference and distinctness of the species on which experiments are made.

It has, however, long been a matter of discussion as to how far the actual hybridity of species may itself be an active factor in the formation of new species, *i.e.*, how far hybrids are capable of forming a new species. Standfuss discusses (*Ent.*, xxxiii., pp. 240 *et seq.*) this question and considers that the experiments that he has already undertaken have largely answered the question in the negative. Even when hybridity is not difficult to procure between two species, the progeny shows little fertility *inter se*, and, although the ♂ s are more frequently fertile with ♀ s of either of the parent species, the ♀ hybrids are much more rarely fertile with the ♂ s of the parent species, and at present few hybrids show comparatively free fertility *inter se*. This appears to be largely due to the anatomical and morphological upset in the sexual organs of the ♀ hybrids, an upset that frequently finds its outward recognition in the development of gynandromorphic forms, in which the primary sexual characters are often considerably modified, and correspondingly marked changes take place in the secondary sexual characters.

Assuming, however, hybridity ever to take place in nature, the hybrids themselves will often, presumably, follow one or other of the parent forms so far as relates to its habits, time of appearance, etc., and the chance of a ♂ and ♀ hybrid, assuming that some of both sexes get through successfully, then meeting each other, as against the possibility of either meeting and pairing with or being paired with a ♂ or ♀ of the much more abundant parent form, is so remote that one puts aside the possibility; one suspects that such individuals as survived would almost certainly pair with one of the parent forms and the hybrid characters (if any marked ones occurred) would be bred out in two or three generations. As illustrating this point, we captured, on May 20th, 1893, a ♂ specimen of what we have no doubt is *Polyommatus corydon* × *bellargus*, at Cuxton, with the shape and contour of *corydon*, but with the unmistakable colouring of *bellargus* in it. It was flying among hundreds of *bellargus* and was paired with a typical *bellargus* ♀. No doubt exists in our mind that this was a cross between an early emerged August specimen of *bellargus* of the preceding year with a late emerged August specimen of *corydon*. It had evidently followed the habit of *bellargus*, had emerged with the early spring brood of that species, had paired with a typical ♀ *bellargus*, and its progeny would, one suspects, if any, have reverted to ordinary *bellargus* in, at most, a few generations, although in appearance the specimen is much more like *corydon*. Possibly following Standfuss' conclusions the male parent was *corydon* and the female *bellargus* (see *Ent. Rec.*, iv., p. 230; *Trans. Ent. Soc. Lond.*, 1894, p. xv). On the other hand, we have already given instances in which divergence from both parent forms occur, and where isolation is fairly certain to lead to their failure to maintain themselves.

The evidence relating to hybridity in lepidoptera is of two distinct kinds: (1) That in which the parentage is known, the crossings having been brought about as the result of artificial conditions determined by the operator. (2) The capture in nature of individuals bearing apparent resemblance to two species, the parentage being altogether unknown. Evidence of the latter kind must be accepted with very great caution. It is well-known to all experienced field-naturalists that, within the limits of a small group of closely-allied species, variation runs frequently in the same direction, so that parallel forms are found, that bear more or less close resemblance to one another, and so that a rare aberration of one species may bear considerable superficial resemblance to the typical form of another species. Such specimens, even to those who have considerable knowledge of the group, have often proved a stumbling-block, whilst to those whose experience is small they form a pitfall, the readiest escape from which is to explain the puzzling form as a hybrid between the two species, *i.e.*, the species which it superficially resembles and the species to which it really belongs. We do not wish to be understood as suggesting that there are no natural hybrids, which is, indeed, contrary to our opinion, but we should be unwilling to acknowledge as hybrids any specimens that did not exhibit structurally some difference that would bring the supposition largely within the bounds of possibility. Mere coloration we should, as a rule, hold to be altogether insufficient evidence. A similar feeling that many of the so-called hybrids that have been recorded may be merely unusual aberrations of well known species, must have led to Standfuss making the remark (*Handbk. Pal. Gross-Schmett.*, pp. 51-52) that much of the so-called hybrid material is untrustworthy, and that many of the so-called hybrids are merely aberrations. Yet some of his own remarks on the matter are particularly unsatisfactory, *e.g.*, he records that he reared many specimens from larvæ found on *Rhamnus catharticus* and *R. alaternus* in Dalmatia and Italy, and supposed to be those of *Gonepteryx cleopatra*, that he considered could be nothing but hybrids between *G. rhamni* and *G. cleopatra*. Again he observes that *Melitaea dictynna*, *M. athalia*, *M. aurelia* and *M. parthenie* are so nearly related to one another that a particular hybrid appearance can scarcely occur, the markings of these species, except in striking occasional aberrations, being so very similar. He, however, believes that, among other Melitæids sent to him for determination, many examples, chiefly from Switzerland, have had a distinct hybrid origin. He further assumes that some of the Erebiids that he has examined, in the *epiphron*, *melampus*, *eriphyle*, and *mnestra* group, have been the result of crosspairing between different species. We have examined some thousands of the Melitæid and Erebiid species mentioned by Standfuss, and have never seen a specimen that we could in anyway suppose was a hybrid. Such evidence as Standfuss thus offers is very unconvincing, and appears to have little real bearing on the solution of the problems relating to hybridity in butterflies. The pairings between butterflies of different species (*antea*, p. 3) also carry our knowledge of whether the species are capable of producing hybrids, very little forward; whilst the determination of individual specimens caught wild, as hybrids, is, as already noted, unless there are some marked structural peculiarities, exceedingly difficult. The specialist must follow these up for himself.

As tending to show how easily natural variation can be mistaken for hybridisation, reference may be made to Edwards' account of *Papilio* var. *brucei* (*Can. Ent.*, xxvii., pp. 229 *et seq.*). It appears that a *Papilio* described as *oregonia* is taken in Washington and British Columbia. Much farther south occurs *Papilio bairdii*. In Colorado, between the two areas inhabited by these forms and at a height of from 5000-6000ft., the species (to which both are now referred) occurs in two forms, both forms slightly modified from the lowland types, and with intermediates frequent, and ♀ s of either produce progeny of both races. Edwards named these intermediates *brucei*, and, having begun by assuming *oregonia* and *bairdii* to be two species, looked upon the Colorado mixture as the result of hybridisation, whereas, no doubt, the lowland varieties are extreme specialisations of the two main forms found in Colorado, each specially suited to its particular area.

We may now deal with the matter under the headings of the various families to which the hybrids belong:—

Papilionides.—Of individual specimens supposed to be hybrids and recorded as such, we have met with the following:—A supposed hybrid of *Aglais urticae* × *Pyrameis atalanta* (Bruand, *Bull. Soc. Ent. Fr.*, ser. 2, 1844, t. ii., p. vi); hybrids between *Coenonympha pamphilus* × *C. iphis* (Stein, *Isis*, 1835, pp. 343-344); *Polyommatus bellargus* × *icarus* (Klopsch, *Stett. Ent. Zeit.*, 1858, p. 409); *P. icarus* × *escheri* (Standfuss, *Handbuch*, etc.); *P. bellargus* × *corydon* (Tutt, *Proc. Ent. Soc. Lond.*, 1894, p. xv); *Limenitis ursula* × *archippus* (Holdredge, *Ent. News*, x., p. 131). Offhand assumptions as to hybridity being common between Lycænid species, like those of Sabine and South (*Entom.*, xix., pp. 40, 81, 181, 220, 222, 294, 274) and criticised at the time (*op. cit.*, pp. 207, 253, 257) are hardly worthy of consideration. Somewhat similar are the suggestions of Butler and Staudinger as to hybridity among the Coliads. In the *Proc. Zool. Soc. Lond.*, 1880, p. 409, *Colias* var. *sareptensis*, *C. erate* and its var. *pallida*, and var. *helichta* (*chrysodona*), etc., come under discussion; so also do they in the *Ann. and Mag. Nat. Hist.*, vii., p. 137; ix., p. 208; 1888, p. 197, and *Proc. Zool. Soc. Lond.*, 1866, p. 371. In his *Cat.*, 3rd ed., p. 17, Staudinger still maintains *chrysodona* (=*helichta*) as a hybrid of *erate* and *edusa*, and *sareptensis* as a possible hybrid betweeen *hyale* and *erate*. It appears to us that there are, no doubt, among the Coliads, difficult questions as to the limits of specific identity and of variation, and several forms, more or less distinguishable, appear to have the character of local races, but, as for real evidence of hybridisation between recognised and well-defined species there is none. The idea of a man in Berlin or London, with a few specimens before him, deciding that, in India, a "hybrid" is displacing the parent form, is great nonsense. The evidence of the so-called hybridity between *eogene*, *cocandica*, and *regia* appears to be equally unsatisfactory.

Honrath (*Berl. Ent. Zeits.*, xxxi., pp. 501-503) asserts that cross-pairing is frequent among the Parnassiid species, states that Grum-Grshimailo frequently observed *P. delphius* ♂ paired with *charltonius* var. *princeps* ♀, in the Alai mts., and that Alphéraky often saw *P. discobolus* paired with *P.* var. *hesebolus*, in the Thianshan mts.

He further notes that Graeser remarked of two (♂ and ♀) suspicious *P. nomion* that he had captured at Pokrofka, that he had taken them both at a time (early July) when *P. bremeri* var. *graeseri* was very worn, and typical *nomion* not on the wing till about 14 days later. This circumstance, and their size, led him to consider them at first as early *P. nomion*, but later he supposed they might be *bremeri*. Dorries also took a pair at Bikin, where also the two species occur. He also thought that they were *nomion*. Honrath, because of these peculiarities, and because the specimens occurred where *bremeri* and *nomion* were both found, and because they were captured between the dates of appearance of the species, and further, because Alphéraky had recorded pairings between the Parnassiids, considered the specimens hybrids. Their peculiarity, he says, consists of their appearing to be *nomion* with the black antennæ of *bremeri*. He further refers to a note by Streckfuss (*op. cit.*, 1887, p. xi) noting that he had taken *apollo* with antennæ ringed like those of *delius* at Muhlwald-Thal, at 3500ft. elevation, where *delius* and *apollo* were flying in company. These he thinks may be hybrids. He then goes on to describe two possible hybrid specimens between *rhodius* and *apollonius* taken by Grum-Grshimailo. None of the evidence appears to be at all conclusive. That of Frings (*Soc. Ent.*, xix., p. 52) who describes a ♂ *Parnassius* taken in the Valais in July 1904, as possibly a hybrid between *apollo* and *delius*, is equally unsatisfactory.

Arctiides.—Attempts to hybridise Arctiides appear up to the present to have failed, except in five instances, in producing imagines. Standfuss records (*Handbuch*, &c., p. 56) having obtained pairings between *Nemeophila plantaginis* ♂ and *Euthemonia russula* ♀, *Arctia caia* ♂ and *A. flavia* ♀, *Phragmatobia fuliginosa* ♂ and *P. luctuosa* ♀, all of which produced a normal number of eggs, but no larvæ. Schreiner records (*Stett. Ent. Zeit.*, xiv., p. 140) repeated pairings between *Spilosoma urticae* ♂ and *S. menthastri* ♀, and Bacot obtained the same but the eggs failed to hatch although they became darker in colour. Caradja made the first approach to success, obtaining crossings between *Spilosoma mendica* var. *rustica* ♂ and *S. luctuosa* ♀, *S. luctuosa* ♂ and *S.* var. *rustica* ♀, *S. luctuosa* ♂ and *S. mendica* ♀. In 1893, eight ♀ *luctuosa* paired with ♂ var. *rustica*, laid some 1800 eggs, of which 99 produced larvæ, some two-thirds of the remaining eggs undergoing some development, the rest being quite infertile, two of the larvæ lived to spin their cocoons, but no imagines resulted. In 1894, six more crossings of *S. rustica* ♂ × *luctuosa* ♀ were obtained, five of the batches of eggs laid gave no larvæ, but the other batch gave 141 larvæ (from the earliest laid eggs), and 194 other eggs were infertile. The reciprocal cross, in its two forms, *S. luctuosa* ♂ × *rustica* ♀ and *S. luctuosa* ♂ × *mendica* ♀, gave only infertile eggs. The hybrid larvæ again fed up vigorously, but none reached the imaginal stage (*Soc. Ent.*, viii., pp. 89-90; ix., p. 49). Later, Caradja was more successful, and described and figured (*Iris*, x., pp. 371-373, pl. ix., figs. 1-11) hybrids between *Spilosoma mendica* and *S. sordida*, two species which he had succeeded in crossing, and the progeny of which he had reared to the imaginal stage. He used two forms of *S. mendica* for the purpose, one, the form *rustica*, the other the form *standfussi* (a cross between *rustica* × *mendica*). In each case, *mendica* (in one of these forms) was the ♂ and *sordida* the ♀ parent. Next year he was even more fortunate obtaining imagines from a crossing of *S. luctuosa* ♂ × *S. sordida* ♀, also from *S. viertli* ♂ × *rustica* ♀, and from *S. inversa* ♂ × *viertli* ♀ (*Iris*, 1898, pp. 392-7, pl. vi). A crossing of *sordida* ♂ × *luctuosa* ♀ produced a few weakly larvæ that soon died. He describes the hybrids as:

1 and 2. Spilosoma hybr. crassa, Caradja (*standfussi* ♂ × *sordida* ♀) and Spilosoma hybr. viertli, Caradja (*rustica* ♂ × *sordida* ♀).—Eight fruitful pairings of *S.* hybr. *crassa* were obtained, the reciprocal crossing of *sordida* ♂ × *standfussi* ♀ being unfruitful. One fruitful pairing of *S.* hybr. *viertli* was also obtained, the reciprocal cross *sordida* ♂ × *rustica* ♀ being, however, unfruitful. In each of the broods of both forms some 12-13 per cent. only of the larvæ hatched (all the eggs had become darker on the 6th day, and some progress of larval development was observed in the eggs that did not hatch), many other larvæ had begun to eat through the eggshell, but had not strength to get further. Of those that hatched, some 25 per cent. refused food and died. The others were healthy, developed normally, and finally pupated, some larvæ, however, taking 48, others 72-76, the majority taking about 60, days. Altogether 12 healthy pupæ of *crassa* and 114 *viertli* resulted. Mismanagement of the pupæ ended in only two pairs of imagines of *crassa*, and a few pairs of *viertli* being reared. These varied considerably, and all four examples of *crassa*, and the seven most diverse specimens of *viertli*, are figured in the *Iris*, vol. x., pl. ix., figs. 1-11. The ovaries of the hybrid ♀s were apparently quite normally developed, and one ♀ *viertli*, paired with a ♂ *rustica*, laid 193 eggs, all of which produced healthy larvæ (see *beata posteà*. The hybrid larvæ of both *crassa* and *viertli* copy the larvæ of *sordida* accurately in the arrangement of the markings, but are more brightly coloured; in the last instar, however, they differed greatly from *sordida*, some having fox-red hairs like *mendica* larvæ, the majority, however, had hairs of dark brown, or brown-grey tint; in all, the light, yellowish-bordered, longitudinal stripes (dorsal and lateral) were as sharply marked as in *sordida*, the last segments being reddish-yellow laterally, these last two characters being characteristic of the hybrid larvæ. In their broad characters, the hybrid larvæ are much nearer *sordida*, although in their last skin some more nearly approach *mendica*.

3. Spilosoma hybr. beata, Caradja (*rustica* ♂ × *viertli* ♀) (*Iris*, 1898, pl. vi., figs. 7-9).—*Rustica* blood is prevalent over that of *sordida* as 3 : 1. The *sordida*-characters transmitted are—the somewhat elongate form of the wings, the faint yellowish-grey ground colour of wings, even in ♀, the tendency to a row of spots commencing at apex, the black-spotted fringe of forewings, and, in the ♀, the dark longitudinal stripes. [Further crossings could not be effected.]

4. Spilosoma hybr. hilaris, Caradja (*inversa** ♂ × *viertli* ♀) (*Iris*, 1898, pl. vi., figs. 10-11).—The facies of *sordida* is not very evident (except in the stronger spotting of wings in ♂), while the influence of *standfussi*, seen in the marked darkening of ♂, is unmistakable. The ♂ tint is similar to that of palest *standfussi* ♀s, whilst the ♀ is similar to the *inversa* ♀ figured by Caradja, except that the black marginal spots of hindwings are much more clearly marked. The form was inbred, each crossing being fertile, those of *rustica* ♂ ×

* The form *inversa* is a mongrel of two *mendica* races, *viz.*, ♂ *rustica* × ♀ (*rustica* × *mendica*).

hilaris ♀ being equally fruitful. From a crossing of *sordida* ♂ × *hilaris* ♀, produced eggs of which about 75 per cent. hatched, whilst from a pairing of *hilaris* ♂ × *sordida* ♀ only about 16 per cent. of the eggs gave larvæ; from a crossing of *hilaris* ♂ × *luctuosa* ♀, a few weakly larvæ only were produced.

5. Spilosoma hybr. seileri, Caradja (*luctuosa* ♂ × *sordida* ♀) (*Iris*, 1898, pl. vi., figs. 1-6).—This crossing succeeded in five cases, the egg-batches producing respectively 3, 3, 7, 48 and 71 eggs. From these only 15 ♂ s and 27 ♀ s reached the imaginal stage. In pattern and the outline of the wings, the hybrid is exactly intermediate between the parents. The ground colour is grey-brown (darker than in *luctuosa*), the yellowish scales, always plentiful in latter, more scanty, appearing along anterior and exterior margins of forewings. The ♀ s rather more thinly scaled than *luctuosa* ♀ s, and with much less transparent wings. The general arrangement of the wing-pattern inclining to that of *sordida*, except that all the spots and stripes are much more sharply marked (nearly as in *luctuosa*). The forewings with three rows of equidistant, parallel (not sinuately-divergent as in *luctuosa*) spots proceeding from costa, a fourth, shorter, row arising from apex, and running obliquely towards outer of the three parallel rows; five black spots along outer margin. The hindwings darker than the forewings, with distinct discal spot, and black longitudinal stripes from base of wing to the seven marginal spots, as in *luctuosa*. There is, however, considerable variation, some specimens inclining to *luctuosa*, the majority to *sordida*. The hybrids pair freely; five fertile pairings produced an average of 180 eggs. Crossings between *sordida* ♂ × *seileri* ♀ and *luctuosa* ♂ × *seileri* ♀ were also fruitful (only about 17 per cent of infertile eggs), whilst crossings between *seileri* ♂ × *luctuosa* ♀ and *seileri* ♂ × *sordida* ♀ resulted largely in infertile eggs, only 13 eggs (out of four batches) producing larvæ, all of which died before the 1st moult. A pairing of *rustica* ♂ × *seileri* ♀ resulted in only a few fertile eggs, only one larva pupating.

Notodontides.—The hybridisation of Notodontids has been rather more frequent. Those recorded are as follows :—

1. Cerura hybr. guillemoti (*vinula* ♂ × *erminea* ♀).—Hybrids of *Cerura vinula* × *erminea* were obtained by Serisié, a pairing between *C. vinula* ♂ and *C. erminea* ♀ occurring May 28th, 1854, the ♀ laying about a hundred eggs of which ten only emerged in fifteen days. Guillemot notes (*Ann. Soc. Ent. Fr.*, 1856, pp. 29 *et seq.*) the larvæ as being nearer *erminea* than *vinula*. All the larvæ safely pupated, the pupæ appeared to be nearer those of *vinula* than *erminea*. From the pupæ, seven (6 ♂ and 1 ♀) emerged at the end of April, 1855, and three (3 ♂) on May 7th-8th, 1856. These were nearer *C. vinula*, but two of the latest to emerge were pale and weakly marked. One of the more typical ♂ s is figured (*op. cit.*, pl. i., fig. 2). Opening the ♀ hybrid and a ♀ *erminea* that emerged at the same time, the body of the latter was found to contain, as usual, a large number of eggs; in the hybrid only 22 eggs, ill-formed, depressed, atrophied, and bathed in a clear fluid, and apparently quite incapable of being fertilised.

2. Notodonta hybr. dubia (*torva* ♂ × *dromedarius* ♀).—Standfuss notes (*Handbuch*, etc., p. 59) that a few years ago, hybrids between *Notodonta torva* ♂ × *dromedarius* ♀, were obtained, but that the hybrid is not known to him. It is, however, one of the species that

he mentions (*op. cit.*, p. 63) as being one in which the ♂ hybrids predominated over the females.

3. NOTODONTA hybr. NEWMANI (*ziczac* ♂ × *dromedarius* ♀).—In early June, 1904, Newman was successful in obtaining a pairing between *Notodonta ziczac* ♂ × *dromedarius* ♀. The ♀ laid some 250 eggs, all of which were fertile, but comparatively few hatched; the larvæ were sleeved on birch, but the mortality was great; pupation took place in due course, imagines appearing from August 1st-31st, 16 ♀ s in all; some pupæ then alive and going over winter. Attempts to pair some of these ♀ s with ♂ *N. ziczac* and *N. dromedarius* failed. We examined two ♀ s of this cross and noted that the hybrids were larger than either parent (of which the ♂ (*ziczac*) was a pale form and the ♀ (*dromedarius*) of the dark northern race). The hybrids exhibited the dark ground colour of *dromedarius*, but had a rather reddish tint, the most important feature of the specimens, however, being the combination of the markings of *dromedarius* and *ziczac*, the apical mark of *ziczac* being exhibited, modified, however, most towards the costa, where the transverse lines of *dromedarius* in this area become visible as costal streaks; the angular extension is also well-marked. The hindwings are dark, like those of *dromedarius*. The pupæ that went over the winter emerged in 1905, in three separate instalments, some in April, others at the end of May, and yet others at the end of June and early July, whilst, at the end of August, two pupæ were still alive. All the 1905 emergences were ♂ s, and their number exceeded that of the ♀ s by two.

CLOSTERA HYBRIDS.—In 1873, Bond exhibited (*Ent. Mo. Mag.*, x., p. 184) hybrid *Clostera curtula* × *pigra* (*reclusa*), which are noted as partaking of the characters of both parents. In 1897, Standfuss also obtained fertile crossings between (1) *C. curtula* ♂ × *pigra* ♀ and reared the offspring (= *C.* hybr. *prima*), also of (2) *C. curtula* ♂ × *anachoreta* ♀ (= *C.* hybr. *raeschkei*). These were followed up by successful pairings between (3) *C. pigra* ♂ × *curtula* ♀, which resulted in the production of imagines (*C.* hybr. *inversa*) in due course, as did also the crossing of (4) *C. anachoreta* ♂ × *curtula* ♀ (= *C.* hybr. *difficilis*). The ♂ s and ♀ s of *C.* hybr. *inversa* were found to be fertile *inter se*, as were also the ♂ s and ♀ s of *C.* hybr. *prima*. The ♂ of (5) *C.* hybr. *raeschkei* was paired successfully with a ♀ *C. anachoreta*, and imagines were reared (*C.* hybr. *facilis*); whilst a male of (6) *C.* hybr. *difficilis* paired successfully with ♀ *C. curtula* and produced imagines (*C.* hybr. *similis*). Males of (7) *C.* hybr. *facilis* were again crossed with *anachoreta* ♀, but the larvæ were not followed up, although, in 1898, from another cross of this parentage, imagines were obtained in due course (= *C.* hybr. *approximata*). In the spring of 1899, ♂ s of *C. curtula* were crossed with ♀ s of *similis*, the latter laying an abundance of fertile eggs which, however, do not appear to have been recorded as successfully reaching the imaginal stage. The following appear to be the chief points relating to these hybrids:—

1. CLOSTERA hybr. PRIMA (*curtula* ♂ × *pigra* ♀).—In 1897, parents crossed readily,* eggs fertile, larvæ fed up rapidly,† produced

* Newman states (*Ent. Rec.*, xii., p. 296) that, in his experience, the crossing of *C. pigra* ♂ × *curtula* ♀ is an easier crossing to obtain than *C. curtula* ♂ × *pigra* ♀, but that the latter lays its eggs more freely.

† Newman notes (*Ent. Rec.*, xii., p. 296) that, whilst the larvæ of *C. pigra* ♂ × *curtula* ♀ feed up very quickly, as do the larvæ of *C. curtula*, those of *C. curtula* ♂ × *pigra* ♀ feed up very slowly, thus following the larvæ of *C. pigra*.

♂ s and ♀ s with normal genital organs [figured *Entom.*, 1900, pl. viii., figs. 11(♀), 12(♂)], and nearer *C. pigra* than *C. curtula*. The ♂ larvæ, however, developed much faster than those of the ♀ s, and ♂ imagines appeared earlier; in order to bring about a pairing, ♂ s were placed in a cool cellar, where they became lethargic and were then brought into ordinary temperature when ♀ s emerged. Five pairings were thus obtained, and the ♀ s laid respectively 85, 103, 112, 121, and 154 eggs; larvæ developed in most of the eggs but only 5, 12 and 17 larvæ hatched (from the 2nd, 4th and 5th batches respectively). Larvæ fed up well for a time, sleeved out on willow, but, being neglected, died. In 1898, *C.* hybr. *prima* was again bred and ♂ s and ♀ s of the hybrids paired, but the larvæ died in spite of good weather and food, being apparently wanting in energy.

2. Clostera hybr. inversa (*pigra* ♂ × *curtula* ♀).—This reciprocal cross to *prima* was obtained in 1898. ♂ s and ♀ s both emerged and are figured [*Entom.*, 1900, pl. viii., figs. 9(♀), 10(♂)], the males emerged rather earlier than females, but not so much earlier as was the case in *C.* hybr. *prima*. It was possible, therefore, to obtain numerous inbreedings of *inversa* without resorting to artificial means; but, although plenty of fertile ova resulted and the larvæ appeared in due course, they died soon after leaving the egg. This hybrid varies, sometimes being nearer *pigra* than *curtula* (Standfuss), at other times hardly different from purely-bred *curtula* (Fletcher).

3. Clostera hybr. raeschkei (*curtula* ♂ × *anachoreta* ♀).—This cross was obtained in 1897, and the greater number of the larvæ fed up very rapidly, pupated about mid-June, and produced imagines before the end of the month—all ♂ s (figured *Entom.*, 1900, pl. viii., fig. 14). The rest of the larvæ developed very slowly, were different in appearance from the rapidly feeding ones, being much nearer pure *curtula* larvæ (with fewer traces of *anachoreta* origin); they fed slowly through August, became very large (larger than big fullgrown *anachoreta* larvæ), one pupating on the 21st and the other on the 23rd; the others died later; the two pupæ produced imagines, probably at the end of September, but were not discovered until the commencement of October when they were still alive, but knocked to pieces; they had distributed in the breeding-cage masses of eggs, which seemed to be normally constructed (but which, of course, had, unfortunately, not been fertilised). In 1898, two more female larvæ pupated, one emerged in October and is figured (*Entom.*, 1900, pl. viii., fig. 13) to show its immense size; the other pupa died during the winter. This ♀ was not so near *curtula* as the two bred in 1897; pairing was not attempted.

4. Clostera hybr. difficilis (*anachoreta* ♂ × *curtula* ♀).—This cross is difficult to obtain. In 1898, 6 pairings obtained, each ♀ laid from 150 to 200 eggs, yet only 70 larvæ were obtained and only 27 imagines bred. Two only of these were ♀ s, both small, and their ovaries could have contained but few eggs (one ♀ is figured, *Entom.*, 1900, pl. viii., fig. 15, and a ♂ fig. 16); 3(or 4) individuals presented gynandromorphic characters; the other 21 were normal ♂ s.

5. Clostera hybr. facilis (*raeschkei* ♂ × *anachoreta* ♀).—The ♂ *raeschkei* that emerged at the end of June 1897, crossed back readily with *anachoreta* ♀ s, the larvæ hatching quickly, and, by the beginning of August (*i.e.*, in only about 4 weeks and before the ♀ *raeschkei* larvæ were nearly fullfed) produced another generation of imagines, but all ♂ s, the female pupæ going on to hybernation, the ♀ imagines emerging in the

spring. Both sexes of this hybrid were much nearer to *anachoreta* than *raeschkei*, but differ in a regular manner from *anachoreta* in the reduction of the group of dark spots at the dorsal angle of the upperside of the forewings. The males of *facilis* paired again with female *anachoreta*, the latter laying eggs that hatched in due course.

6. CLOSTERA hybr. APPROXIMATA (*facilis* ♂ × *anachoreta* ♀).—Males of the secondary hybrid *facilis* were paired with *anachoreta* ♀ in August 1897, eggs and larvæ were obtained, but the latter sleeved out, and not noted further. In 1898, however, imagines of this tertiary hybrid were reared, all males, and differing very little from *anachoreta*. The ♂s were not tried but were, Standfuss thinks, without doubt, capable of reproduction.

7. CLOSTERA hybr. SIMILIS (*difficilis* ♂ × *curtula* ♀).—A ♂ of hybr. *difficilis*, paired with a ♀ *curtula* in the summer of 1898; fertile eggs were obtained and the larvæ fed up very quickly and pupated, the pupæ separated into two lots, one, the males, producing imagines very quickly, the other, the females, going over the winter as pupæ and emerging in the spring of 1899. The males and females were both very like *C. curtula*, and the females were especially well-developed. The latter paired freely with ♂s of *C. curtula*, eggs were laid, and the larvæ were especially healthy.

SPHINGIDES.*—As we have already pointed out, crosspairing between different Sphingid species has been noticed, and, although pairings, such as those of *Hyloicus pinastri* ♂ and *Mimas tiliae* ♀ (Bartel, *Pal. Gross-Schmett.*, ii., p. 148), *Smerinthus ocellata* ♂ and *Hyloicus pinastri* ♀ (Treitschke, *Die Schmett.*, x., pt. 1, pp. 137-138), and *Sphinx ligustri* ♂ and *Smerinthus ocellata* ♀ (*Entom.*, i., p. 357), have taken place, in some cases more than once, they have resulted, as might be expected, in the production of infertile ova. The pairing of *Smerinthus ocellata* ♂ and *Mimas tiliae* ♀ (Herfert, *Insekten-Börse*, xvi., p. 280), although not productive of fertile ova, may be successful, for imagines of its reciprocal cross, *Mimas* hybr. *leoniae* (*tiliae* ♂ × *ocellata* ♀) have been reared by Standfuss. We have, however, already dealt with the recorded hybrid Sphingids at such length (*anteà*, iii., pp., 380-381; pp. 390-396; p. 495; iv., pp. 44-54; p. 481) that detailed repetition would be purposeless. We simply note, therefore, the actual Sphingid hybrids that have so far been reared. These are:

AMORPHIDÆ:—1. MIMAS hybr. LEONIÆ, Stdfss. (*tiliae* ♂ × *ocellata* ♀) (*anteà*, iii., pp. 391-2), of which only ♂s were obtained, and these resembled *Mimas tiliae* much more than *Smerinthus ocellata*.

2. CALASYMBOLUS hybr. INTERFAUNUS, Neum. (*astylus* ♂ × *ocellata* ♀) (*anteà*, iii., p. 392), of which 25 ♂s emerged in the summer of 1894, other pupæ apparently healthy going over a second winter.

3. SMERINTHUS hybr. HYBRIDUS, Stphs. (*ocellata* ♂ × *populi* ♀) (*anteà* iii., pp. 392-3; pp. 448-459) the best-known, and most frequently bred of all the Sphingid hybrids; in appearance intermediate between the parent species; some hundreds have been bred of late years by Standfuss and Newman.

4. SMERINTHUS hybr. OBERTHUERI, Tutt (*atlanticus* ♂ × *austauti* ♀) (*anteà*, iii., p. 393), only once successfully reared by Austaut, the

* As the details of the hybrids belonging to this superfamily have already been published in volumes iii and iv, we give only brief summaries of them here. Details can be obtained by reference to the earlier volumes.

imagines not differing much from those of *Amorpha* hybr. *metis*, Aust., the reciprocal cross between these Algerian species.

5. SMERINTHUS hybr. FRINGSI, Stdfss. (*atlanticus* ♂ × *populi* ♀) (*anteà*, iii., pp. 393-394), somewhat smaller than *A.* hybr. *metis*; both sexes of the hybrid were reared.

6. AMORPHA hybr. METIS, Aust. (*austauti* ♂ × *atlanticus* ♀) (*anteà* iii., pp. 394-5), a hybrid with parentage similar to that of *A.* hybr. *inversa* and like that, according to Austaut, exceedingly difficult to obtain.

7. AMORPHA hybr. INVERSA, Tutt (*populi* ♂ × *ocellata* ♀) (*anteà* iii., pp. 395-396, 495), exceedingly rare and difficult to obtain; the imagines are nearer to *A. populi* that is *S.* hybr. *hybridus*, but have traces of the ocellated spots on the hindwings. It was not till the early part of 1902 (March 20th and May 11th), that Standfuss succeeded in rearing *Amorpha* hybr. *inversa*. Whether earlier breedings took place is open to question, at any rate this appears to be the first recorded one.

EUMORPHIDÆ:—1. THERETRA hybr. STANDFUSSI, Bart. (*porcellus* ♂ × *elpenor* ♀) (*anteà*, iv., 46), one specimen reared from a larva found at large with others on *Epilobium*, and supposed to be *Eumorpha elpenor*, a second single specimen afterwards bred by Rossi.

2. TURNERIA hybr. VESPERTILIOIDES, Bdv. (=*amelia*, Feisth.)* (*hippophaes* ♂ × *vespertilio* ♀) (*anteà*, iv., pp. 49-51, 481-482), described by Boisduval and Feisthamel almost simultaneously from larvæ found near Grenoble.

3. HYLES hybr. EPILOBII, Bdv. (*euphorbiae* ♂ × *vespertilio* ♀) (*anteà*, iv., pp. 46-49), reared from captured larvæ which resembled those of *euphorbiae*, but fed on *Epilobium*, and reported from Hüningen in Alsace, Basle and the Valais in Switzerland, Bozen and Vienna in Austria, Lyons in France.

4. HYLES hybr. EUGENI, Mory (? *epilobii* ♂ × *vespertilio* ♀) (*anteà*, iv., pp. 51-52), bred from larvæ taken with normal larvæ of *T. vespertilio*, but differing from them in coloration, markings and presence of a short caudal horn. The latter character certainly suggests hybridity, but there must be always great doubt as to *epilobii* being the ♂ parent in nature.

5. HYLES hybr. LIPPEI, Mory (? *eugeni* ♀ × *vespertilio* ♀) (*anteà*, iv., pp. 52-53), bred from larvæ found at Hüningen with those of *eugeni* above; the particular larvæ that produced them were unrecognised as being different at the time, and the nearer resemblance of the imagines to *vespertilio* appears to have suggested the assumed parentage.

6. HYLES hybr. PAULI, Mory (? *euphorbiae* ♂ × *hippophaes* ♀) (*anteà*, iv., p. 53), described from an imago bred from a pupa obtained from a larva taken near Sion, no description of the larva being made. The parentage is guessed from the appearance of the imago.

7. CELERIO hybr. PHILEUPHORBIA, Mütz. (? *gallii* ♂ × *euphorbiae* ♀), bred from a larva quite like that of *C. gallii*, but the imago came nearer in appearance to *euphorbiae* than *gallii*.

The value of this latter evidence is small compared with that of the

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* Guillemot (*Ann. Soc. Ent. Fr.*, 1856, p. 29) throws doubt on the hybrid origin of *epilobii* and *vespertilioides*, and asks "Who is to say that they are not very rare varieties of one of the species from which they are said to have descended?"

Amorphids. If the parentage of most of these hybrids be as assumed, and such forms are developed in nature, there should be little trouble to verify the facts by breeding in captivity. It is not, perhaps, out of place to note that Standfuss (*Handbuch*, etc.) states that remarkable Phryxid larvæ were taken by Röber of Dresden, on fuchsia that he supposed might be the progeny of a cross between *Hyles euphorbiae* and *Eumorpha elpenor*. He failed, however, to rear them.

ATTACIDES.*—The first notes we have of hybridity among the Attacids (Saturniids) are those of Ochsenheimer (*Die. Schmett.*, ii., p. viii; iii., pp. 9-10; iv., pp. 191-193). Here he described two forms of *Saturnia* hybr. *hybrida* (*spini* ♂ × *pavonia* ♀); which he later separated as *hybrida-major* (approaching *spini*) and *hybrida-minor* (approaching *pavonia*). Staudinger and Standfuss appear to have been misled into assuming a different parentage, which we have discussed (*anteà*, iii., pp. 296-297). These appear to have come from Vienna. In 1856, Anker bred others, at Budapest and Brünn (*Ent. Nach.*, 1878, pp. 130-131; p. 175). Later notes on *S.* hybr. *hybrida* were published by Aigner, in 1880 (*Soc. Ent.*, 1880, pp. 57-58; 1889, pp. 56-57). In 1870, however, Wallace records (*Ent. Mo. Mag.*, vi., p. 267) pairings (obtained in 1869) between *Antheraea pernyi* ♂ × *cecropia* ♀, *Antheraea pernyi* ♂ × *polyphemus* ♀, and *Antheraea pernyi* ♂ × *yamamai* ♀, of which eggs produced from the *A. pernyi* × *yamamai* pairing proved fruitful. Part of these eggs were handed to Dr. T. A. Chapman, and, although Wallace failed to get imagines, Chapman obtained one example, which was sent to Bond in 1876, and exhibited by him (*Ent. Mo. Mag.*, vii., p. 263), the first *A.* hybr. *perny-yama* successfully reared (the remark that it was reared by Wallace being an error due to the reporter). About 1870, Bigot, a French sericulturist, also obtained (1) *Antheraea* hybr. *perny-yama* (*pernyi* ♂ × *yamamai* ♀) and (2) its reciprocal cross, *A.* hybr. *inversa* (*yamamai* ♂ × *pernyi* ♀), the progeny being magnificent moths, hybernating in the pupal stage and maintaining themselves as distinct for some time. Berce also obtained examples of *A.* hybr. *inversa*, and nineteen of these cocoons came into the possession of Wailly in 1875 (*Entom.*, xiii., pp. 154 *et seq.*). From these cocoons only one imago, a ♀, emerged, and this paired with a ♂ *A. pernyi*, the larvæ, when hatched, being entirely black like those of *A. pernyi*, and bearing no resemblance to those of *A. yamamai*. Wailly does not tell us what special characters were developed later, or whether he reared these imagines, but says that degeneracy quickly occurs in the hybr. *perny-yama* as a result of inbreeding. About 1878, the Bombay silk-spinners are said to have successfully hybridised *Antheraea mylitta* with *A. yamamai*, whilst Bourdier, in 1878, obtained further fruitful pairings between *Antheraea pernyi* and *yamamai* (*A.* hybr. *perny-yama*), and Wailly observed (*Entom.*, xiii., pp. 154 *et seq.*), in 1880, that, for several years he has obtained crossings between *pernyi* ♂ × *polyphemus* ♀, *cecropia* ♂ × *cynthia* ♀, several times; *cecropia* ♂ × *gloveri* ♀; *cecropia* ♂ × *polyphemus* ♀, several times; *pyri* ♂ × *cecropia* ♀, but that, in every case, the eggs had proved infertile. In 1884, Wailly

* The details of the hybridism in this superfamily have already been published in volume iii, to which reference must be made, as only a brief summary of facts is recorded here.

exhibited (*Ent. Mo. Mag.*, xxi., p. 115) hybrids between *Antheraea roylei* and *A. pernyi*, and *Samia cecropia* × *californica* (*ceanothi*). The first-named hybrid had been described in 1882 by Kirby (*Proc. Ent. Soc. Lond.*, 1882, p. vii), whilst Moore described the reciprocal cross (*Ent.*, xxix., p. 237). Here, too, Wailly gives (*op. cit.*, pp. 235 *et seq.*) a full account of *Antheraea* hybr. *roylei* × *pernyi*, stating that the hybrids are perfectly fertile *inter se*, and notes that, at the end of three years, they showed no signs of degeneracy. Wallace cites (*Darwinism*, 1889, p. 163) from Quatrefages, a case of fertility, *inter se*, in *Attacus cynthia* × *arrindia*. This Watson attempted to discount (*Ent.*, xxvi., p. 174) by stating that *arrindia* (which he calls *ricini*) is the Burmese local many-brooded variety of the common *cynthia*, but we believe that it is the Burmese local form of *lunula* not *cynthia* (Kirby, *Cat.*, p. 748). He, however, notes (*op. cit.*, p. 176) that *Antheraea mylitta* crossed with *yamamai* and *A. pernyi* with *mylitta*, but gives no details of eggs or larvæ. Records of many other unsuccessful crosspairings are made by Heyer (*Soc. Ent.*, xiii., pp. 137-138 and quoted *anteà*, vol. iii., p. 291). At the meeting of the Entom. Society of London, July 7th, 1886, Wailly exhibited some remarkable hybrids between *Platysamia cecropia* and *P. californica* (*ceanothi*), a fuller account, however, of the hybridisation of the American species being published later (*Ent.*, xxvi., pp. 176-177; *Proc. Ent. Soc. Lond.*, 1895, pp. xxxiv-xxxv). An account of five of these, with descriptions, is given *anteà*, vol. iii., pp. 292-293. These are *Platysamia* hybr. *griffithsi* (*cecropia* × *gloveri*), *P.* hybr. *watsoni* (*cecropia* × *ceanothi*), *P.* hybr. *heyeri* (*ceanothi* × *cecropia*), *P.* hybr. *americana* (*columbia* × *cecropia*), *Actias* hybr. *mortoni* (*luna* × *selene*). Heyer notes (*Soc. Ent.*, xiii., p. 137) that attempts to pair *P.* hybr. *watsoni* and *P.* hybr. *heyeri* with each other failed to produce a single egg, whilst ♀ s of *P. cecropia* paired with ♂ s of both these hybrids produced a very high percentage of fertile eggs. Standfuss (*Handbuch*, &c., pp. 99-100) records the pairing of *Saturnia pavonia* ♂ with *Actias luna* ♀, obtaining nine pairings, and over 1000 eggs, of which, however, none hatched. A crossing of *Saturnia pavonia* ♂ with *A. isabellae* ♀ also took place (*loc. cit.*), the ♀ laying 98 eggs, of which 7 hatched, the larvæ, however, not surviving the first change of skin.

But it is the experiments that Standfuss has carried out on the hybridism of *Saturnia pavonia*, *S. spini*, and *S. pyri* that have thrown probably more light on some of the problems of hybridity than any others (see *Handbuch*, &c., pp. 66 *et seq.*, pl. i-iv; and *Entom.*, 1900, pp. 343 *et seq.*, pl. vii-viii), already fully noticed (*anteà*, iii., pp. 296 *et seq.*) and that may be detailed as follows:—In 1891, Standfuss crossed *S. pavonia* ♂ with *pyri* ♀ (the hybrid produced being figured *Handbuch*, pl. i., figs. 1-4, and pl. iii., figs. 13-14), and, in 1892, *S. pavonia* ♂ with *spini* ♀ (the hybrid produced being figured *op. cit.*, pl. ii., figs. 3-5; pl. iii., figs. 9-10). These Standfuss named respectively *S.* hybr. *emiliae* (with a dark ab. *daubii*) and *S.* hybr. *bornemanni*. In 1893, Standfuss bred the first of his secondary hybrids by crossing *S.* hybr. *emiliae* ♂ back with *S. pavonia* ♀. This was described by Wiskott (*Iris*, vii., pp. 237-240) as *S.* hybr. *standfussi*. A pairing between *S.* hybr. *emiliae* ♂ and *S. pyri* ♀ was also obtained in 1893, and eggs obtained, but these were infertile, but, in 1894, a few larvæ hatched and the resulting imago was called *S.* hybr. *risii* by Standfuss; the hybr. *standfussi* is figured in *Handbuch*, &c., pl. ii.

figs. 6-7; and *risii*, pl. iv., figs. 1-3, the former being three parts *pavonia* and one part *pyri*, the latter one part *pavonia* and three parts *pyri*. This year also he crossed *S.* hybr. *bornemanni* ♂ with *pavonia* ♀, but the larvæ all died of an infectious disease in the last stadium. The greatest surprise of 1893 was, however, the pairing of *S. pavonia* ♂ with *Graëllsia isabellae* ♀; of this cross 98 eggs were obtained, and seven larvæ hatched. These Standfuss reared as far as the second moult, when they died (a figure of the larva is given *op. cit.*, pl. iii., fig. 6). Hermann, at Heinrichau, also paired a ♂ *Dimorpha versicolora* with a ♀ *Aglaia tau*, and a ♂ *Aglaia tau* with a ♀ *Saturnia pavonia*, but the eggs laid were infertile. In April, 1894, Standfuss obtained six pairings of *A. tau* ♂ × *Saturnia pavonia* ♀ and seven pairings of the reciprocal cross, *S. pavonia* ♂ × *A. tau* ♀; from the first lot of pairings 800 eggs were obtained, and from the second 500 eggs; yet, although they were laid quite normally, not a single larva hatched. In 1895, Standfuss reports nine apparently normal pairings between *S. pavonia* ♂ and *Actias luna* ♀, and over 1000 eggs were laid, but none of these hatched.

During 1896 and 1897, Standfuss carried further his crossings with the Saturniid hybrids. Having already obtained the primary hybrids—*S.* hybr. *bornemanni* (*pavonia* ♂ × *spini* ♀), *S.* hybr. *emiliae* (*pavonia* ♂ × *pyri* ♀)—and found the males of both hybrids fertile with the original parents; he obtained the secondary hybrids—*S.* hybr. *schaufussi* (*bornemanni* ♂ × *pavonia* ♀), *S.* hybr. *dixeyi* (*bornemanni* ♂ × *spini* ♀), *S.* hybr. *standfussi* (*emiliae* ♂ × *pavonia* ♀), and *S.* hybr. *risii* (*emiliae* ♂ × *pyri* ♀). He then carried his experiments further, obtaining the hybrid *S.* hybr. *complexa* (*standfussi* ♂ × *pavonia* ♀), and a remarkable tertiary hybrid, *S.* hybr. *schlumbergeri* (*bornemanni* ♂ × *pyri* ♀), *i.e.*, a combination of *pavonia*, *spini* and *pyri*. Two other hybrids were reared to the larval stage, *viz.*, *pavonia* ♂ × *schaufussi* ♀, *schaufussi* ♂ × *pavonia* ♀, whilst a quaternary hybrid reached the larval stage, *viz.*, *bornemanni* ♂ × *schaufussi* ♀, thus proving *S.* hybr. *schaufussi* ♀ to be fertile. This proof he carried still further by pairing a ♂ *schaufussi* with a ♀ *schaufussi*, from which he obtained ♂ imagines, a full account of which has already been given (*anteà*, iii., p. 298).

LACHNEIDES*.—Of the Lachneids, Standfuss obtained pairings between *Malacosoma franconica* ♂ and *M. castrensis* ♀, between *M. castrensis* ♂ and *M. franconica* ♀, between *M. neustria* ♂ and *M. franconica* ♀, between *M. neustria* ♂ and *M. castrensis* ♀ (*Stett. Ent. Zeitg.*, 1884, pp. 193-199). The experiments were detailed later (*Handbuch*, &c., pp. 62-63), and it is to be noted that only the crossing *M. castrensis* ♂ × *franconica* ♀ produced no imagines. The others he described and named as follows:—

1. MALACOSOMA hybr. CARADJÆ, Stdfss. (*neustria* ♂ × *franconica* ♀) 12 ♂s bred, no ♀. These resemble *M. franconica* more in contrast of colour of wings with that of thorax and abdomen, and resemble *M. neustria* more in distinct yellow border of central band of forewings and dark fringes on nervures iii and iv of hindwings.

2. MALACOSOMA hybr. SCHAUFUSSI, Stdfss. (*neustria* ♂ × *castrensis*

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* For full details of the *Lachneid* hybrids see *anteà*, vol. ii., pp. 524-525.

♀). 12 ♀s bred, no ♂. The markings intermediate between those of the two species, following *castrensis* in that the inner transverse line of band makes a small pointed angle into median band, just before costa.

3. Malacosoma hybr. penzigi, Tutt (*franconica* ♂ × *castrensis* ♀).—1 ♀ only bred. Traces of the median band of *castrensis* (always absent in *franconica*) are weakly indicated in the hybrid. The reciprocal crossing, *M. castrensis* ♂ × *franconica* ♀, produced two batches of eggs from which 70 and 92 larvæ emerged, but these died without eating anything except their own eggshells.

In 1901-1902, Bacot successfully reared *Malacosoma* hybr. *schaufussi* (*neustria* × *castrensis*) (*Proc. Ent. Soc. Lond.*, 1902, p. vii; *Ent. Rec.*, xiv., p. 106), when, from 200-300 eggs were laid, some of which were quite empty, some devoloped embryos, which then died, others produced larvæ. The young larvæ (very like those of *M. castrensis*), after the second moult, divided into two sections: (1) "Forwards," that were healthy, fed up at an unprecedentedly rapid rate and produced only ♀ imagines. (2) "Laggards," an unhealthy, slow-feeding, weakly lot that produced 30 pupæ, from which 7 ♂s only emerged, the other pupæ belonging apparently to the same sex. The last ♀ emerged three weeks ahead of the first ♂ and before any ♂ of either of the parent species. In 1902, these experiments were continued and described more at length (*Proc. Ent. Soc. Lond.*, 1903, pp. viii-ix; *Ent. Rec.*, xv., p. 134). Again the larvæ divided into "forwards" and "laggards," the former producing only females, and the latter males. By forcing the ♂ pupæ, however, pairings between ♂ and ♀ *schaufussi* were obtained. The ♀s went through all the ordinary movements of egglaying and deposited the ordinary cement without, however, laying any eggs. Pairings between ♂ *schaufussi* × ♀ *castrensis*, and ♂ *schaufussi* × ♀ *neustria* were obtained, but only few eggs were laid, and these were infertile. The imagines of *schaufussi* bred in 1901 were remarkably uniform in colour and markings, those in 1902 were particularly variable. Of the 1901 brood, there were 6 ♂s and 44 ♀s, the ♂s with pale forewings and dark hindwings, and showing unmistakable traces of both parent species. In the forewings, the straightness of the transverse lines follows the ♂ parent, but there is a tendency in some of the specimens for the inner of the two lines to turn inwards towards the base of the wing, as in *castrensis*, instead of continuing straight to the outer margin as happens with *neustria*; they also follow the ♀ parent in showing more or less strongly the outer dark shaded band, between the transverse line and the margin of the wing (which is developed throughout a long series of *castrensis*, but is present in none of the *neustria*); the dark hindwings are also almost entirely due to the same source, as I have never seen a ♂ of the pale canary-coloured form of the last-named species that had dark hindwings, whereas this is the normal arrangement in *castrensis*. The 44 ♀s are practically all of one type like the ♂s, the ground colour being very dark umber-brown with narrow pale transverse lines on the forewings; these are much sharper as well as narrower, than is normally the case with *castrensis*, in which species the lines are not only broader, but are suffused as well as at their edges. In contour, they rather follow the *neustria* pattern, but there are not wanting traces of the ♀ influence if carefully looked for.

There is a slight, but very slight, only just discernible, trace of the space between the transverse lines, being more strongly (darkly is hardly the word) coloured than the remainder of the wing area, this darkening being a marked characteristic of the females of *neustria* where the band is more faintly, but still clearly, continued across the hindwing as well, but of this there is no trace in any of the hybrid specimens except on one where the outer transverse line is very faintly continued on the secondaries; this continuation of the transverse lines is, however, frequently noticeable in *castrensis* ♀s. There is no intermingling of ♂ coloration or pattern in any of the ♀ specimens, the variegated marginal fringe, which many of the specimens show, being quite normal to the ♀s of both the parent species, though more strongly marked in *neustria*. One ♀ is aberrant in having a broad longitudinal streak of the pale canary colour of the transverse lines on the right wing only, and it is perhaps significant that this streak is interrupted on the area between the transverse lines. The 1902 brood prodused 6 ♂s and 16 ♀s. Of these, the ♂s differ considerably among themselves and also from the previous brood. The largest is a very fine specimen of the last year's type, but much more strongly and richly marked. There is one other weakly-marked specimen of this type, but the others differ greatly. One is of a suffused ochre-brown, which is not uncommon in specimens of *castrensis*, and is occasionally present in males of *neustria* as well; both the bars and the outer dark shading of *castrensis* are very faintly in evidence, and the hindwings, though of a slightly different tint, are not markedly darker than the forewings, the remaining three specimens are also of this type as regards form and markings but very much darker, being of a rich umber-brown, one of them being exceedingly dark, their hindwings also being noticeably darker than the primaries. As regards coloration and variation these last four seem certainly to be following *castrensis* rather than *neustria*. The 16 ♀s, like the ♂s, show much variation among themselves, about half of them approximating to last year's brood, one of these, however, has a pale unicolorous marginal fringe. The other specimens have, to a varying extent, lost the pale transverse bars, in some instances entirely, and they vary in regard to their uniform coloration from the darkest umber-brown, to a pale dull brownish ochre; in two specimens there is a tendency to be thinly scaled, after the fashion of females of *franconica* (Bacot).

Selmons records (*Soc. Ent.*, 1894, p. 156) pairings between *M. alpicola* ♂ × *castrensis* ♀, and *M. castrensis* ♂ × *alpicola* ♀; the eggs proved infertile.

4. Lasiocampa hybr. wagneri (*quercûs* ♂ × *trifolii* ♀).—Standfuss records (*Handbuch*, &c.) that Wagner obtained a pairing between *Lasiocampa quercûs* × *trifolii* ♀ from which fertile eggs and larvæ were obtained, only one ♀, however, reaching the imaginal state. He gives no further particulars.

Geometrides.—Hybridity among the Geometrids is rare, rather, one suspects, from want of experiment than any other reason. Those already recorded are as follows:—

1. Zonosoma hybr. brightoni (*orbicularia* ♂ × *linearia* ♀).—In 1859, Cooke paired a ♂ *Zonosoma orbicularia* with a ♀ *Z. linearia* (*trilinearia*): eight eggs only were laid, these hatched in due course,

and the larvæ varied much, some being like that of *Z. linearia*, others like that of *Z. orbicularia*, others intermediate. They all pupated, but only one imago appeared—a specimen much more like *Z. porata* or *Z. punctaria* than either of its parents (*Ent. Wk. Int.*, viii., p. 47).

2. Amphidasys hybr. herefordi (*strataria* ♂ × *doubledayaria* ♀).—In 1890, Chapman forced pupæ of *Amphidasys betularia* in order to pair the imagines with those of *A. strataria* and succeeded in obtaining a pairing, a ♂ *A. strataria* with a large black ♀ *A. betularia*. Many fertile eggs were laid, the larvæ hatched and fed up well, some half-dozen missing a moult, not feeding died without being up to full-size, and assuming the pupal stage earlier than the others. All the imagines from these emerged in autumn or winter and died without being observed at the time. The rest of the larvæ only produced about a dozen pupæ, which refused to be forced, and died with the exception of two, which lived on until June, apparently meaning to go over until another season (*Ent. Rec.*, ii., p. 83).

3 and 4. Biston hybr. pilzii (*hirtarius* ♂ × *pomonarius* ♀) and Nyssia hybr. hünii (*pomonarius* ♂ × *hirtarius* ♀).—In 1890, Pilz found a ♂ *Biston hirtarius* paired with a ♀ *B. pomonarius* in nature; from the eggs obtained, some interesting imagines were bred in due course, and named by Standfuss, *Biston* hybr. *pilzii* (*Ent. Zeits. Guben*, iv., pp. 142-143; v., pp. 109-110). This form is figured by Standfuss (*Handbuch*, &c., pl. iii., figs. 1-2). Wiskott is said to have a ♂ of this hybrid, captured many years before on the promenade at Breslau. This and its reciprocal cross have again since been bred, and Oberthür, in 1897, described the reciprocal cross under the name of *Nyssia* hybr. *hünii*, figuring both *pilzii* and *hünii* (*Bull. Ent. Soc. Fr.*, 1897, pl. i., *pilzii*) (10 ♂s, 4 ♀s); (pl. ii., *hünii*) (14 ♂s). In 1900 (*op cit.*, 1900, p. 274, pl. i) he published a supplementary note and figured the ♀ of *hünii*. He notes that the interesting point of crossing these species lay in the fact that the ♀ of *Biston hirtarius* is winged, that of *Nyssia pomonarius* is apterous. The hybrid *pilzii* shows an intermediate stage of development between those of the two parents, being semideveloped, and not apterous as the mother (*pomonarius* ♀). The ♂ of the reciprocal cross *hünii* is rather yellower in tone than the ♂ *pilzii*, but the ♀ *hünii* is very similar to the ♀ *pilzii*. Hüni, who bred the specimens of the two hybrids that Oberthür figures, says that he obtained, in 1896, about 100 eggs of *pilzii* (*hirtarius* × *pomonarius*) and about 200 of *hünii* (*pomonarius* × *hirtarius*); these hatched in May 1896, and the larvæ were not easy to distinguish, approaching rather to *pomonarius*, although a few only differed slightly from the larva of *hirtarius*. They were, throughout their growth, larger than larvæ of *pomonarius* of the same age, and ate apple, pear, plum, and *Prunus padus*, but preferred plum; the mortality was comparatively small. In July, the larvæ pupated, and, as a result, about 70 pupæ of *pilzii* and 140 of *hünii* were obtained; the pupæ wintered in a cocoon, and, in March, 1897, 30 examples (15 of which were illdeveloped) made their appearance, the ♂s and ♀s at the same time (although Pilz, who had first bred the form, obtained the ♀s the first year and the ♂s the second year). Some hybrid *hünii* also emerged in March, 1897, but these consisted only of ♂s, the rest of the pupæ going over. None then emerged until March, 1899, and March, 1900, when 6 ♀s were reared, other pupæ at the time still being alive and going over to another spring.

On the whole, in spite of certain similarities that make the two hybrids very like each other, *hünii* tends more to *pomonarius* (its ♂ parent) and *pilzii* to *hirtarius* (its ♂ parent), thus supporting Standfuss' first law (*anteà*, p. 12) that the ♂ has a greater result on the hybrid progeny than the ♀. Pairings were obtained between *pilzii* ♂ × *pilzii* ♀, *pilzii* ♂ × *hirtarius* ♀, *hünii* ♂ × *pomonarius* ♀, and *hünii* ♂ × *pilzii* ♀, but the eggs resulting from all these pairings proved infertile.

5. Ennomos hybr. dartfordi (*alniaria* ♂ × *angularia* ♀).—In 1895, Farn recorded (*Ent. Mo. Mag.*, xxxi., p. 280) the breeding of a cross between *Ennomos alniaria* (*autumnaria*) ♂ and *E. angularia* (*quercinaria*) ♀, the latter, which emerged unusually late in 1894, being paired with a ♂ *E. alniaria*, which happened to come out in the same breeding-cage; the progeny showed characters of both parents and paired together, but the ova proved infertile.

6. Selenia hybr. parvilunaria (*bilunaria* ♂ × *tetralunaria* ♀).—In 1902, Newman crossed a ♂ *Selenia bilunaria* with a ♀ *S. tetralunaria* (*Ent. Rec.*, xv., p. 25); the ♀ laid about 60 ova that hatched, the larvæ, however, appeared to be sickly, and, in the end, only 3 ♂ s, which emerged between July 30th and August 2nd, were reared. In general tone these more nearly approach *tetralunaria*, and the inner line of forewings and band of hindwings follow that species, whilst the outer line of forewings and absence of any spot on hindwings are characteristic of *bilunaria* (*Proc. Sth. Lond. Ent. Soc.*, 1902, pp. 110-111). Bartel records (*Ent. Nachr.*, xxvi., pp. 340 *et seq.*) that his friend Herr R. Sauermann obtained, in several cases, reciprocal crosses between *Selenia bilunaria* and *tetralunaria* second broods, the progeny of captured specimens of the spring generation. In both crossings, the duration of copulation was shorter than is normal in these species. The eggs were only laid very gradually, and the emergence of the larvæ was irregular. The larvæ are described and were distinguishable from both parent forms, but differed little from one another. The only hybrid form which had emerged up to the date of writing is named (on p. 342) *Selenia* hybr. *parvilunaria*, and is diagnosed as: "Hybrida *Selenia bilunaria*, Esp. var. *juliaria*, Haw. ♂ et *Selenia tetralunaria*, Hufn. var. *aestiva*, Stgr. ♀; lunula media alarum omnium supra minima. Expans. alarum anticarum: 21-30mm. (♂); ♀ ignota." These appeared as a third generation, some pupæ of the same brood going over the winter, as also did all those from crosses of the types, and those from the reciprocal cross *tetralunaria* ♂ × *bilunaria* ♀, which had seemed the more difficult cross to obtain. A very detailed description of hybr. *parvilunaria* is given, from which it appears that it is intermediate between the parent forms in colour and some other respects, but is readily distinguishable from both in some particulars, especially in the minutely small, transparent lunules on the upper side of the forewings.

7-12. Tephrosiid hybrids.—The most important scientific results obtained by hybridising Geometrid moths, however, are those produced by crossing *Tephrosia bistortata* and *T. crepuscularia*, in the experiments carried out in 1897 by Bacot and Riding. These, and the conclusions drawn therefrom, are published in detail (*Ent. Rec.*, ix., pp. 149, 243, 277, 319; x., 143; *Trans. Ent. Soc. Lond.*, 1898, pp. 17-42). We can only here give the following summary thereof:

I. Riding's Experiments: Fertile crossings were obtained of—

1. *T. bistortata* ♂ × *T.* ab. *delamerensis* ♀.—*α*. Paired March 11th; ova deposited March 15th; hatched April 26th to 27th.

2. *T.* ab. *delamerensis* ♂ × *T. bistortata* ♀.—*α*. Paired March 9th; ova deposited March 14th; hatched April 18th to 19th.—*β*. Paired March 9th; ova deposited March 13th to 14th; hatched April 18th to 19th.

3. *T. bistortata* ♂ × *T. crepuscularia* ♀.—*α* and *β*. Two pairings on March 17th; ova deposited March 20th to 22nd; hatched April 25th to 27th.

4. *T. crepuscularia* ♂ × *T. bistortata* ♀.—*α*. Paired March 7th; ova deposited March 16th; hatched April 21st to 22nd. *β*. Paired March 14th; ova deposited March 20th; hatched April 22nd to 23rd.

Crossings that failed were—(1) *T.* ab. *delamerensis* ♂ × *T. bistortata* ♀, two pairings, February 28th and March 12th. (2) *T. crepuscularia* ♂ × *T. bistortata* ♀, three pairings, March 7th, 10th, 14th. The results of the above crossings were as follows:—

i. *Hybrid between* ♂ *T. bistortata* (Clevedon) *and* ♀ *T.* ab. *delamerensis* (York).—No. 1 in list above. One batch of eggs hatched April 26th to 27th, 100 imagines emerged between June 12th and October 22nd, 1897; 48 ♂s and 52 ♀s = T. hybr. ridingi-suffusa, n. hybr.

ii. *Hybrid between* ♂ *T. crepuscularia* ab. *delamerensis* (York) *and* ♀ *T. bistortata* (Clevedon).—No. 2 of above list. Two batches of eggs obtained; hatched April 18th to 19th. The two broods were fed up together, the imagines exhibited being a mixture of both broods. 61 imagines were reared (60 ♂s and 1 ♀). These emerged between June 12th and September 19th, 1897 = T. hybr. bacoti-suffusa, n. hybr.

These two crosses represent the reciprocal crosses of *T. bistortata* and *T. crepuscularia* ab. *delamerensis*. Only 1 ♀ occurred in cross ii. The percentage of a form approaching ab. *delamerensis* in the two crossings is 60 and 40 per cent. respectively; the crossing in which *T. bistortata* was the male parent produced by far the larger and more vigorous offspring.

iii. *Hybrid between* ♂ *T. bistortata* (Clevedon) *and* ♀ *crepuscularia* (York).—No. 3 of above list. Two batches of eggs obtained; hatched April 25th to 27th; larvæ fed up together. 121 imagines emerged between June 17th and November 3rd, 1897. These consist of 65 ♂s and 56 ♀s = T. hybr. ridingi, n. hybr.

iv. *Hybrids between* ♂ *T. crepuscularia* (York) *and* ♀ *T. bistortata* (Clevedon).—No. 4 of above list. Two batches of eggs obtained; hatched April 21st to 23rd; larvæ fed up together, 40 imagines emerged between June 16th and November 1st, 1897. These consist of 40 males and no female = T. hybr. bacoti, n. hybr.

These crosses iii and iv, are the reciprocal crosses of typical *T. bistortata* and *T. crepuscularia*. The most noticeable point is that cross iii produced 47 per cent. of females, and cross iv no female. The earliest specimens to emerge (of both sexes) were pale, those longest in the pupal stage were the darkest.

II. Bacot's experiments: Fertile crossings were obtained of—

1. *T. bistortata* ♂ × *T.* ab. *delamerensis* ♀.—Paired March 9th.

2. *T.* ab. *delamerensis* ♂ × *T. bistortata* ♀.—Three pairings. *α*. Paired February 26th; ova hatched April 6th. *β*. Paired March 5th. *γ*. Paired March 9th; ova hatched April 7th.

3. *T. bistortata* ♂ × *T. crepuscularia* ♀.—Two pairings. *α*. Paired March 9th; ova hatched April 8th to 9th. *β*. Paired March 9th; ova hatched April 8th to 9th.

4. *T. crepuscularia* ♂ × *T. bistortata* ♀.—Paired February 27th.

Crossings that failed were—(1) *T. crepuscularia* ♂ × *T. bistortata* ♀. Paired February 27th. (2) *T.* ab. *delamerensis* ♂ × *T. bistortata* ♀. Paired March 4th. The results of the above crossings were as follows:

i. *Hybrid between* ♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*.—(Ova received from Dr. Riding. They are part of Dr. Riding's cross marked 1.) Eggs laid March 15th; hatched April 26th to 27th. 21 specimens emerged—11 males, 10 females = T. hybr. ridingi-suffusa, n. hybr.

ii. *Hybrid between* ♂ *T.* ab. *delamerensis* × ♀ *T. bistortata*.—No. 2*α* above.

One batch of eggs, hatched April 6th; some larvæ fullfed by May 9th; larvæ mostly like that of the ♀ parent (*bistortata*), only a few having the apex of the ʌ-mark open like the larva of *T. crepuscularia*. Most of the larvæ pupated about the middle of May. Imagines commenced to emerge early in June, at first rapidly and afterwards more slowly, until end of June; there was then a break until July 16th, when they again commenced to emerge, and continued to do so at intervals until the first week in September; one specimen emerged during the last week in October. 58 specimens emerged, all males—29 pale and 29 dark specimens = T. hybr. BACOTI-SUFFUSA, n. hybr.

iii. *Hybrid between* ♂ *T. bistortata* × ♀ *T. crepuscularia*.—Of this cross there were two different broods. Of the first, (α) (marked 3α in Bacot's pairings), the larvæ for the most part followed the ♂ parent (*bistortata*), only a few having the apex of the ʌ-mark open as in that of ♀ parent; fullfed from about 16th to 20th May. 22 specimens emerged—14 ♂ s and 8 ♀ s. These emerged in June, with the exception of two (which came out in July). (β) Of the other brood of this cross (marked 3β) a fair number of the larvæ fed up and pupated very quickly, but others fed up slowly, and did not go down until the earliest specimens had commenced to emerge; larvæ unhealthy, large proportion died. 9 specimens emerged—six males and 3 females. Four minute specimens—$\frac{15}{16}$in. (♂), $\frac{15}{16}$in. (2 ♀ s), $1\frac{1}{8}$in. (1 ♀). These small specimens emerged in late June, two normal specimens in early June, one on September 29th, and two late in October. It may be well to mention here that these tiny specimens are not infrequent in inbred *T. bistortata*. Such a brood as this last is practically useless for comparative purposes = T. hybr. RIDINGI, n. hybr.

INBRED HYBRIDS OF T. HYBR. RIDINGI AND T. RIDINGI-SUFFUSA.—*T.* hybr. *ridingi* and *T.* hybr. *ridingi-suffusa* were the only two hybrids that were inbred to the imaginal stage. (1) Of the form (*ridingi*) both Riding and Bacot obtained fertile ova and bred imagines in due course. The former obtained two batches of eggs:—(α) Paired August 10th; ova laid August 12th; hatched during the fourth week of August, some only fertile. (β) Paired August 13th; ova laid August 15th; hatched first week in September. By October 22nd all except thirteen larvæ had pupated. The first two imagines emerged on November 4th, five fullfed larvæ at that date not having gone down. The imagines continued to emerge till January 19th, 1898—34 imagines in all (23 ♂ s and 11 ♀ s). These are paler than the parents, varying from pale brownish to brownish-grey, some approaching the 2nd brood of *T. bistortata*, others the ♂ s of *T. crepuscularia*, but most have very mixed characters. Six of these were paired in November, of which about half the eggs hatched in January, but the larvæ soon died (*Ent. Rec.*, xi., p. 144). Bacot obtained two similar crossings, both from parents belonging to his batch iii*a*, the parents being in each case normal for that brood—(α) Pairing took place on June 17th, 1897; 22 imagines emerged, 12 ♂ s and 10 ♀ s, between the middle of August and end of October. (β) Of this brood, 8 imagines, 4 ♂ s and 4 ♀ s, emerged during August, and others continued to do so until the end of October. (2) Of the latter (*ridingi-suffusa*), the parents were both taken from Bacot's batch i. They paired on June 13th, and as progeny produced, in September, only two small round-winged imagines—one a ♂ ($1\frac{1}{8}$in. in expanse) suffused with ochreous-fuscous, and with distinct transverse lines; the other a ♀ ($1\frac{1}{4}$ins. in expanse), whitish ground colour, with basal and median bands, and well-developed submarginal lines to forewings, and median and outer bands to hindwings. Both specimens show traces of a fine black longitudinal line on median nervure at outer point of discoidal cell, and a small black costal blotch at upper end of the basal line. This latter is most marked in two males of *T. crepuscularia* (2nd brood) bred by Bacot.

Besides obtaining reciprocal crossings of the two species, as detailed above, pairings of the hybrids were obtained by Riding between June 13th and 26th, as follows:—

1. ♂ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*) × ♀ (♂ *T.* ab. *delamerensis* × ♀ *T. bistortata*).
2. ♂ (♂ *T.* ab. *delamerensis* × ♀ *T. bistortata*) × ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*).
3. ♂ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*) × ♀ (♂ *T. bistortata* × ♀ *T. crepuscularia*).
4. ♂ (♂ *T. crepuscularia* × ♀ *T. bistortata*) × ♀ (♂ *T. bistortata* × ♀ *T. crepuscularia*).
5. ♂ (♂ *T. bistortata* × ♀ *T. crepuscularia*) × ♀ (♂ *T. crepuscularia* × ♀ *T. bistortata*).

Of these different crosses twelve pairings in all were obtained, eleven of which gave ova, and yet, of these eleven batches, only two were fertile, both crosses of ♂ (♂ *T.* ab. *delamerensis* × ♀ *T. bistortata*) × ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*). Later pairings of ♂ (♂ *T. crepuscularia* × ♀ *T. bistortata*) × ♀ (♂ *T. bistortata* × ♀ *T. crepuscularia*) also proved infertile. Riding, however, obtained four inbred pairings of ♂ (♂ *T. bistortata* × ♀ *T. crepuscularia*) × ♀ (♂ *T. bistortata* × ♀ *T. crepuscularia*); one of these produced no eggs, another was infertile; the two others were, however, partially fertile. In addition to the first crosses already summarised, Bacot obtained the following more or less fertile crossings of the various hybrids reared from the already described broods:

1. ♂ (♂ *T.* ab. *delamerensis* × ♀ *T. bistortata*) × ♀ (♂ *T. bistortata* × ♀ *T. crepuscularia*). Two pairings—α. June 10th; β. August 6th.
2. ♂ (♂ *T.* ab. *delamerensis* × ♀ *T. bistortata*) × ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*). Two pairings on June 10th (eggs mostly fertile).
3. ♂ (♂ *T. bistortata* × ♀ *T. crepuscularia*) × ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*). Paired June 11th.

He further obtained the following inbred pairings:—

4. ♂ (♂ *T. bistortata* × ♀ *T. crepuscularia*) × ♀ (♂ *T. bistortata* × ♀ *T crepuscularia*). Four pairings:—α. June 10th. β. June 10th. γ. June 14th. δ. June 17th. (A large percentage of the eggs infertile.)
5. ♂ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*) × ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*). One pairing June 13th.

The following pairings of a hybrid with one of the parent species were also obtained:

6. ♂ (♂ *T.* ab. *delamerensis* × ♀ *T. bistortata*) × ♀ *T. bistortata* (second brood). Paired June 15th. Only one or two ova hatched, remainder infertile.
7. ♂ *T. crepuscularia* (second brood) × ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*). Paired July 4th.

The following crosses entirely failed:—

1. ♂ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*) × ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*). Paired June 12th.
2. ♂ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*) × ♀ (♂ *T. bistortata* × ♀ *T. crepuscularia*). Paired June 14th.
3. ♂ (♂ *T.* ab. *delamerensis* × ♀ *T. bistortata*) × ♀ (♂ *T. bistortata* × ♀ *T. crepuscularia*).

Only one secondary hybrid was reared to the imaginal stage, *viz.*:—

v. *Hybrid between* ♂ *T. bacoti-suffusa* × ♀ *T. ridingi-suffusa.*—A ♂ (♂ *T.* ab. *delamerensis* × ♀ *bistortata*) paired with a ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*), the parents being taken from Dr. Riding's crossings ii and i above respectively. Two batches of eggs, hatched June 27th-30th; forty-six imagines emerged between August 21st and November 19th, 1897 (see *Ent. Rec.*, x., pp. 143-145). It is almost impossible to classify these=T. hybr. MIXTA, n. hybr. *T.* hybr. *mixta* was inbred by Riding. The pairing is noted as occurring on August 31st, 1897 (*Ent. Rec.*, ix., p. 320) and fertile eggs were laid September 4th, which hatched September 18th-19th; the larvæ were fullfed in November and early December. From the pupæ, imagines emerged December 28th, 1897-January 27th, 1898—14 in all (11 ♂ s and 3 ♀ s). The imagines small, pale brownish-white or greyish-brown in colour, with some ancestral markings more or less defined but 4 only can be referred to a distinct form (*viz.*, *T. crepuscularia*). Another batch of eggs laid October 21st-22nd produced larvæ November 13th-14th, but the larvæ died. Of the 14 inbred *T.* hybr. *mixta* four were paired, one ♀ depositing two, the other six eggs; seven of these hatched, but the larvæ died in a few days.

In one case a ♂ of the parent race was crossed with a ♀ hybrid, and the cross successfully reared to the imaginal stage, *viz.*:—

vi. *Hybrid between* ♂ *T. crepuscularia* × ♀ *ridingi-suffusa*.—The parentage being ♂ *T. crepuscularia* (second brood) × ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*). The progeny is, therefore, three-fourths *T. crepuscularia* and one-fourth *T. bistortata*. The female hybrid chosen for this experiment was of the *delamerensis* form, and taken from Bacot's batch i. Pairing took place on July 4th. 49 imagines resulted and were exhibited, 38 ♂ s and 11 ♀ s. These emerged during September and October. Only 2 ♀ s were present among the first 37 emergences, and 9 among the last 12. The imagines consisted of 31 pale and 18 dark specimens. With the exception of 7 females the remainder of this brood are, to all intents and purposes, *T. crepuscularia*. Only one who has made a very special study of these species could tell that the latter specimens had been obtained from parents that had been crossed with *T. bistortata* = T. hybr. REVERSA, n. hybr.

CYMATOPHORIDES.—The Cymatophorids give, we believe, only one recorded instance of hybridity, *viz.*:—

CYMATOPHORA hybr. FLETCHERI (*ocularis* ♂ × *or* ♀).—Fletcher placed in a sleeve a *C. ocularis* (*octogesima*) ♂ and *C. or* ♀, in June, 1893, obtained eggs and larvæ and bred 33 ♀ moths in August and September of the same year. The progeny resembled *C. or*, except that both orbicular and reniform stigmata were very conspicuous, being pure white filled up slightly with black, whereas in *C. or* they are usually inconspicuous and the orbicular sometimes wanting. None of the pure bred *C. or* reared at the same time has the stigmata so fully developed as have the hybrids, which were most uniform in this respect (*Ent. Record*, iv., p. 304).

DREPANULIDES.—Hybrids among the Drepanulids are exceedingly rare. We can only trace the following:

1. DREPANA hybr. REBELI (*curvatula* ♂ × *falcataria* ♀).—The first record of this hybrid appears to be that of Gravenhorst (*Isis*, 1834, p. 720) who notes that a pairing of *Drepana curvatula* ♂ × *falcataria* ♀ produced fertile eggs, larvæ, and finally ♀ imagines, whilst the reciprocal cross produced infertile eggs (see also *Stett. Ent. Zeit.*, 1858, pp. 231, 411). The same crossing was made by Standfuss in 1897, and imagines reared and figured (*Entom.*, 1900, pl. viii., figs. 5-6). This he named *Drepana* hybr. *rebeli*. The resultant hybrid imagines paired very easily and the females laid a varying number of eggs, normal to outward appearance, in which embryos formed, but no larvæ hatched therefrom, the shells, when opened, being found to contain normally developed, but dead, caterpillars. In 1898, from fresh hybrid crossings, a small number of larvæ of *rebeli* ♂ × *rebeli* ♀ emerged from eggs, the larvæ full of life, but they refused food and died within 48 hours. In 1898, also, the reciprocal hybrid was bred by Standfuss (*Entom.*, 1900, pl. viii., figs. 7-8).

2. DREPANA hybr. APPROXIMATULA (*falcataria* ♂ × *curvatula* ♀).—In Standfuss' *D.* hybr. *rebeli* the ♂ s and ♀ s emerged together; in *D.* hybr. *approximatula*, the ♂ s soon emerged (autumn), but the females hybernated as pupæ, and emerged in spring. All the ♀ s of *approxi-*

matula had a number of eggs in their ovaries, although their developing power was not ascertained. Both hybrids are nearer to *Drepana curvatula* than to *D. falcataria*, but the limited number of *D.* hybr. *approximatula* bred makes it difficult to determine whether the ♂ has a stronger influence on the aspect of the hybrid than the ♀. The earliest record of rearing this form is apparently that noted in the *Ann. Soc. Ent. Fr.*, 1833, p. lvi, where M. Apatz is stated to have done so and named the hybrid *approximatula*.

Anthrocerides.—We have already referred (*anteà*, p. 1) to the remarks of Standfuss as to the frequency of crosspairing among the Anthrocerids, and we have ourselves detailed (*anteà*, i., pp. 418-420) a large number of cases, including the obtaining of larvæ of *A. filipendulae* ♂ × *achilleae* ♀, of *A. hippocrepidis* (*transalpina*) ♂ × *peucedani* ♀, and of *A. fausta* ♂ × *A. hippocrepidis* ♀. In spite of this we agree with Oberthür (*Bull. Soc. Ent. France*, 1897, pp. 256-7) that wild Anthrocerid hybrids are very rare, and we are not altogether inclined to accept as hybrids the many captured specimens, that Standfuss avers that he has received, belonging to the group including *trifolii*, *lonicerae*, *stoechadis*, *filipendulae*, *angelicae*, and *transalpina*, and which he has not been able to refer to any of these species. Still we are not altogether free from the suspicion that *Anthrocera hippocrepidis*, Stphs. (*stephensi*, Dupont), described in detail (*anteà*, i., pp. 532-538; 544-546), has had a hybrid origin (*Ent. Rec.*, ix., pp. 103-107). Of actual hybridisation experiments, the earliest are those made by Fletcher, in 1889 and 1890, between *Anthrocera lonicerae* and *A. filipendulae**, and in 1891 and 1892 between *Anthrocera lonicerae* and *A. trifolii*, the details of which were recorded in 1893 (*Ent. Mo. Mag.*, xxix., p. 53). At the same time he obtained two pairings between *A. viciae* (*meliloti*) ♂ and *A. filipendulae* ♀, and one pairing between *A. viciae* ♂ and *A. worthingi* ♀; he failed entirely to obtain a pairing between *A. viciae* and *A. trifolii*, and the eggs resulting from the pairings obtained failed to hatch. The fertile crossings obtained by Fletcher (see *anteà*, vol. i., pp. 418-420) may be summarised as follows :—

1 and 2. Anthrocera hybr. intermedia (*filipendulae* ♂ × *lonicerae* ♀) and Anthrocera hybr. inversa (*lonicerae* ♂ × *filipendulae* ♀).—These reciprocal crosses are reported as being intermediate in markings between the parents, some of the ♂s showing only a slight trace of the sixth spot when examined with a strong lens, whilst some of the ♀s have it as well-developed as it is in typical *A. filipendulae*. The specimens were very large; two pairings of the hybrids were obtained, but the eggs were infertile.

3 and 4. Anthrocera hybr. fletcheri (*trifolii* ♂ × *lonicerae* ♀) and Anthrocera hybr. worthingi (*lonicerae* ♂ × *trifolii* ♀).—Both these hybrids laid fertile eggs, and the hybrids were fertile *inter se*, progeny of *fletcheri* ♂ × *fletcheri* ♀, and of *worthingi* ♂ × *worthingi* ♀ being obtained. Pairings between *fletcheri* and *lonicerae* (one of the parent species) were obtained and progeny reared.

5. Anthrocera hybr. secunda (*lonicerae* ♂ × *fletcheri* ♀).—Larvæ of *A.* hybr. *secunda* ♂ × *fletcheri* ♀ were also obtained, which, however,

* Hamm records (*Ent. Rec.*, xi., pp. 269-270) the finding of five pairs of *A. lonicerae* and *A. filipendulae*, *in copulâ*, in nature, on the same day in July, 1899, near Oxford. Three of the females found thus paired laid good batches of fertile eggs.

were not persevered with, to bring them to the imaginal state. A secondary hybrid, however, was reared as follows:—

6. Anthrocera hybr. complexa (*worthingi* ♂ × *fletcheri* ♀); which, in due course, was extended still further by obtaining—

7. Anthrocera hybr. confusa (*complexa* ♂ × *trifolii* ♀), and—

8. Anthrocera hybr. complicata (*lonicerae* ♂ × *complexa* ♀).

It may be here noted that *A.* hybr. *complexa* interbred freely, imagines of *complexa* ♂ × *complexa* ♀ being successfully reared.

9 and 10. Anthrocera hybr. angloitalica (*filipendulae* ♂ × *ochsenheimeri* ♀) and Anthrocera hybr. italoanglica (*ochsenheimeri* ♂ × *filipendulae* ♀).—In 1895 and 1896, Fletcher was successful in crossing British *A. filipendulae* with Italian *A. ochsenheimeri*, and also obtained the reciprocal cross. The hybrid ♂s exhibited markedly the characters of ♂ *ochsenheimeri*, the hybrid ♀s the characters of ♀ *filipendulae* (see *Ent. Rec.*, ix., pp. 69-70). Fletcher records further (*Trans. Ent. Soc. Lond.*, 1897, p. lii) that these crosses were fully fertile *inter se*.

11. Anthrocera hybr. escheri (*trifolii* ♂ × *filipendulae* ♀).—In 1896, Standfuss describes and figures (*Handbuch*, etc., pl. iii., fig. 5) imagines of a hybrid (*A.* hybr. *escheri*, Stdfss.) which he had bred, the imagines being distinctly intermediate between the parents, *Anthrocera trifolii* ♂ × *A. filipendulae* ♀.

Ægeriides.—Concerning hybridism among the Ægeriids, some interesting details as to a supposed hybridisation in nature of *Ægeria chrysidiformis* and *Æ. ichneumoniformis* are given (*Ent. Rec.*, xiii., pp. 174-175) by Delahaye, who asserts that he observed pairing between *ichneumoniformis* ♂ and *megillaeformis* ♀, and between *chrysidiformis* ♂ and *megillaeformis* ♀, but the facts given are such as to obscure any useful conclusions.

Psychides.—Among the Psychids, Standfuss reports (*Handbuch*, etc., p. 56) that Püngeler reared hybrid imagines from eggs obtained by crossing *Fumea casta* ♂ × *F. affinis* ♀; also from eggs obtained from the reciprocal cross *Fumea affinis* ♂ and *F. casta* ♀, only ♂s resulting in each case.

Catalogue of hybrid Lepidoptera.

Arctiides.
- Spilosoma, Stphs.
  - *hybr.* crassa, Caradja (standfussi ♂ × sordida ♀).
  - *hybr.* viertli, Caradja (rustica ♂ × sordida ♀).
  - *hybr.* beata, Caradja (rustica ♂ × viertli ♀).
  - *hybr.* hilaris, Caradja (inversa ♂ × viertli ♀).
  - *hybr.* seileri, Caradja (luctuosa ♂ × sordida ♀).

Notodontides.
- Cerura, Schrk.
  - *hybr.* guillemoti, Tutt (vinula ♂ × erminea ♀).
- Notodonta, Ochs.
  - *hybr.* dubia, Tutt (torva ♂ × dromedarius ♀).
  - *hybr.* newmani, Tutt (ziczac ♂ × dromedarius ♀).
- Clostera, Stphs.
  - *hybr.* prima, Tutt (curtula ♂ × pigra ♀).
  - *hybr.* inversa, Tutt (pigra ♂ × curtula ♀).
  - *hybr.* raeschkei, Stdfs. (curtula ♂ × anachoreta ♀).
  - *hybr.* difficilis, Tutt (anachoreta ♂ × curtula ♀).
  - *hybr.* facilis, Tutt (raeschkei ♂ × anachoreta ♀)
  - *hybr.* similis, Tutt (difficilis ♂ × curtula ♀).
  - *hybr.* approximata, Tutt (facilis ♂ × anachoreta ♀).

SPHINGIDES.
Mimas, Hb.
hybr. leoniæ, Stdfss. (tiliæ ♂ × ocellata ♀).
Calasymbolus, Grote
hybr. interfaunus, Neum. (astylus ♂ × ocellata ♀).
Smerinthus, Latr.
hybr. hybridus, Stphs. (ocellata ♂ × populi ♀).
hybr. oberthueri, Tutt (atlanticus ♂ × austauti ♀).
hybr. fringsi, Stdfss. (atlanticus ♂ × populi ♀).
Amorpha, Hb.
hybr. metis, Aust. (austauti ♂ × atlanticus ♀).
hybr. inversa, Tutt (populi ♂ × ocellata ♀).
Theretra, Hb.
hybr. standfussi, Bart. (porcellus ♂ × elpenor ♀).
Turneria, Tutt
hybr. vespertilioides,* Bdv. (? hippophaes ♂ × vespertilio ♀).
Hyles, Hb.
hybr. epilobii,* Bdv. (? euphorbiæ ♂ × vespertilio ♀).
hybr. eugeni,* Mory (? epilobii ♂ × vespertilio ♀).
hybr. lippei,* Mory (? eugeni ♂ × vespertilio ♀).
hybr. pauli,* Mory (? euphorbiæ ♂ × hippophaes ♀).
Celerio, Oken
hybr. phileuphorbia*, Mütz. (? gallii ♂ × euphorbiæ ♀).

ATTACIDES.
Antheræa, Hb.
hybr. perny-yama, Bourd. (pernyi ♂ × yama-mai ♀).
hybr. inversa, Tutt (yama-mai ♂ × pernyi ♀).
hybr. kirbyi, Tutt (pernyi ♂ × roylei ♀).
hybr. moorei, Tutt (roylei ♂ × pernyi ♀).
Philosamia, Grote
hybr. wallacei, Tutt (cynthia ♂ × arrindia (lunula) ♀).
Samia, Hb.
hybr. griffithsi, Tutt (cecropia ♂ × gloveri ♀).
hybr. watsoni, Tutt (cecropia ♂ × rubra (californica) ♀).
hybr. americana, Tutt (columbia ♂ × cecropia ♀).
Platysamia, Grote
hybr. heyeri, Tutt (rubra (californica) ♂ × cecropia ♀).
Actias, Leach
hybr. mortoni, Tutt (luna ♂ × selene ♀).
Saturnia, Schrk.
hybr. bornemanni, Stdfss. (pavonia ♂ × spini ♀).
hybr. hybrida, Ochs. (spini ♂ × pavonia ♀).
hybr. emiliæ, Stdfss. (pavonia ♂ × pyri ♀).
hybr. hybrida-major, Staud. (pyri ♂ × spini ♀).
hybr. hybrida-media, Staud. (pyri ♂ × pavonia ♀).
hybr. schaufussi, Stdfss. (bornemanni ♂ × pavonia ♀).
hybr. standfussi, Wiskt. (emiliæ ♂ × pavonia ♀).
hybr. risii, Stdfss. (emiliæ ♂ × pyri ♀).
hybr. schlumbergeri, Stdfss. (bornemanni ♂ × pyri ♀).
hybr. dixeyi, Tutt (bornemanni ♂ × spini ♀).
hybr. complexa, Tutt (standfussi ♂ × pavonia ♀).

LACHNEIDES.
Lasiocampa, Schrk.
hybr. wagneri, Tutt (quercûs ♂ × trifolii ♀).
Malacosoma, Hb.
hybr. schaufussi, Stdfss. (neustria ♂ × castrensis ♀).
hybr. caradjæ, Stdfss. (neustria ♂ × franconica ♀).
hybr. penzigi, Tutt (franconica ♂ × castrensis ♀).

GEOMETRIDES.
Zonosoma, Led.
hybr. brightoni, Tutt (orbicularia ♂ × trilinearia ♀).

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* Those marked * require to be reared in confinement to substantiate the parentage.

Amphidasys, Tr.
hybr. herefordi, Tutt (stratariа ♂ × betularia ♀).
Biston, Leach
hybr. pilzii, Stdfss. (hirtaria ♂ × pomonarius ♀)
hybr. hunii, Obth. (pomonarius ♂ × hirtaria ♀).
Selenia, Hb.
hybr. parvilunaria, Bartel (bilunaria ♂ × tetralunaria ♀).
Ennomos, Tr.
hybr. dartfordi, Tutt (alniaria ♂ × angularia ♀).
Tephrosia, Bdv.
hybr. ridingi, Tutt (bistortata ♂ × crepuscularia ♀).
hybr. bacoti, Tutt (crepuscularia ♂ × bistortata ♀).
hybr. ridingi-suffusa, Tutt (bistortata ♂ × delamerensis ♀).
hybr. bacoti-suffusa, Tutt (delamerensis ♂ × bistortata ♀).
hybr. mixta, Tutt (bacoti-suffusa ♂ × ridingi-suffusa ♀).
hybr. reversa, Tutt (crepuscularia ♂ × ridingi-suffusa ♀).
CYMATOPHORIDES.
Cymatophora, Hb.
hybr. fletcheri, Tutt (ocularis ♂ × or ♀).
DREPANULIDES.
Drepana, Schrk.
hybr. rebeli, Stdfss. (curvatula ♂ × falcataria ♀).
hybr. approximatula, Apatz (falcataria ♂ × curvatula ♀).
ANTHROCERIDES.
Anthrocera, Scop.
hybr. escheri, Stdfss. (trifolii ♂ × filipendulæ ♀).
hybr. intermedia, Tutt (filipendulæ ♂ × loniceræ ♀).
hybr. inversa, Tutt (loniceræ ♂ × filipendulæ ♀).
hybr. fletcheri, Tutt (trifolii ♂ × loniceræ ♀).
hybr. worthingi, Tutt (loniceræ ♂ × trifolii ♀).
hybr. secunda, Tutt (loniceræ ♂ × fletcheri ♀).
hybr. complexa, Tutt (worthingi ♂ × fletcheri ♀).
hybr. confusa, Tutt (complexa ♂ × trifolii ♀).
hybr. complicata, Tutt (loniceræ ♂ × complexa ♀).
hybr. angloitalica, Tutt (filipendulæ ♂ × ochsenheimeri ♀).
hybr. italoanglica, Tutt (ochsenheimeri ♂ × filipendulæ ♀).
PSYCHIDES.
Fumea, Stphs.
hybr. püngeleri, Tutt (casta ♂ × affinis ♀).
hybr. inversa, Tutt (affinis ♂ × casta ♀).

CHAPTER II.

MONGRELISATION IN LEPIDOPTERA.

It is often assumed, as a biological fact, that the crossing of individuals of the same species that have been subjected to somewhat different conditions of environment usually results in the production of progeny that are more vigorous and fertile, and it is generally considered that, so long as we keep strictly within the specific limit, this law holds good, even when the forms crossed constitute distinct local races of special form or colour. Little is really known of the limitations of this generalisation, and it is obvious that, if local races of special form, colour, or habit, engendered by different conditions of environment, are the primary steps in the development of species, exceptions may possibly be found, for, coupled with this change of external characters, there may be changes in the tissues, in the functional details of the organism, etc., superimposed by the changed conditions of food, mode of life, habit, etc., in other words, that these local races themselves vary in the extent to which they have travelled towards species, for we have no doubt that the internal physiological variations are often of much greater importance in the making and fixation of species than the external differences which are so patent. These external differences, on which the systematist separates his species, are often merely outward marks of a much more fundamental internal variation of structure and function, difficult to observe and still more difficult to demonstrate. Whilst, therefore, the general principle may be admitted, that crossbreeding between males and females of the same species that have been subjected to different environmental conditions resulting only in superficial differences, usually results in greater vigour and fertility, it must not be overlooked that, if functional and internal structural changes have also taken place, the results may be entirely contrary to those expected, and that a lower grade of vigour and fertility, if not a real approach to sterility, so frequently found in the crossing of true species, may be presented. In this way, the crossing of races of the same species may give very different results in different species, and their study may help much to solve some of the difficult problems growing out of the subject of hybridism.

We have suggested here that internal differences of structure and function, changes in mode of life, food, and habit, etc., have brought about the separation of specific forms, and that closely-allied species are more often due to a differentiation of function or habit than to any marked external structural character, and hence we find that, when local races begin to offer marked physiological, *i.e.*, functional, differences, the races often lose that invigorating power that crosses of more nearly related local forms present, and produce offspring that are in some degree sterile. But, although this may be conceded, we must be careful not to assert that, because two assumed species being crossed do produce fertile progeny, the two species are not in reality distinct species, but only forms of the same species. The attempt to make sterility the test of species has already been put forward; it can only, however, be considered as one of many other tests of specific distinction.

In dealing with this subject it is well to keep clearly in mind the distinction between crosses of distinct species, resulting in the production of hybrids, and crosses of varieties (local races) of the same species, resulting in the production of mongrels. The scientific utility of the results hitherto obtained by crossing two forms of a species, one of which is more or less typical, and the other merely a sporadic aberration, or a form which has not yet developed into a distinct local race, is very problematical, and the results are, probably, so far as their bearing on the broad questions underlying hybridity is concerned, of little more importance than of breeding any two other specimens of the same species together. That the sporadic aberration happens to have a marked peculiarity of colour or form (due possibly to a matter of larval health) may be nothing, and, so far as this question is concerned, such an aberration is not to be considered on the same level as a local race. The crossing of different forms of a dimorphic, trimorphic, or polymorphic species, the two, three, or more forms being developed naturally, in the same locality, and occurring in the same brood, must be placed in a different category, but the most that can be said for the results yet obtained by crossing one of such forms with another, is that they may possibly throw some light on the problems of heredity. As soon, however, as a form becomes permanently associated with a certain condition, or conditions, of environment, and has, possibly, a correspondingly marked variation in its internal structure and functions, the results become directly connected with the broad problems relating to hybrids proper, and are likely to throw light on the origin of the peculiarities which so many hybrids undoubtedly present.

As bearing on this point, Darwin writes (*Origin of Species*, 1884 ed., p. 263): "It is not surprising that the difficulty in crossing any two species and the sterility of their hybrid offspring, should, in most cases, correspond, even if due to distinct causes, for both depend on the amount of difference between the species which are crossed. Nor is it surprising that the facility of effecting a first cross, and the fertility of the hybrids thus produced, should all run, to a certain extent, parallel with the systematic affinity of the forms subject to experiment; for systematic affinity includes resemblances of all kinds. First crosses between forms known to be varieties, or sufficiently alike to be considered as varieties and their mongrel offspring, are very generally, but not, as is so often stated, invariably, fertile. Nor is this almost universal and perfect fertility surprising when it is remembered how liable we are to argue in a circle with respect to varieties in a state of nature, and when we remember that the greater number of varieties have been produced under domestication by the selection of mere external differences, and that they have not been long exposed to uniform conditions of life. It should also be especially kept in mind, that long-continued domestication tends to eliminate sterility, and is, therefore, little likely to induce this same quality. Independently of the question of fertility, in all other respects there is the closest general resemblance between hybrids and mongrels—in their variability, in their power of absorbing each other by repeated crosses, and in their inheritance of characters from both parent forms. Finally, then, although we are ignorant of the precise cause of the sterility of first crosses and hybrids . . . . yet the facts given do not seem to be opposed to the belief that species aboriginally existed as varieties."

In this, without expressly stating the fact, Darwin recognised that domesticated races that have been brought about first of all by selection of casual similar aberrations, and weeding out from the progeny all but those possessing the superficial characters desired, without bringing into play any selection of characters essentially functional, are distinctly different from those races that have been selected by nature, not only as presenting some superficial external character, such as colour, etc., that fits each one better for its environment, but as also having undergone some functional modification with regard to some detailed specialisation, *e.g.*, to some particular foodplant, which has separated it to some small extent functionally as well as superficially from the parent race.

The broad statement that we have made, that the results of crossing a quite sporadic aberration with an example of typical form may possess little scientific value, appears to be well substantiated by the experiments noted later with *Mimas tiliae* and its obsoletely-banded aberration (Standfuss), *Abraxas ulmata* and its ab. *suffusa* (Riding), etc., that is to say, that an aberration resulting from individual constitutional weakness, or other temporary cause, is not to be developed into a special local race, nor has the progeny of such a parent reared under healthy conditions any tendency to reproduce the form of the individually weak parent.

Where, however, a dimorphic, trimorphic, or polymorphic species develops its various forms from healthy larvæ in nature, under the same or somewhat similar conditions, it affords *primâ facie* evidence that any one form is kept from becoming predominant because the others are equally well protected and enter into competition with it on equal terms. The experiments enumerated tend to prove that this is the case, *e.g.*, in the case of *Coremia ferrugata* (red-banded) and its aberration *unidentaria* (black-banded), the two forms of which occur together in most parts of Britain, it is possible in a few generations, by careful selection of inbred parents, to breed purely red- or black-banded forms. Similarly the experiments with *Gonodontis bidentata*, tend to prove that where the ab. *nigra* is a protected form, it is easy, by selection of black parents and by removing the ordinary outside competition of the typical form, to rear artificially a race of almost purely black individuals. Almost identical with this are the cases of *Lymantria monacha* ab. *eremita*, *Hemerophila abruptaria* ab. *fuscata*, and *Amphidasys betularia* ab. *doubledayaria*, of which careful selection and the removal of normal outside environmental conditions allow one to rear typical or melanic races at will, showing that very little variation in these conditions would convert these melanic forms from mere aberrations into local races, which would supplant the type in those districts where the conditions were favourable to their development. These appear to us to be much more nearly of the character of natural local races than does *Spilosoma lubricipeda* ab. *zatima*, which appears to be everywhere a rare aberration in a wild state, and to have assumed its present fixed varietal or racial characters from domestic selection spread over many years, in some cases, perhaps nearly half-a-century. The racial character of *Boarmia repandata* ab. *conversaria*, in certain districts, is almost on a par with those of the melanic forms of the species already noted, *viz.*, that it is a form able to hold its own with the type in the particular areas in which it appears and is possibly due to comparatively modern changes of the environment in the areas which it affects. One of the most remarkable instances of racial value, in what would otherwise have been deemed a purely sporadic and incidental sport, is that of *Zonosoma annulata* ab. *obsoleta*. The results of Riding's experiments prove the racial value of the form, but our ignorance of the habits of the insect does not enable us to give an explanation of its meaning. We may surmise fairly that *Amphidasys betularia*, *Tephrosia crepuscularia*, *Gonodontis bidentata*, *Lymantria monacha*, etc., are undergoing racial change for protective purposes, and in response to a changing environment, that possibly, in most of these cases, the so-called melanic form is atavistic, and that the peculiar colour has been slowly acquired at an earlier period in the life-history of the species, so that it has always had potentialities in this direction, that *Boarmia repandata* ab. *conversaria*, is the result of a change in the wooded haunts the typical form loves, and is also most probably atavistic, whilst its var. *sodorensium*, has been produced by its having an entirely different habit (resting on rocks), but, as we have just noted, we are unable to give an explanation of the reason why it is so easy to breed out the little omicron in the centre of each wing of *Zonosoma annulata*, nor can we hazard a guess as to whether the abs. *obsoleta* and *biobsoleta* are atavic forms, or developments due to recent changes in the haunts where they occur. Workers in this branch of study must not overlook the secondary bearings of the experiments of Riding and Bacot when using *Tephrosia crepuscularia* ab. *delamerensis* as one of the forms of the species experimented on, for their hybrid experiments between *T. crepuscularia* and *T. bistortata*. Reference can be readily made to the details (*Trans. Ent. Soc. Lond.*, 1898, pp. 17-42). The influence of the aberrational form, when used instead of the typical form as one of the parents, on the progeny, was most marked.

It must be conceded, that there may sometimes be considerable scientific value in knowing the results of crossing a well-marked aberration with its typical form, yet it must not be overlooked that it is still more important to discover how far the characters that come to the front in an aberration are capable of being made permanent by selection, and also what are the natural conditions of environment that repress these latent characters, so that they are only occasionally exhibited in any brood bred under quite natural conditions. Many data in this direction are no doubt available, but they are difficult to discover, and often too incomplete to be of real value. Exact data bearing on this view of the question are much wanted.

As an illustration of the nature of the so-called "dominant" and "recessive" elements that appear and disappear in the progeny resulting from the crossing of a type and a well-marked colour, or structural, aberration, we may call attention to Raynor's account of the breeding of the *flavofasciata* (*lacticolor*) form of *Abraxas grossulariata* (*Ent. Rec.*, xiv., pp. 321 *et seq.*; xv., pp. 8 *et seq.*). In these experiments, a first crossing of *grossulariata* ♂ × *flavofasciata* ♀ produced only *grossulariata*, whilst inbred *grossulariata* of this strain, *i.e.*, with *flavofasciata* latent in them, produced several *flavofasciata* ♀s. These *flavofasciata* ♀s, again crossed with outside ♂ *grossulariata*, produced no *flavofasciata*, etc. Doncaster, who has made an attempt to explain Raynor's results, on the basis of Mendel's "law of heredity," observes (*Ent. Rec.*, xv., pp. 142 *et seq.*) that it may seem remarkable that among the children of a *flavofasciata* there should be none resembling their mother, but that the aberration should appear again in some abundance in the grandchildren, but the results are so exactly in accord with what would be expected according to the Mendelian law of heredity, that it has seemed worth while to draw attention to the facts. In a simple Mendelian case when two varieties—in this instance *grossulariata* and *flavofasciata*—are bred together, their offspring all resemble *one* of the parents, and the character of that parent is said to be "dominant," while the character of the other parent, which disappears in the first generation of offspring, is called "recessive." But, although the recessive character disappears, it is latent, and the hybrid offspring produces germ-cells bearing *either* the dominant character *or* the recessive, but not both characters, in the same germ-cell. If, now, equal numbers of dominant (*grossulariata*) and recessive (*flavofasciata*) germ-cells are produced by each hybrid, and these meet one another in fertilisation quite by chance, then, according to the law of probability, the insects of the second generation should be in the proportion of 1DD, 2DR, 1RR, the form DD representing an insect derived from an ovum and spermatozoon each bearing the dominant character, RR from two germ-cells bearing the recessive character, and DR from germ-cells, one of which bore the dominant, the other the recessive, but, in every case where a dominant-bearing germ-cell has taken part in fertilisation, the offspring will show the dominant character, so that, in the second generation from the cross, one quarter only of the insects should appear with the recessive (*flavofasciata*) character. Of the remaining three-quarters, all of which will be *grossulariata*, two-thirds will be hybrid in nature, and will give recessive *flavofasciata* when bred together, while the remainder will be pure *grossulariata*, and will never throw *flavofasciata* when bred together. This particular instance is complicated by the fact that *flavofasciata* is confined to the female, and, therefore, if a specimen is paired with a pure *grossulariata*, no *flavofasciata* will appear in the offspring; but it should be possible to breed *flavofasciata* in every generation by pairing it with a dominant hybrid (DR) which has the *grossulariata* character in appearance, but also the recessive *flavofasciata* character in a latent condition. Mr. Raynor does not tell us what proportion of his insects were *flavofasciata* in the second generation from the cross, but this is a matter of considerable interest, for if there were much less than a quarter of the whole, which the Mendelian theory leads us to expect, it might indicate that there is a male *flavofasciata* which has the character of *grossulariata*, and, therefore, cannot be distinguished from it except by breeding it with a *flavofasciata* ♀, in which case *all* the females produced from such an union should be *flavofasciata*. Not all Mendelian cases are so simple, for there may be two or more characters which are inherited separately, but it seems worth while to call the attention of entomologists to the matter, for most of the work upon the Mendelian theory has been done upon vertebrate animals and flowering plants, and it would be of great value to have additional evidence from insects. Further details relating to this subject are noted (*posteà* p. 65), Raynor having since bred ♂ s of the *flavofasciata* form.

In dealing with the details we have been able to collect, relating to the question of mongrelisation, we think it may be well to consider them under the following headings.

I. Crossing of typical form and local race.

Standfuss is one of the few authors who has worked out mongrelisation experiments on the basis of obtaining data similar to those obtained by hybridisation experiments, and Dixey (*Science Progress*, vii., April, 1898) considers the results in many cases analogous. The facts at our disposal concerning the crossing of a type form with a local race may be summarised as follows :—

1. Callimorpha dominula ♂ × persona ♀.—In these crossings, the imaginal issue produced, though very variable, resembled on the whole *dominula* rather than *persona*. In one brood, however, a majority more closely resembled the latter, whilst one specimen was even more extreme than ordinary *persona*. From 3 to 5 per cent. of the eggs were sterile (*Handbuch*, etc., pp. 220-221, pl. v., figs. 6-10). Of the five examples figured from this crossing, three are noted by Standfuss as *C.* ab. *romanovi*, Stdfss. (with red hindwings and excess of black markings), one is a *C.* ab. *italica* (with yellow hindwings and excess

of black markings), and one is a *C.* var. *persona* (with yellow hindwings almost entirely suffused with black).

2. Callimorpha persona ♂ × dominula ♀.— In this, the reciprocal cross of the last, the imagines also varied between the parental types, but, on the whole, came nearer to *C. dominula* than to the variety, though less so than in the former cross. Of the eggs, from 10 to 15 per cent. were sterile, from which Standfuss concludes that the ♂ of *persona* has already diverged from the physiological standard of the species (*Handbuch*, etc., pp. 221-222, pl. v., figs. 11-15). Of the five specimens of this crossing figured by Standfuss all are of the var. *romanovi*, with red hindwings and increased black markings. The specimens are markedly smaller than those of the preceding cross.

Standfuss notes that the imagines produced from each of these crosses are fertile in both sexes. One suspects, from the overwhelming preponderance of *dominula* characters in both lots of mongrels, as represented by the specimens figured by Standfuss, that the typical *dominula* is not only the phylogenetic type of the species, but is also the predominant and more powerful form.

3. Ocnogyna hemigena ♂ × zoraida ♀.— Although these are treated as distinct species by some lepidopterists (*e.g.*, Staud. and Reb., *Cat.*, 3rd ed., p. 367), Standfuss considers that they are only local races of the same species, the former inhabiting the Pyrenees and the latter the mountains of Andalusia and Aragon (*Handbuch*, etc., p. 65). The progeny of the cross called by Standfuss, *zoragena*, Staud., resembles a large *O. hemigena*. He says that Kröning found that the mongrel issue was fertile *inter se*, but quickly degenerated in size and vitality (*Handbuch*, etc., pp. 222-223).

4. Spilosoma mendica ♂ × rustica ♀.—Standfuss says that the larvæ resulting from a crossing of *mendica* ♂ × *rustica* ♀, were nearly always formed within the egg, but, in some broods, not one, and, in others, only from 8 to 12 per cent. hatched. In one case, however, as many as 93 per cent. of the eggs gave living larvæ. All the broods suffered severely from disease, the perfect insects reared, however, in 1894, did not show much variation, and diverged only slightly in appearance from var. *rustica*. The ♂s were mostly light-coloured as in that variety, and the darkest of them were far lighter than any ♂ of *S. mendica* (*Handbuch*, etc., pp. 223-224, pl. iv., figs. 12-13). The two ♂s of this cross figured by Standfuss represent one no darker than ordinary ♂ *rustica* (=*standfussi*), the other considerably paler than typical ♂ *mendica* (=*mus*). Caradja noted that the eggs resulting from his early experiments gave only about 15 per cent. of larvæ.

5. Spilosoma rustica ♂ × mendica ♀.—This (or the reciprocal) cross was first bred by Adkin in 1889,* the specimens being noted (*Proc. Ent. Soc. Lond.*, 1890, p. xl), the ♂s being of a dusky-white colour and intermediate between the English and Irish forms. The imagines of this reciprocal cross, which Standfuss reared from pupæ

* It is doubtful whether Adkin bred this or the reciprocal cross. His first (*Trans. Ent. Soc. Lond.*, 1890, p. xl) and second records (*Proc. Sth. Lond. Ent. Soc.*, 1890, p. 56) of this pairing give the parentage as *mendica* ♂ × *rustica* ♀. His third and fourth records (*Entom.*, xxvi., p. 297, and *Entom.*, xxx., p. 206) give the parentage as *rustica* ♂ × *mendica* ♀, and this latter he now asserts is the accurate parentage.

obtained by Caradja, consisted of 17 ♂ s and 14 ♀ s. These were more variable than the former cross-product, but, on the whole, inclined towards var. *rustica* (*Handbuch*, etc., pp. 224-225, pl. iv., figs. 9-11). Earlier specimens of this cross were reared by Caradja, in 1894, and named by him *standfussi* [*Soc. Ent.*, ix., p. 43 (see *Ent. Rec.*, v., p. 189)]; he further notes that his experience of this crossing was that every egg yielded a larva. In 1895, Caradja gave further results (*Soc. Ent.*, x., no. 7) which we have translated in full (*Ent. Rec.*, vii., pp. 75-78). The results of two fairly large broods were very different, one producing a very variable lot of ♂ s, consisting of (1) 24 per cent. of var. *standfussi* (a form exactly intermediate between the dark smoky-grey of ♂ *mendica* and the milk-white of ♂ *rustica*, etc.). (2) 33 per cent. of var. *mus* (a darker form nearer ♂ *mendica*, but distinctly lighter grey, etc.). (3) 23 per cent. of var. *clara* of a pale dirty yellow colour. (4) 20 per cent. which form transitions between the forms described. The second batch yielded imagines, most of which he said must be considered genuine *standfussi*, but were more strongly dotted than the original of that form; three examples, however, called var. *mixta* are as pale as the form *clara* on the thorax, discoidal cell of forewings, and outer margin of fringes of all wings, the rest of the wing area thickly sprinkled with black dots. Standfuss gives three figures of this cross (*Handbuch*, etc., pl. iv., figs. 9, 10, 11) of which fig. 9 is noted as *clara*, fig. 10 as *standfussi* and fig. 11 as *mus*. Caradja concludes that the ♂ of these crosses determines far more essentially the external facies of the mongrel than the ♀, and asserts that var. *rustica* is the older form phylogenetically, a conclusion with which we entirely agree. Caradja further notes that the mongrel forms interbreed freely, *e.g.*, *standfussi* ♂ s and ♀ s, 14 pairings; *standfussi* ♂ × *mendica* ♀ and *standfussi* ♂ × *rustica* ♀, 24 pairings, every one of which produced fertile ova. One can only suppose that Caradja's comparative failure in obtaining fertile eggs of *mendica* ♂ × *rustica* ♀ must have been due to quite outside circumstances. The experiments point to the fact that *rustica* ♂ or ♀ has more to do with determining the facies of the progeny than has *mendica*. His later note (*Entom.*, xxxii., p. 296), referring to the crossing of *rustica* ♂ × *standfussi* ♀, gives no further particulars of importance.

6. Emydia candida ♂ × cribrum ♀.—Schultz records the results of a crossing between the well-known Alpine white *candida* and typical *cribrum*. He notes (*Intern. Ent. Zeits. Guben*, 1895, pp. 184-185) that, of 17 imagines reared, 15 were of the *cribrum* and only two of the *candida* form.

Oporabia filigrammaria × autumnata.—Allen, who has wide experience in breeding these insects, considers *filigrammaria* the moorland and *autumnata* the woodland (lowland) form of the same species. They pair readily, and the offspring are freely fertile *inter se*. The imagines in their extreme forms appear to overlap, some specimens of *autumnata* being hardly, if at all, distinguishable from the lightest forms of *filigrammaria*, etc. In 1900, Allen reared larvæ of *autumnata* (Fermanagh) and *filigrammaria* (Lancashire); and by retarding pupæ of the latter, the imagines of the two forms were brought out at the same time so that four pairings resulted, *viz.*, three of *filigrammaria* ♂ × *autumnata* ♀ and one of the reciprocal cross (*autumnata* ♂ × *filigrammaria* ♀).

7. Oporabia filigrammaria ♂ × autumnata ♀.—(*a*) The progeny

(reared in 1901) resembled *filigrammaria* in appearance, and *autumnata* in size. The imagines were healthy, a ♂ and ♀ of the mongrels were paired, and from these 2 ♂ s and 2 ♀ s were reared, in 1902, smaller than the parents, about the size of *filigrammaria*, and hardly so strongly marked. A pairing was also obtained between a ♀ of the mongrels and a ♂ *autumnata*, the eggs were fertile, and larvæ hatched, but no imagines were reared (Mera). (β) Some 200 ova were laid, about 100 kept, and from these 11 specimens were reared, 7 ♂ s and 4 ♀ s (Allen). (γ) 112 ova obtained. About 60 hatched, but less than half of these arrived at the pupal state, and only 7 moths emerged, all ♂ s, average size rather small, and one a cripple. 4 pale specimens strongly favour *autumnata*, one or two being whiter than any known *filigrammaria*, the 3 dark ones are more intermediate, but only one could be called fairly representative of the normal *filigrammaria* (Prout).

8. Oporabia autumnata ♂ × filigrammaria ♀.—About 70 ova laid, from which 28 imagines were reared, 18 ♂ s and 10 ♀ s. Of these 17 ♂ s emerged before a single ♀. The specimens were rather small (perhaps due to unfavourable rearing conditions). Many would pass for undoubted *autumnata*, others were of a nondescript appearance, with wavy lines crossing the wings and more or less obliterating the markings (Allen).

9. Lasiocampa quercûs ♂ × meridionalis ♀.*—(α) 3 ♂ s and 4 ♀ s, the former quite of the broad-banded English type; the ♀ s also show this broadening of the transverse bands. The larvæ showed the predominant characteristics of the English *quercûs* strain (Bacot coll.). (β) 4 ♂ s and 8 ♀ s, the offspring distinctly like British *quercûs* in both sexes, the ♂ s with the characteristic tendency to wider bands, the ♀ s less red and more yellow than the ♀ parent (Warburg coll.). (γ) 11 ♂ s, the offspring small; the outer marginal area weak in colour compared with the ♂ parent; the transverse bands narrow (Warburg coll.).

10. Lasiocampa meridionalis ♂ × viburni ♀.—(α) The ♂ s (30) are scarcely distinguishable from the ♂ parents (the progeny is from four pairings); the ♀ s are distinctly yellower than the ♀ parents, which are more than usually red even for *viburni* (Warburg coll.). (β) 5 ♂ s, all showing rather more than a tendency to the widening of the transverse band of fore- and hindwings; two have them somewhat wider than any *viburni* examined, and in this respect approach British *quercûs* (Bacot coll.). The great interest in this cross lies in the fact that, in every case, the mongrel larvæ divided into two series following the larval forms of the parent (white-haired or brown-haired).

11. Lasiocampa sicula ♂ × meridionalis ♀.—(α) 3 ♂ s and 1 ♀; the ground colour rather nearer the darker tint of *meridionalis* than the more russet hue of *sicula*; the transverse band of forewing definite and narrow; the hindwing with the orange marginal area of *sicula* altered to the brown marginal area and narrow yellow transverse band of *meridionalis*; the ♀ retains the russet tint of *sicula*, but has not the distinct pale outer marginal area of that form (Bacot coll.). (β) 2 ♂ s and 1 ♀ emerged the first year, the males of the russet hue of *sicula*, but the hind marginal area of hindwing surrounded with brown as in

* For details of the crossings, characters (larval and imaginal) of parents, etc., see *anteà*, iii., pp. 34 *et seq.*; *Ent. Record*, xiii., pp. 114 *et seq.*, and pp. 237 *et seq.*

meridionalis; 2 ♂ s and 2 ♀ s of same batch emerged second year, one weakly pigmented ♂ of above form, the other ♂ with full yellow marginal area to hindwings, as in *sicula*; ♀ s small, and had evidently been ill-nurtured (Warburg coll.).

12. Lasiocampa sicula ♂ × quercûs ♀.—(α) 8 ♂ s and 10 ♀ s, the ♂ s almost identical with *sicula* except for a gradual fading of transverse band of forewings into the marginal area, and a slight trace of a marginal brown shade edging the orange marginal area of hindwings; the ♀ s distinctly of the ♀ parent form, yellow, and quite unlike the warmer-tinted ♀ *sicula* (Warburg coll.). (β) 21 ♂ s and 7 ♀ s. All the specimens comprising this brood larger, otherwise the ♂ s very like the last in ground colour, and follow the ♂ parent; the outer margin of hindwing rather less orange-yellow and more shaded with brown externally, and hence nearer *quercûs*. The ♀ also yellow, nearer *quercûs* than *sicula*, although there is a distinct trace of the warmer *sicula* hue than in ♀ s of preceding brood. 3 ♀ s (of same brood), emerging after second year in pupa, are very dark reddish-ochreous, the outer marginal areas of hindwings scarcely differing in tint from the rest of wings (Warburg coll.).

13. Lasiocampa sicula ♂ × bacoti ♀.—8 ♂ s and 2 ♀ s; the ♂ s having distinctly wider transverse bands to forewings than *sicula*, the ground colour showing trace of the *sicula* tint, but on the whole both bands and colour are nearer those of *bacoti* (*meridionalis* × *viburni*) than of *sicula*; the hindwings in all the specimens with distinct brown marginal border, in three quite as well defined as in *viburni*; the ♀ s follow the ♀ parent (*meridionalis* × *viburni*).

14. Lasiocampa bacoti ♂ × sicula ♀.—2 ♂ s and 4 ♀ s. The ♂ s peculiar, one being very near the ♂ parent, with well-developed narrow bands, the other with the transverse bands on the forewing restricted and not quite reaching the costa; that on the hindwing absent, the marginal area (including normal position of band) being very dark buff and almost unicolorous, the fringes paler; the ♀ s incline rather to *meridionalis* × *viburni* than *sicula* (Bacot coll.).

15. Lasiocampa intermedia ♂ × bacoti ♀.—2 ♂ s of most bizarre appearance; a peculiar mixing of the dark chocolate and russet tints of the males of *meridionalis* and *sicula* respectively, the transverse band on the forewing being reduced to a narrow line, that on the hindwing still narrower and tending to obsolescence (Warburg coll.).

II. Crossing of typical form and aberration.—Production of artificial races by inbreeding.

We have already stated that the results obtained by crossing a typical individual of a species with an aberration of the same species, may have very little scientific value from the particular standpoints afforded by the results to be obtained from a crossing of two already differentiated species, or by the crossing of an example of the typical form with a highly specialised local race of the same species. Standfuss has already carried out, and published, the results of some experiments in this direction, and summarises (*Handbuch*, etc., pp. 305 *et seq.*) these results as showing that "when an aberration is crossed with its parent form the issue is sharply divided in both sexes into specimens of the aberration and of the normal form of the species" (see Standfuss, *Berl. Ent. Zeits.*, 1886, pp. 238-9). We suspect that this conclusion largely depends upon the character of the aberration, *e.g.*, to illustrate this point, Standfuss observes that between the aberration *intermedia* of *Spilosoma lubricipeda* and the darkest of its aberrations, *deschangei*, there are many degrees leading from one to the other, but that no transitional forms occur to bridge over the wide gap between *intermedia* and *lubricipeda*, nor can they be produced by crossing these two. "It seems," Standfuss says, "as if there were antagonistic characters which cannot exist in the same individual." When one turns to Standfuss' figures (*op. cit.*, pl. viii., figs. 11, 12, 13, 14), one finds that his fig. 12 is an *intermedia* really fairly close to *lubricipeda*, between which, however, we ourselves have many examples bred with broods that have given progeny extending from the palest typical forms to the darkest *deschangei*. We are, therefore, in want here of a distinct definition from Standfuss as to what he considers an intermediate. The statement that intermediates are not to be produced in the manner described by crossing these forms is entirely contrary to fact.

What one desires, in estimating the value of results in the direction of crossing aberrations with the parent form, is, as we have already indicated, a clear idea of the value of the aberration used. It is quite certain that there will be considerable difference in the results obtained if we use for such experiments as are here indicated—(1) an individual which is a chance sport occasionally (or frequently) appearing in nature, but with no capability of becoming a fixed race under its natural conditions of environment, or (2) one of a selected race, produced and maintained as such under artificial conditions of environment through many generations, and inbred until it has all the characters of a local race rather than an aberration.

This point is well illustrated in *Spilosoma lubricipeda* ab. *zatima*. In Heligoland, and on the northeast coast of England, occasional extreme, and other less marked, aberrations of *S. lubricipeda* have occurred for more than a century (Cramer, 1782; Haworth, 1812; Wood, 1839, etc.), but the total number taken in Britain, for at least a century, appears to have been fewer than a dozen, and evidence as to any greater regularity of its occurrence in Heligoland and Holland, other than as an almost equally rare sporadic aberration, appears to be wanting. Gätke, in 1882, had numerous examples bred in Heligoland, including intermediates between *zatima* and the type (see *Entom.*, xxviii., pp. 6-7). In Britain, up to that time, it had never occurred except as a purely sporadic and very rare aberration. From the Heligoland stock, a French lepidopterist (and dealer), named Deschange, appears to have interbred extreme and intermediate forms for many years, advertising the imagines and pupæ for sale in the continental magazines, whilst, in 1886, Depuiset described and figured the then most extreme form known as *deschangei* (*Ann. Soc. Ent. France*, 1886, pl. iv., fig. 4). In 1889 and 1890, imagines were on sale in Britain, and in 1889, Clark exhibited examples, so bought (*Ent. Rec.*, i., p. 71). In 1891, Harrison advertised for pupæ of *lubricipeda*, and, later, bred a ♀ *zatima* from a pupa, supposed to have come from London through Riches (*Ent.*, xxvi., p. 346). Riches considered this a mistake, asserting that he had never bred the form, and that it was quite unknown as a local form to London lepidopterists (*op. cit.*, p. 347), and he further informed us that South's description of the ♀ bred (*op. cit.*, p. 346) exactly coincided with the specimens exhibited by Clark in 1889. Tugwell transferred (*Ent.*, xxvii., p. 97) the probable home of this pupa to Grimsby, but there is no evidence whatever that this was so. Our own suspicion is that it was unwittingly obtained from someone already breeding the form.* This ♀ was paired with a typical ♂ (*loc. cit.*) and from the progeny of these, in 1892, Harrison obtained typical *lubricipeda*, intermediates, and many *zatima*.† Some of the latter he paired, and from these thousands have been reared and distributed in British collections. It is sufficient to say that at this first inbreeding the characters of the race were strongly marked and fixed. The fixity of the *zatima* type in these specimens was excellently illustrated in the results obtained by Tugwell (*Entom.*, xxvi., p. 247) and Porritt (*op. cit.*, p. 296).

Bateson notes (*Science Progress*, October 1897, January 1898) the contradictory results observed in the breeding of varieties of *Spilosoma lubricipeda* as recorded by Burckhardt (Standfuss, *Handbuch*, etc., 2nd ed., p. 11), and by South (*Entom.*, 1893, p. 257). He considers this to have been largely brought about by atavic conditions, and that the results depended upon the strain employed. With this latter statement we quite agree. In some strains of *S. lubricipeda* ab. *zatima*, used for experimental purposes, the strain has possibly been more or less inbred for from 25 to 30 years, whilst others have been much crossed with typical forms, and others recently produced by selection. In other words, the results depend upon the degree of domestication. He further notes the crossing of typical *Lymantria monacha* with ab. *eremita*, and compares the results obtained by Standfuss and Fletcher. The forms of *S. lubricipeda*, as occurring in the reared broods in this country, are of little more than aberrative value, and *eremita* is distinctly an aberration, and not a local race. Until selection for some years had been carried on, one cannot but conceive that the results produced by these crossings would be largely vitiated by the atavic conditions necessarily arising in every brood. The following experimental results throw some light on the points here dealt with :—

1. Spilosoma zatima ♂ × zatima ♀.—(*a*) Eggs received from Harrison (inbred *zatima*) in 1892, produced larvæ and pupæ in due course, 27 imagines appearing in April, 1893, "every example of *zatima* (*radiata*) type, each true to heredity, varying in intensity, still all *zatima* (*radiata*)." (*β*) Two of these were paired, ova obtained in April, larvæ fed up in May and June, and between July 8th and end of September, the imagines appeared, "all again quite true to parental type, some almost black,‡ etc., ... the great point of interest being the remarkable manner in which the offspring followed the type of the parents . . . . Not one relapsed into the normal *lubricipeda* form, although a few were extremely pale, one, particularly, had the hindwing very closely approaching that of the ab. *fasciata*, but not

* This history is given so that future workers may know of the uncertainty of the origin of the parent of some thousands of specimens since bred, and the descendants of which are in numbers in all our collections.

† It is to be noted that Harrison (*Trans. Ent. Soc. Lond.*, 1892, p. xxix ; *Ent.*, xxvi., p. 346) gives what he considers the parentage of the *zatima* he bred, and that he took no part in trying to prove their British origin. This was attempted by Tugwell (*Ent.*, xxvii., pp. 96-97 ; 129-130 ; 205-206) and Hewett (*Ent.*, xxviii., pp. 3-8 ; 27-30) whose statements are all purely assumptive. Harrison wrote us that he obtained pupæ from several sources, and, therefore, there appeared room for error, but that the "parentage given he believed to be correct."

‡ We learn (*Ent.*, xxvii., p. 206) that there were 720 eggs in this one batch, and not one resultant imago went down so low in the series towards the type as the ab. *eboraci* (*op. cit.*, p. 205, fig. 3).

quite identical." Some of the pupæ went over and produced imagines in the spring of 1894 (Tugwell). (γ) Eggs also received from Harrison, and 50 imagines bred in May, 1893, all *zatima*, approaching *deschangei*, with no paler ones. (δ) From a pairing of these also, a partial second brood, again all *zatima*, appeared in September, 1893, etc. (Porritt). [The result was the same everywhere, all those who had eggs in 1892 from Harrison's stock reared practically pure *zatima*. For scientific purposes, therefore, the insects resulting from these early *zatima* must be looked upon as the progeny of a long inbred, highly specialised, race of this form, and, therefore, very different from those since obtained by selection in various parts of the country. Later, when crossed with ordinary *lubricipeda*, by various lepidopterists, numerous pale examples—*intermedia* as well as the type—were produced with the dark forms.] (ϵ) [Pairing in 1899, from selected specimens inbred for some generations, parents originally from the Lincolnshire coast. Both parents of medium *zatima* forms; fringes and central area of forewings pale; hindwings with only the basal and inner marginal areas pale; the undersides with only fringes, nervures, basal areas, and a few streaks of buff colour (the female with a broad streak of the pale ground colour, extending from basal area half across the wings, parallel with, and near, the hind margin of both wings; this is absent from forewings of ♂, well-marked, though modified, in the hindwings).] Reared 74 ♂s and 74 ♀s, of which 1 ♂ and 2 ♀s were complete, and 1 ♂ and 3 ♀s partial, cripples. Using the parents (description above) as standards, the upper wing characters were classified as follows:—

1. Reversion to *lubricipeda* form—

	Forewings.	Hindwings.
A.—♂s with marked tendency to revert	— ..	6
B.— ,, ,, medium ,, ,, ...	— ..	3
C.— ,, ,, slight ,, ,, ...	5 ..	5
D.— ,, ,, very slight ,, ,, ...	5 ..	13

[Note.—One of the specimens in A, as regards hindwings, shows a reverse (darkening) tendency on forewing, and another specimen in D exhibits the same tendency.]

	Forewings.	Hindwings.
A.—♀s with marked tendency to revert	— ..	—
B.— ,, ,, medium ,, ,, ...	— ..	—
C.— ,, ,, slight ,, ,, ...	— ..	4
D.— ,, ,, very slight ,, ,, ...	6 ..	2

[Note.—Two specimens in C, and one in D, have progressive forewings.]

2. Progression from *lubricipeda* form (*i.e.*, darkening to greater extent than parents)—

	Forewings.	Hindwings.
A.—♂s showing increased darkening..	12 ..	7
B.—♀s ,, ,, ,, ...	20 ..	29

[Note.—Five of the specimens in A, with progressive forewings, have reversionary hindwings; three of B, with progressive forewings, have reversionary hindwings.]

The pale hindmarginal streak on the underside of the forewing is a distinctive character that may be utilised for the purpose of study, the similar mark on the underside of hindwing is too much confused with the basal patch. In the brood under discussion the ♂ parent had not, and the ♀ parent had, this mark. The details in this respect are:—

	Absent.	Weaker than in ♀ parent.	Stronger than in ♀ parent.
1. ♂s with pale streak ..	19	35	17
2. ♀s ,, ,, ,, ..	28	39	5

[NOTE.—A few (3 ♂s and 2 ♀s) damaged and crippled specimens could not be used for the study of this character.]

It is remarkable how true this brood follows the individual parents. Only three or four (♂s) are suggestive of *lubricipeda*, the specimens, with these exceptions, being of the *zatima* type, though not equally dark. The independence of fore- and hindwings with regard to progression from or reversion towards the *lubricipeda* form is to be noted. Also the fact that in the only point of difference noted between ♂ and ♀ parents there appears to be a marked tendency to cross inheritance, *i.e.*, ♂ offspring following ♀, and *vice versa*. (ζ) Four pairings were obtained, but, owing to neglect in larval stage, comparative failure occurred in three instances, and total failure in the other. In one pairing, between an extra dark ♂ and ♀, still further darkening was exhibited in the few specimens reared, a few of the specimens having the buff areas reduced considerably more than in either parent (or any specimen of the brood from which they were selected). From the two other pairings—(1) a dark ♂ and pale ♀, and (2) an intermediate ♂ and a normal *zatima* ♀, both darker and paler forms were produced, but in neither case are the offspring paler than the parents (Bacot).

2. SPILOSOMA LUBRICIPEDA ♂ × ZATIMA ♀.—(α) In the spring of 1891, a pairing of this cross resulted in the ♀ laying about 500 ova. Only part retained, which resulted in 160 imagines in 1892, of which about one-third were *zatima*, and one-third *intermedia* (Harrison, *Proc. Ent. Soc. London*, 1892, p. xxix). (β) In April, 1889, Burckhardt obtained eggs of this cross, breeding in July* a number of typical *lubricipeda*, *intermedia* and *zatima*. In July, 1889, a pair of the *intermedia* of this brood copulated, and, in 1890, again produced the three forms. Of these, pairings were effected, and results obtained as follows:—

α. *Spilosoma zatima* ♂ × *lubricipeda* ♀.—Resulted in 4 *lubricipeda*, 2 *intermedia*, 3 *zatima*.

β. *Spilosoma lubricipeda* ♂ × *zatima* ♀.—Resulted in 11 *zatima*.

γ. *Spilosoma intermedia* ♂ × *intermedia* ♀.—Gave 25 *lubricipeda*, 15 *intermedia*, 35 *zatima*.

δ. *Spilosoma intermedia* ♂ × *zatima* ♀.—Gave 2 *lubricipeda*, 15 *intermedia*, 85 *zatima*.

ε. *Spilosoma lubricipeda* ♂ × *lubricipeda* ♀.—Paired from brood δ in May, 1891, and produced in May, 1892, 34 *lubricipeda* and 1 *zatima* (almost *deschangei*).

3. SPILOSOMA FASCIATA ♂ × FASCIATA ♀.—Specimens, differing somewhat from the type, in the fasciate conditions of the lines, were selected by Jackson and other York lepidopterists, for some years, until, between 1880 and 1889, a race was established in which an elongate condition of the spots was combined with a tendency to form a central band across the fore- and hindwings. This form is referred to by Carrington (*Entom.*, xxiii., p. 207); Porritt (*Nat.*, 1889, p. 233; *Entom.*, xxiv., p. 296), South (*Entom.*, xxvi., p. 346), Tugwell (*Entom.*, xxvii., p. 95), etc. By selection, and pairing two marked fasciated examples,

* This domesticated double-brooded condition of a very marked single-brooded species has already been noted in the broods reared by Tugwell and Porritt (*anteà*, pp. 50, 51).

Tugwell obtained a modification of these inbred York examples, in which the fascia is clearly and boldly shown on all four wings, which he named *fasciata*, and figured *Entom.*, xxvii., p. 205, fig. 4. But even then, in his most successful brood, 50 per cent. came out quite like the pale typical southern form (*op. cit.*, p. 96).

4. Spilosoma zatima ♂ × fasciata ♀.—Cross obtained May, 1893, by Porritt (*Entom.*, xxvii., p. 206), eggs shared by Tugwell and Porritt. Tugwell's results = (1) A few *zatima* like the ♂ parent. (2) Most specimens favoured the ♀ parent, but not one was a pure *fasciata*, almost all being like the race already inbred by Jackson, and known as the York form, which Tugwell figures and names *eboraci* (*Entom.*, xxvii., p. 205, fig. 2). This specimen is wonderfully near what Standfuss figures (*Handbuch*, etc., pl. viii., fig. 12) as *intermedia*, Bang-Haas, in the latter, however, the black marks of the hindwings reach back to the fringes. Many of Tugwell's more extreme *eboraci* reached Standfuss' figure in this respect. Staudinger (*Cat.*, 3rd ed., p. 364) refers *intermedia* to Standfuss (1896) (not Bang-Haas), and drops *eboraci*, Tugwell (1894), as a synonym, which is hardly accurate, Tugwell's name on these dates being the older. Jackson's series of *fasciata*, of which we possess photographs, are referred to by Hewett (*Entom.*, xxviii., p. 28).

Zonosoma annulata.—Certainly, with no close similarity in the form of race developed, a very parallel production of an artificial race, by means of the inbreeding of a rare natural aberrational form, has taken place in *Zonosoma annulata*. This little Geometrid occasionally, in nature, produces a form without the characteristic "omicron" in the centre of the forewings, but with the omicron on hindwings = ab. *obsoleta*. In inbreeding this form an aberration without the omicron on fore- and hindwings occurred = ab. *biobsoleta*, and, by selection, this, as well as *obsoleta*, were both isolated as distinct races. Riding's experiments (*Ent. Record*, x., p. 239; xi., p. 212, etc.) may be summarised as follows:

5. Zonosoma obsoleta ♂ × annulata ♀.—Three pairings obtained May, 1898. These broods produced 78 imagines—14 ♂s and 7 ♀s = *obsoleta*, and 25 ♂s and 32 ♀s = *annulata*, *i.e.*, 27 per cent. of *obsoleta* and 73 per cent. of *annulata*. There were no intermediates.

6. Zonosoma obsoleta ♂ × obsoleta ♀.—(α) Five pairings between June 30th-July 1st, 1898. Larvæ from these pupated in early August, and 15 per cent. of the pupæ gave autumnal imagines, all ♂s except one. With one exception also, all were without the omicron on forewings = *obsoleta*. One also had the omicron on the hindwings very imperfect, *i.e.*, intermediate between *obsoleta* and *biobsoleta*. The other part of these broods emerged April-June, 1899, all of the form *obsoleta*, 16 pupæ, however, went on to the autumn (*Ent. Rec.*, x., p. 239; xi., p. 212). (β) Three other broods noted, all the progeny being *obsoleta* (*op. cit.*, xi., p. 212). (γ) Another partial brood recorded, from inbred *obsoleta*: two had the hindwings faintly ringed only, most of the rest were *biobsoleta* (*op. cit.* xi., p. 289). (δ) From inbred parents, experiments carried on for a considerable time show that *obsoleta* breeds true. There has been no reversion to type for several years (Riding, *in litt.*, December, 1904).

7. Zonosoma obsoleta ♂ × biobsoleta ♀.—This crossing, from inbred parents, still yields (December, 1904) a majority of intermediates, but the omicrons on the hindwings are gradually becoming much less distinct, being often represented by a few dots only. In most of the

broods there are some *obsoleta*, varying from a few to as many as intermediates (Riding, *in litt.*).

8. ZONOSOMA BIOBSOLETA ♂ × BIOBSOLETA ♀.—One small brood (parents very carefully selected) bred true this year (1904), but this is the only time they have hitherto done so. [I often have difficulty in getting the desired selections, the emergences failing to suit, and, fearing to lose the race, I have to mate with intermediates. I have not crossed wild *annulata* with *obsoleta* for four years, so there has been no new blood introduced during this time; the imagines, however, keep full size, indeed, a few are larger than any I have taken with the net or bred from fullgrown larvæ beaten from maple.] (Riding, *in litt.*).

III. CROSSING OF TYPICAL FORMS WITH ABERRATIONS TENDING TO DEVELOP MELANOCHROIC RACES.

Having noted the recorded results of inbreeding *Spilosoma lubricipeda* with its domesticated races, we now refer to a certain number of forms, whose varying environmental conditions are such as to tend, in certain districts, to the development of a melanic race, side by side with, or gradually supplanting, the type. The origin of melanic, albinistic, and analogous races, is, perhaps, outside the scope of this chapter, yet, without considerable knowledge concerning the environment, etc., of these, the bearing of experimental work in the direction of isolating such races, or having for its object the study of their development, etc., is largely missed, and the experiments themselves rendered to a certain extent purposeless. This view we have already discussed at length (*Melanism and Melanochroism in British Lepidoptera*), and simply add here a note recently penned by Bacot, who considers it a point of some importance that a small patch of pale colour on the upper (costal) margin of the hindwing occurs in many *Amphidasys* ab. *doubledayaria*, this portion being covered by the forewings in the normal resting-position of the moth. It suggests that the dark form was evolved later than the type, and strongly hints that the dark coloration is not due to any sudden discontinuous change or darkening of the wing-pigment as a whole, but is the outcome of a long course of evolution in the history of the species, during which the death-roll of individuals showing minute variations in the direction of darkening was lower than in the typical form, *i.e.*, the colour is due to an adjustment to a gradual darkening of the resting-surface over at least a portion of the range of the species. Such a change may have originated in a greater humidity of the atmosphere and denser forests, or, possibly, in part, to a successive change in the trees, of which the forests themselves were composed, *e.g.*, pine replaced by oak, oak by beech, beech by birch, etc. Such a succession alone would probably cause considerable change in the facies of a species without a change in atmospheric conditions, which, in all probability, however, would be associated with the change, *e.g.*, if it be allowed that *A. betularia* started on its career during the oak dynasty, the comparative open nature of the wood and the fact that the trees would hardly be in full foliage at the time of the emergence of the moths, would be favourable to the development of the "pepper and salt" pattern. The succeeding beech period would give a denser foliage, and, as the trees break into leaf earlier, a much darker forest results at the period when the moths are at large, while the replacement of beech by birch would again bring in lighter conditions, accompanied by a paler resting surface. It is probable, however, that such a series of changes could not produce the extreme forms without the co-operation of additional moisture, or some factor antagonistic to the growth of lichens. Granted favourable conditions on the lines above indicated, and the evolution of a stirps of a species showing dimorphic or polymorphic conditions is only what might be expected. The apparent discontinuity, due to the absence or extreme rarity of intermediate forms, would be accounted for by the period of change being too brief, in comparison with the long periods of approximate stability that follow, to allow of heredity fixing the intermediate stages with any degree of firmness in the architecture of the germinal material. The present appearance and rapid spread of dark forms, must, on this hypothesis, be explained by (*a*) the recurrence of conditions favourable to the melanic race, putting an enormous premium on the few dark forms that would appear from time to time, (*b*) the desire of entomologists to possess the dark forms leading to extensive artificial selection and rearing from dark stock, and the escape of surplus imagines and young larvæ (Bacot). Such a view as this would necessarily tend to the rejection of the opinions of Standfuss, concerning *Lymantria monacha* and its dark form *eremita* (*infrà*), and postulate, for such forms, an origin by slow response to changed environmental conditions, excluding largely the theory of sudden development by discontinuous variation. Our view is distinctly in favour of the former, and against the latter explanation of the origin of such forms. One suspects that all these races are atavistic, and have the potentialities of producing melanic races (by selection) within the ordinary variational limits of the species. The inbreeding of these aberrations, however, has not been carried out in a sufficient number of experiments to give any sound or reliable data. Some of the crossings, however, that have been recorded are as follows :—

1. Grammesia trigrammica ♂ × bilinea ♀.—Standfuss records (*Handbuch*, etc., p. 313) a cross of this supposed parentage, but ♂ really unknown ; 67 perfect insects resulted, 38 being *trigrammica* and 29 *bilinea*, there being no intermediates. One of the latter he figures (pl. viii., fig. 10).

2. Polia olivacea ♂ × olivacea ♀.—Eggs laid September, 1891, hatched May, 1892 ; larvæ did well till half-grown, when many died. Those that pupated and resulted in imagines produced in every case *olivacea*. [Two typical *chi* ♀s taken in same locality and ♂s unknown, produced in each case 75 per cent. *chi* and 25 per cent. *olivacea*.] (Maddison, *Ent. Rec.*, iv., p. 3).

3. Lymantria monacha ♂ × eremita ♀.—Standfuss, in 1893, reared a brood from a pair of normal *monacha*, from near Breslau, in Silesia. This brood contained one ♀ *eremita*, which was paired with a normal *monacha* ♂, from Zürich. The issue consisted of 22 typical *monacha*, 2 ♂s and 20 ♀s ; 23 *eremita*, 18 ♂s and 5 ♀s, and 6 intermediates, 5 ♂s and 1 ♀, in which the characters of the two were asymmetrically mixed, but with no apparent tendency to gynandromorphism. One of these is figured by Standfuss (*Handbuch*, etc., pl. iv., fig. 4).

4. Lymantria eremita ♂ × monacha ♀.—Standfuss found, in 1883, near Liegnitz, in Silesia, a ♂ *eremita* paired with a ♀ *monacha*. The result was entirely different from that of the reciprocal crossing noted (*suprà*), for the issue contained every kind of transition between the two parent forms, whilst a few were even darker than the ♂

parent. [Standfuss explains this by supposing that the two specimens of ab. *eremita*, though externally so much alike, possessed entirely different properties in regard to their power of transmission to descendants. He looks upon the first *eremita* as a true sport or aberration, and in its case, he says, the rule, already formulated, held good as usual. The second *eremita* (which did not show the particular varietal characters so well as some of its own offspring), he considers, was a link in the chain leading, by slight variations, to a darker, and, presumably, better protected form of *monacha*, which, under the influence of natural selection, is gradually developing itself in certain parts of the range of the species; it took rank, therefore, he says, not as an aberration, but rather as a member of a local race, and with this its behaviour accorded. We consider this a very wide conclusion to draw on only two experiments. The immediate ancestry of the two specimens of *eremita* here dealt with may have been entirely different. We are inclined to dissent strongly from the sport theory of the dark form and the extensive inbreeding experiments of Fletcher and others (the results unfortunately not published) suggest a development very parallel with *doubledayaria*, etc.]

Aglia tau.—From 1885 to 1893, Standfuss reared numbers of *Aglia tau*, and named the melanistic specimens *lugens*. So great was the difference in these latter that Bang-Haas called the extreme melanic form *nigerrima*, and Thierry-Mieg, the least melanistic *ferenigra*; as a matter of fact this latter only exhibits black on the outer margin of the wings. Standfuss, in crossing these, notes that he obtained *tau* and all the different transitional forms of *lugens* (from *ferenigra* to *nigerrima*), but nothing between *tau* and *ferenigra** has been so produced. His experiments work out as follows:—In 1888, Standfuss crossed *lugens* ♂ s (inbred for two generations) with *tau* ♀ s. From these more *lugens* were obtained in 1889, and were used in the following pairings: *lugens* ♂ × *tau* ♀; *tau* ♂ × *lugens* ♀; *lugens* ♂ × *lugens* ♀. The ♀ *tau* were in each case of different ancestry to the *lugens* stock. The results were:—

5. Aglia lugens ♂ × tau ♀.—95 eggs laid, 86 imagines reared, *viz.*, 14 ♂ s and 28 ♀ s of *tau*, and 31 ♂ s and 13 ♀ s of *lugens*.

6. Aglia tau ♂ × lugens ♀.—82 eggs laid, 75 imagines bred, *viz.*, 13 ♂ s and 25 ♀ s of *tau*, and 26 ♂ s and 11 ♀ s of *lugens*.

7. Aglia lugens ♂ × lugens ♀.—89 eggs laid, 86 imagines bred, *viz.*, 10 ♂ s and 21 ♀ s of *tau*, and 34 ♂ s and 21 ♀ s of *lugens*. In 1890, from this brood, two more pairings of ♂ and ♀ *lugens* were obtained: (*a*) 117 eggs were laid, giving 102 imagines, *viz.*, 3 ♂ s and 8 ♀ s of *tau*, and 49 ♂ s and 42 ♀ s of *lugens*. (*β*) 103 eggs laid, giving 87 imagines, *viz.*, 3 ♂ s and 7 ♀ s of *tau*, and 46 ♂ s and 31 ♀ s

* Just as the ♀ of *S. lubricipeda* ab. *intermedia* figured by Standfuss (*Handbuch*, etc., pl. viii., fig. 12), appears to us a very slight advance on typical *lubricipeda*, when one considers the character of each parent (*e.g.*, *zatima* in the cross of *zatima* and *lubricipeda*), so *Aglia tau* ab. *ferenigra* appears to run somewhat close to typical *tau* when one has to take into account that a strongly-marked *lugens* had been one of the parents. There appears little room for what Standfuss calls intermediates between *A. tau* and *ferenigra*, or between *S. lubricipeda* and *intermedia*; certainly nothing in our opinion that betokens discontinuous variation. We should say that pl. viii., figs. 12, 11, 13, 14, with a type of *lubricipeda* in front of 12; and 5, 4, 6, 7, with a typical ♂ and ♀ of *tau* following 7, would make a very fair consecutive series.

of *lugens*. These imagines, emerging in 1891, had parents and grandparents of the *lugens* type. It will be observed that the 1889 pairings, *lugens* ♂ × *tau* ♀ and *tau* ♂ × *lugens* ♀, gave roughly about 50 per cent. of each form, with a slight preponderance of forms resembling the ♂ parent—in the first case *lugens*, in the second case *tau*. The 1889 pairing of *lugens* ♂ and ♀, gave 36 per cent. of *tau* and 64 per cent. of *lugens*, whilst, in 1890, the proportion of *tau* fell to a little over 11 per cent. in one, and a little under 11 per cent. in the other. In each of the five cases about twice as many ♀s as ♂s were of the *tau* form; so that it appears to be more difficult to transform the ♀ of *A. tau* than the ♂.

8. Amphidasys betularia ♂ × doubledayaria ♀.—(α) Steinert gives (*Isis*, 1892, pp. 424-427) details of a brood resulting from a ♀ moth found near Dresden, in June, 1891 (in which he assumes the ♂ to have been of typical form). The result was 30 ♂ and 45 ♀ *betularia*, and 34 ♂ and 56 ♀ *doubledayaria*. Two of those classed as *betularia* were darker than ordinary, and were the only intermediates. Standfuss thinks that these two need not be regarded as owing their darker coloration to the cross, but as mere aberrations due to the species becoming gradually darker in the district (*Handbuch*, etc., pp. 315-316). Standfuss, in our opinion, is far too much inclined to explain away intermediates when they occur in these crossings. (β) A typical ♂ paired with ♀ *doubledayaria* taken *in cop.* in June, 1902, at Brentwood. The eggs divided between Robbins and Bacot, the latter from his moiety reared 232 moths in 1903, as follows :—

♂s 118 = typical 56 and *doubledayaria* 62.
♀s 114 = ,, 67 ,, ,, ,, 47.

No intermediates were bred. There appeared to be some cross-inheritance, the majority of the ♀s following the pale ♂, and the majority of the dark ♂s following the ♀ (Bacot). (γ) A similar pair taken *in copulâ*, at Rugeley, in 1904; most of the larvæ escaped, but 40 pupæ were secured. From these 34 imagines were bred, May-June, 1905, all black *doubledayaria* (Freer, *in litt.*). (δ) A pairing of *betularia* × *doubledayaria* (at Willington), produced eggs, from which only 15 imagines were finally reared, *viz.*, 7 ♂s (1 black and 6 typical) and 8 ♀s (6 black and 2 typical) (Smallwood, *Ent.*, xxix., p. 222).

9. Amphidasys doubledayaria ♂ × betularia ♀.—(α) Forty years ago, Edleston obtained a crossing, and the progeny resulted in some remarkably pretty aberrations, forming a connecting link between *doubledayaria* and the type, but far before either as regards beauty (*Ent.*, ii., p. 150). (β) A pair taken *in cop.* in 1888, in Delamere Forest. The progeny showed 85 per cent. black, 15 per cent. typical (Arkle, *Entom.*, xxii., 236). (γ) In 1903, a ♂ *doubledayaria* was taken *in cop.* with a ♀ *betularia*, at Woodford; the results of the imagines that emerged in 1904 were as follows :—

	Type.	Var.		Type.	Var.
♂s	22	21	=	21%	20%
♀s	35	26	=	34%	25%
	57	47		55	45

Of the 43 ♂s 22=51%=type, following the ♀ parent.
21=49%=var. ,, ♂ ,,
Of the 61 ♀s 35=57%=type, following the ♀ parent.
26=43%=var. ,, ♂ ,,

As the result of "assembling" at Woodford, in June, 1904, it was found that:

17= ♂ type	=63%
10=var. *doubledayaria*	=37%
27	100

(Harrison and Main, *in litt.*)

10. Amphidasys doubledayaria ♂ × doubledayaria ♀.—(*a*) The parentage of these two individuals was as follows: ♂—the progeny of typical ♂ (Worthing) × black ♀ (Hull); ♀—the progeny of wild black ♀ from Market Drayton. Of the offspring of this pairing (the imagines emerging between June 2nd and 27th, 1895)—a very large number was bred—about two-thirds were *doubledayaria*, and one-third typical. There were no intermediates (Bankes, *in litt.*). (β) Some ♂s and ♀s of this brood were paired, and a large number of imagines bred in May-June, 1896. All these were unicolorous black, and all were more or less undersized, not, however, for any lack of food, many being so small as not to be worth setting (Bankes, *in litt.*). (γ) All the progeny black, ♂s and ♀s (Newey, *Ent.*, xxix., p. 222).

11. Hemerophila abruptaria ♂ × fuscata ♀.—(*a*) An ab. *fuscata* ♀ taken in north London paired with typical ♂, May 22nd, 1896. Larvæ from this pairing fed up (number not stated) about half emerging in August, 1896, among which was only one *fuscata*, the rest typical, the other half emerging in May, 1897, among which were only five *fuscata*, the number of intermediates and typical forms not being stated (Southey, *Ent. Rec.*, x., p. 122). (β) Two broods with this parentage, reared by Hamling, in May and June, 1904, gave the following results:

Broods.	No. pupated.	No. type bred.		No. *fuscata* bred.		Pupæ died.
		♂	♀	♂	♀	
A.	23	7	1	4	4	7
B.	32	12	6	—	1	13

(γ) Another pairing obtained May 26th, 1904. Of the offspring, 18 were reared in August of the year, 10 ♂s, 5 *abruptaria* and 5 *fuscata*, and 8 ♀s, 4 *abruptaria* and 4 *fuscata*. The *fuscata* ♂s were darker than the ♀s but very small, much less than the light specimens of the same brood (Harris, *Proc. Ent. Soc. Lond.*, 1904, p. lxxii), two of the same brood emerged April, 1905, 1 ♂ and 1 ♀ *abruptaria* (*in litt.*). (δ) A pairing from Harris' brood 13*a* (*infrà*), made May, 1905, of ♂ *abruptaria* × ♀ *fuscata*, produced in August, 1905, 19 ♂s and 14 ♀s of *fuscata*, and 7 ♂s and 8 ♀s of *abruptaria* [14 pupæ had not yet changed on September 25th].

12. Hemerophila fuscata ♂ × abruptaria ♀.—(*a*) Pair found *in cop.* in nature in North London on May 23rd, 1895. The progeny from these resulted in 30-40 imagines in 1896. The percentage of typical (pale), intermediate (*brunneata*), and dark (*fuscata*) forms not recorded (Pearce, *Ent. Rec.*, x., p. 121). (β) Four broods of this parentage reared by Hamling, in May and June, 1904, resulted as follows:—

	No. pupated.	No. type bred. ♂	No. type bred. ♀	No. *fuscata* bred. ♂	No. *fuscata* bred. ♀	Pupæ died.
1 brood	28	7	2	7	4	8
3 broods	80	10	7	31	17	15

(γ) A ♂ *fuscata* paired with a ♀ *abruptaria*, May 1905, from Harris' brood 13α (*infrà*). In August, 1905, 8 ♂ s and 15 ♀ s of *fuscata* and 3 ♂ s and 3 ♀ s of *abruptaria* had emerged (two pupæ not yet produced imagines).

13. Hemerophila fuscata ♂ × fuscata ♀.—(α) Paired August 12th, 1904 (from brood 11γ); larvæ hatched August 28th and following days, of which 57 spun up between October 11th and November 5th. Imagines emerged between March 24th and May 6th, 1905 as follows: ♂ s = 12 *fuscata* and 5 *abruptaria*, ♀ s = 16 *fuscata* and 6 *abruptaria*. The remaining 18 did not emerge, although the moths formed in the pupæ; of these apparently 11 would have been dark and 7 pale. The dark ♂ s much larger than those of preceding autumn (Harris, *in litt.*, June 28th, 1905). (β) A ♂ and ♀ of the *fuscata* from this brood were paired and fertile eggs resulted; the larvæ fed up and pupated, and the imagines emerged as a second brood in August, 1905. The 67 imagines bred produced 34 ♂ s and 33 ♀ s, all *fuscata*, not a light specimen among them (10 pupæ had on September 25th not yet produced imagines). [N.B.—A ♂ and ♀ light *abruptaria* of same brood were paired, the progeny resulting in nine light ♂ s and nine light ♀ s, with no *fuscata*; whilst three pupæ had not changed.] (γ) An inbred brood this year (1905) produced some 20 specimens, all of the dark chocolate form, not a trace of the ordinary type among them (Porritt, *in litt.*, June 23rd, 1905).

Gonodontis bidentata ab. nigra.—A batch of 146 ova laid by a ♀ *nigra* (♂ unknown), taken at Methley, near Leeds, in 1900, produced 136 imagines, 66 being typical, and 70 *nigra*, in 1901. From this brood the following experimental crossings were obtained, *viz*:—

14. Gonodontis bidentata ♂ × bidentata ♀ (*nigra* strain).—Four broods bred together. Largely died off as larvæ, 77 pupæ only resulted; 4 emerged in November, 1901, 3 *bidentata* and 1 *nigra*; 64 in May, 1902, 23 *nigra*, 41 *bidentata*. The remainder did not emerge. Total, 44 *bidentata*, 24 *nigra*.

15. Gonodontis bidentata ♂ × nigra ♀ (from same brood).—Three broods kept together. Only 60 pupated. Two *nigra* emerged in December, 1901, and 23 *nigra* and 13 *bidentata* in May, 1902. The remainder did not emerge. Total, 25 *nigra*, 13 *bidentata*.

16. Gonodontis nigra ♂ × bidentata ♀ (from same brood).—Three broods kept together. Only 57 pupæ resulted. These produced in May, 1902, 37 *nigra*, and 10 *bidentata*. The rest did not emerge.

17. Gonodontis nigra ♂ × nigra ♀ (from same brood).—Four broods kept together. Only 120 pupated. In December, 1901, and January, 1902, 9 *nigra* and 2 *bidentata* appeared. In May, 1902, 81 *nigra*, and 4 *bidentata*. Total, 90 *nigra* and 6 *bidentata*.

The results of the last four crossings summarise as follows:—

Ova obtained from.	Broods.	Number Pupated.	Number *nigra* Bred.	Number Type Bred.	Cripples. ab. *nigra*	Cripples. Type	Did not emerge.
Typical ♂ × ♀ ..	4	77	15	25	9	19	9
type ♂ × *nigra* ♀ ..	3	60	21	8	4	5	22
nigra ♂ × type ♀ ..	3	57	34	9	3	1	10
nigra ♂ × ♀ ..	4	120	76	3	14	3	24

Hamling, to whom we are indebted for these experiments, regrets that he did not notice the division of the sexes (For further details, see *Transactions of the City of London Entomological and Natural History Society*, 1903, pp. 43 *et seq.*).

17*a*. GONODONTIS NIGRA ♂ × NIGRA ♀.—A black ♀ *G. bidentata*, captured in 1903, produced about 66 per cent. of *nigra*, and two inbred pairings of *nigra* from these have this year produced 80 per cent. of *nigra* (Porritt, *in litt.*, June 23rd, 1905).

18. LARENTIA NUBILATA (MULTISTRIGARIA) ♂ × NUBILATA ♀.—(α) Ova, to the number of 104, obtained March, 1904, from *nubilata* (the melanic form of *L. multistrigaria*) parents. The number of larvæ pupated = 59. The brood divided as follows:—Typical form 13 = 8 ♂s and 5 ♀s; *nubilata* 32 = 17 ♂s and 15 ♀s; 14 pupæ failed to emerge (Hamling, *in litt.*). (β) A wild pairing (at Skelmanthorpe) in 1903, of *nubilata* × *nubilata*, resulted in 9 ♂ and 8 ♀ *nubilata*, 4 ♂ and 2 ♀ *multistrigaria*, and 2 ♀s, dull smoky in tint, with the markings almost obliterated (Morley, *in litt.*). (γ) Captured black females in 1903, near Huddersfield, produced about half *nubilata*, half typical. Black pairings from these produced about 75 per cent. black. Black pairings from these (but mixed with larvæ from captured black moths), again produced about 70-75 per cent. black, but no data available as to what proportion were from the captured, and what from the inbred, *nubilata* (Porritt, *in litt.*, June 23rd, 1905).

19. VENUSIA CAMBRICA AB. BRADYI.—Eggs from several dark captured ♀s, ♂s of course unknown. Only 13 pupæ obtained, from these 7 moths emerged, all dark lead-coloured (Porritt, *in litt.*, June 23rd, 1905).

IV. CROSSING OF TYPICAL FORM WITH ABERRATION TRYING TO SET UP LOCAL RACE.

In the western parts of England and elsewhere *Boarmia repandata* passes insensibly by various gradations into a well-marked banded form, which is evidently in these localities attempting to supplant the type. The banded aberration is of the greatest rarity in most localities. Similar local aberrations are set up in the banded form of *Cidaria suffumata* in Kent and Yorkshire, and possibly parallel developments have taken, or are taking, place in many other species. These forms are possibly quite analogous in their development with those last considered, but the racial tendency exhibits different characters for protective purposes. The only recorded experimental crossings that we can trace are the following:—

1. BOARMIA REPANDATA ♂ × CONVERSARIA ♀.—(α) A large brood of moths reared from the eggs of a pair of normal *repandata* contained 3 ♂ and 1 ♀ *conversaria*. This ♀ was paired with a wild ♂ *repandata*, and produced 10 ♂ and 18 ♀ *repandata* and 4 ♂ and 2 ♀ *conversaria*. Intermediate forms were entirely absent (Standfuss, *Handbuch*, etc., p. 317). (β) From Bristol eggs laid by *conversaria* ♀ (♂ possibly typical); 19 imagines reared consisted of 10 *repandata* and 9 *conversaria* (South, *Proc. Sth. Lond. Ent. Soc.*, 1885, p. 43, *Trans. Ent. Soc. Lond.*, 1887, p. xliv). (γ) In 1903, I reared a brood from a wild Devon crossing of *repandata* × *conversaria*; about ten per cent. only were *conversaria*. From these I paired ♂ *conversaria* with ♀ *repandata*, and in the result I obtained about 40 per cent. *conversaria*, whilst from another pairing of ♂ *repandata* and the ♀ *conversaria*, I got a very similar result.

Those that were not *conversaria* were in these broods very typical (Massey, *in litt.*, July 13th, 1905).

2. Cidaria suffumata ♂ × porrittii ♀.—Paired April, 1891 (*Ent.*, xxiv., p. 172). Only seven imagines bred, all ♀ s (five typical, 2 *porrittii*) (South). [Two broods of typical ♂ × typical ♀ are noted at same time. From one, 3 ♂ and 4 ♀ typical examples were bred, and from the other two typical ♀ s only.]

V. Crossing of dimorphic forms of a species which occur together and rarely appear to attempt to supplant each other.

Probably the experiments here described as carried out on the red-banded *Coremia ferrugata* and its black-banded form *unidentaria* are best considered under a separate heading. Those of *Cidaria truncata* are very unsatisfactory, the ♂ not being known for certain in two of the cases.

Coremia ferrugata*.—Prout observes (*Trans. City Lond. Ent. Soc.*, 1898, pp. 27 *et seq.*) that intermediate colour aberrations are very rare, suggesting that, in this species, from red to black is the simplest change, only 1½ per cent. of a large number bred being intermediate. Many others partially intermediate, approach most to red, and are classed as red. His results are too detailed to be repeated at length. We note the following :—

1. Coremia unidentaria (black-banded) ♂ × ferrugata (red-banded) ♀.—A large brood resulted in 39 per cent. red, and 61 per cent. black, forms.

2. Coremia ferrugata ♂ × ferrugata ♀.—Nine broods show an average of about 68·5 per cent. red, and 30 per cent. black, forms, the rest intermediate ; red ♂ s came first numerically, then red ♀ s, then black ♂ s, and lastly, black ♀ s.

3. Coremia ferrugata ♂ × unidentaria ♀.—Four broods give about 46·5 per cent. red, 51 per cent. black, and 2·5 per cent. intermediate, forms. Black ♂ s were most numerous, then red ♀ s, then black ♀ s, and lastly, red ♂ s.

4. Coremia unidentaria ♂ × unidentaria ♀.—Seven broods yielded 98·5 per cent. black, none red, and 1·5 per cent. intermediate. In this connection it should be noted that 6 of these 7 broods had red ♀ grandparent, and in one case both parents were the offspring of a red ♀ ; yet the 1·5 per cent. really represents only a single intermediate specimen. None of the broods were very large, but two of them contained 16 specimens apiece without a single intermediate. One of these two had a strong reddish tendency in the ♀ parentage, and was also predominantly red on the ♂ side (♂ was one of a brood with 22 red to 18 black.)

5. Coremia unidentaria ♂ × intermedia ♀.—Produced (to date of record) three black specimens only.

The actual numbers† reared of 14 of the broods of which both parents (and both ♀ grandparents) were known, and which produced 328 specimens, subdivided into—

(*a*) One brood, red ♀ (red ♀ parent) × black ♂ (black ♀ parent)—giving 17 ♂ s and 10 ♀ s red, 31 ♂ s and 11 ♀ s black, 0 intermediate, specimens.

(*b*) Three broods, red ♀ s (red ♀ parent) × red ♂ s (red ♀ parent)—giving 13 ♂ s and 14 ♀ s red, 10 (or 11) ♂ s and 11 (or 10) ♀ s black, 0 intermediate.

* The allied red-banded species is known as *C. spadicearia*.

† In cases where these numbers differ from those published in the original paper, the figures have been supplied by Mr. Prout, and include the later emergences.

(*c*) Two broods, black ♀s (red ♀ parent) × red ♂s (red ♀ parent)—giving 28 ♂s and 35 ♀s red, 38 ♂s and 35 ♀s black, 1 ♂ and 3 ♀s intermediate, specimens.

(*d*) One brood, black ♀ (red ♀ parent) × red ♂ (brother to ♀)—giving 5 ♂s and 5 ♀s red, 4 ♂s and 3 ♀s black, 0 intermediate.

(*e*) One brood, black ♀ (black ♀ parent) × black ♂ (black ♀ parent)—giving 1 ♂ and 5 ♀s black (rest died in pupal stage).

(*f*) Three broods, black ♀s (black ♀ parent) × black ♂s (red ♀ parent)—giving 0 red, 17 ♂s and 20 ♀s black.

(*g*) Two broods, black ♀s (red ♀ parent) × black ♂s (black ♀ parent)—giving 0 red, 22 ♂s and 26 ♀s black, 1 ♂ and 0 ♀ intermediate (some still in pupa).

(*h*) One brood, black ♀ (red ♀ parent) × black ♂ (brother to ♀)—giving 0 red, 3 ♂s and 1 ♀ black, 0 intermediate.

Actual number of specimens reared in 4 broods in which pedigree can be traced back, in one direction at least, for three generations, produced 175 specimens, subdivided into—

(*a*) Black ♀ [(? ♂ × red ♀s) black ♂ × (? ♂ × black ♀) black ♀] fertilised by red ♂ (captured)—giving 23 ♂s and 24 ♀s red, 26 ♂s and 23 ♀s black, 0 intermediate.

(*b*) Red ♀ [(? ♂ × black ♀) black ♂ × (? ♂ × red ♀) red ♀] fertilised by red ♂ [(? ♂ × red ♀) red ♂ × (? ♂ × black ♀) black ♀]—giving 1 ♂ black, 1 ♂ red (parents closely related).

(*c*) Red ♀ [(? ♂ × red ♀) red ♂ × red ♀ (same parentage)] fertilised by red ♂ (captured)—giving 27 ♂s and 25 ♀s red, 15 ♂s and 6 ♀s black, 0 intermediate.

(*d*) Red ♀ [(? ♂ × red ♀) red ♂ × (? ♂ × red ♀) red ♀] fertilised by red ♂ [? ♂ × red ♀]—giving 5 ♂s and 11 ♀s red, 3 ♂s and 4 ♀s black.

Three broods in which the pedigree could be traced back, in one direction at least, for four generations, produced 72 specimens, and subdivide into :—

(1)

? ♂ × red ♀ (captured)

red ♂ × red ♀

red ♂ (captured) × red ♀   ? ♂ × red ♀ (captured)

red ♂ × red ♀

26 ♂ 11 ♀ (red)   8 ♂ 1 ♀ (black)   0 ♂ 1 ♀ (intermediate)

(2)

? ♂ × red ♀ (captured)   ? ♂ × black ♀ (captured)

black ♂ × black ♀

? ♂ × red ♀   red ♂ (captured) × black ♀

red ♂ × red ♀

6 ♂ 7 ♀ (red)   1 ♂ 1 ♀ (black)   0 ♂ 1 ♀ (intermediate)

(3)

? ♂ × red ♀   ? ♂ × black ♀

black ♂ × black ♀

red ♂ × black ♀   ? ♂ × red ♀

red ♂ × red ♀

5 ♂, 1 ♀ (red)   0 ♂, 2 ♀ black)   1 ♂, 0 ♀ (intermediate)

(4) Another experiment in which the pedigree could, in part, be traced back four generations, was made subsequently—

? ♂ × red ♀   ? ♂ × red ♀

red ♂ × red ♀

? ♂ × red ♀

? ♂ × red ♀   red ♂ × red ♀

black ♂ × black ♀

5 ♂, 5 ♀ (all black).

(5) One brood in which the pedigree can be traced back, in one direction for five generations, produced twelve specimens.

? ♂ × red ♀   ? ♂ × black ♀

black ♂ × black ♀

red ♂ × black ♀

? ♂ × red ♀

? ♂ × black ♀   red ♂ × red ♀

black ♂ × intermediate ♀

5 ♂, 6 ♀ (black)   0 ♂, 0 ♀ (red)   0 ♂, 1 ♀ (intermediate).

Summarising, Prout notes (*op. cit.*, p. 30) that, in *unidentaria* × *ferrugata*, and *ferrugata* × *unidentaria*, black-banded (*unidentaria*) forms preponderate as 4 : 3 . . . . In *ferrugata* × *ferrugata*, red-banded examples strongly predominate, nearly as 7 : 3. [Reference to *Trans. City Lond. Ent. Soc.*, 1897, p. 18, will show that continued red selections steadily increase the percentage.] In crossings of *unidentaria* × *unidentaria*, the red-banded form seems almost entirely unable to assert itself. Prout further notes that he was much impressed by the general very direct response to immediate parentage—especially if black—*unidentaria* × *unidentaria* producing black-banded only, irrespective of ancestry; *ferrugata* × *ferrugata* resulting in over two-thirds red-banded examples; whilst *ferrugata* × *unidentaria* produced roughly half and half, or black slightly in the ascendant. . . . The potency of the ♂ and of the ♀ parent seems roughly equal, nor does it, so far as the statistics here show, exert its influence more strongly on one sex than on the other in the progeny.

6. CIDARIA ? TRUNCATA ♂ × COMMA-NOTATA ♀.—(α) 41 specimens reared, 17 followed the ♀ parent, 24 were of other forms, 13 pale and 11 dark (South, *Proc. Sth. Lond. Ent. Soc.*, 1894, p. 74). (β) In June, 1904, small batch of ova laid by ♀ *comma-notata* (♂ possibly typical, but uncertain), 12 imagines resulted, 5 ♂ and 1 ♀ *truncata*, 4 ♂ and 2 ♀ *comma-notata* (Raynor, *in litt.*).

7. CIDARIA COMMA-NOTATA ♂ × COMMA-NOTATA ♀.—In May, 1905, bred ♂s and ♀s of this form were paired, 3 ♀s giving fertile ova. They produced very few moths, probably due to inbreeding. The results were as follows:—(α) 4 moths, *viz.*, 1 *russata*, 3 *comma-notata*. (β) 23 moths, *viz.*, 6 *truncata*, and 17 *comma-notata*. (γ) 12 moths, *viz.*, 6 *truncata*, and 6 *comma-notata*. Of the 39 specimens bred, therefore, 13 were *truncata* and 26 *comma-notata* (Raynor).

8. ANGERONA PRUNARIA ♂ × SORDIATA ♀.—Zeller reared this and the reciprocal cross in 1885-1886. (α) A brood of this cross, emerging in 1886, resulted in 6 ♂ and 11 ♀ *prunaria* (speckled), and 5 ♂ and 9 ♀ *sordiata* (banded). In these there were no intermediates (Standfuss, *Handbuch*, pp. 313-314). [Intermediates are also practically unknown in nature.] Standfuss figures two of these (*op. cit.*, etc., pl. viii., figs. 8-9). (β) Pickett notes (*Ent. Rec.*, xv., pp. 146-147) obtaining three broods of this cross. He reared them altogether and obtained 39 ♂ and 21 ♀ *prunaria*, and 47 ♂ and 25 ♀ *sordiata*.

9. ANGERONA SORDIATA ♂ × PRUNARIA ♀.—(α) Of this cross, Zeller, in 1886, reared a brood resulting in 51 ♂ and 33 ♀ *prunaria*, and 38 ♂ and 30 ♀ *sordiata*. Standfuss notes that there were no intermediates. [We should add that one would expect none] (*Handbuch*, etc., p. 314). (β) Pickett notes (*Ent. Rec.*, xv., pp. 146-147) two broods of this form, which together resulted in 45 ♂ and 23 ♀ *prunaria* and 38 ♂ and 17 ♀ *sordiata*.

10. ANGERONA SORDIATA ♂ × ♀.—Zeller reared among a large brood from a pair of normal *prunaria*, 3 ♂ and 2 ♀ *sordiata**. (α) Pairing a ♂ and ♀ of these, Standfuss obtained 3 ♂ and 10 ♀ *prunaria*, and 24 ♂ and 18 ♀ *sordiata* (*Handbuch*, etc., p. 315). (β) Pickett also inbred this form, *viz.*, 3 broods (light-banded ♂ × light-banded ♀), and (γ) 1 brood (dark-banded ♂ × very light-banded ♀). The first (3 broods) resulting in 78 banded ♂s and 37 banded ♀s, and the second (1 brood) producing 64 dark-banded ♂s and 36 dark-banded ♀s (*Ent. Rec.*, xv., pp, 147-148).

11. ABRAXAS GROSSULARIATA ♂ × FLAVOFASCIATA ♀.—The ab. *flavofasciata*, Huene (=*lacticolor*, Raynor) is a rare form of the species occurring sporadically with the type. Raynor gives an account of breeding the same in the *Ent. Record*, 1902, pp. 32 *et seq.* When a ♀ *flavofasciata* was paired with a ♂ *grossulariata*, no *flavofasciata* appeared. When, however, these (in appearance) *grossulariata* inbreds were paired

* It may be well to observe here that Pickett reared three broods of *prunaria* ♂ × *prunaria* ♀, and from them obtained 89 ♂s and 45 ♀s without a *sordiata* among them (*Ent. Rec.*, xv., p. 147).

together, several *flavofasciata* appeared in the progeny. Some of these were then paired with normal ♂ *grossulariata*, presumably of different stock, and again no *flavofasciata* appeared. In 1904, Raynor and Doncaster had gone further with regard to the question of heredity and sex determination in these crosses, and gave the following summary to date :—The ab. *flavofasciata* is recessive in the Mendelian sense, not appearing at all in the first cross. In the offspring of heterozygotes paired together, half the females are *flavofasciata*, the remainder of the females, and all the males, being normal *grossulariata*, *e.g.*, the numbers bred in one family of this class were 25 normal ♂ s, 14 normal ♀ s, 9 *flavofasciata* ♀ s; in another, 22 normal ♂ s, 9 normal ♀ s, 11 *flavofasciata* ♀ s (1). When, however, a *flavofasciata* ♀ is paired with a first cross ♂ (namely, F ♀ × G(F) ♂), among the offspring not only some of the females, but also some of the males, are *flavofasciata* (2). The numbers available are not yet enough to determine with certainty what are the proportions; in one family there were 10 normal and 6 *flavofasciata* ♂ s, 4 normal and 2 *flavofasciata* ♀ s. The facts may be summarised in genealogical tables thus :—

1.

F ♀ × G ♂

G(F) ♀ × G(F) ♂

1F ♀ 1G(F) ♀ 2G ♂ (=probably 1G(F) ♂ + 1GG ♂)

2.

F ♀ × G ♂

G(F) ♂ × F ♀

F ♀ G(F) ♀ F ♂ G(F) ♂

The experiments are of importance in relation to Castle's hypothesis that gametes bear one or the other sex, and that certain somatic characters may be coupled with a given sex in the gametes. The hypothesis, if somewhat modified, is in excellent accord with the facts; but, until we know the result of the pairing *flavofasciata* ♂ × crossbred ♀, it would be premature to draw far-reaching conclusions. [Explanation of exhibit at the meetings of the British Association, Cambridge, 1904.]

12. Abraxas grossulariata ab. flavofasciata ♂ × flavofasciata ♀.—In July, 1904, ♂ s of ab. *flavofasciata* were bred for the first time. One was paired with a ♀ of same aberration. Of the progeny, 13 imagines were reared in 1905, all of the ab. *flavofasciata* (Raynor, *Ent. Rec.*, October, 1905).

VI. Crossing of typical forms with possible constitutional aberrations.

These crossings, as may be supposed, appear to fail almost entirely in carrying on the special aberrational forms apparently due to constitutional weakness, *i.e.*, the latter, *per se*, is not handed on to the progeny, but must be engendered anew by fresh abnormal and unsatisfactory conditions. Standfuss notes that the crossing of typical *Issoria lathonia*, *Gastropacha tremulifolia*, and *Agrotis linogrisea*, with aberrational forms of the respective species, resulted in no aberrative individuals in the progeny (*Insekten Börse*, xix., p. 163). Other experiments noted in more detail, bearing on this phase of the subject, are as follows :—

1. Mimas tiliæ ♂ × obsoleta ♀.—Two broods. The first brood gave 72 imagines, all normal; the second, 65 moths, all normal (Standfuss, *Insekten Börse*, xix., p. 163).

2. Mimas obsoleta ♂ × tiliæ ♀.—Three broods. First produced 69 moths, 68 normal, and 1 ♀ slightly aberrant; the second gave 52 moths, 51 typical, and 1 ♀ of the *obsoleta* form; the third resulted in 81 imagines, 77 being normal, 1 ♂ and 1 ♀ of the *obsoleta* form, and 1 ♂ and 1 ♀ intermediate (Standfuss, *Insekten Börse*, xix., p. 163).

3. Abraxas ulmata (?) ♂ × suffusa ♀.—[The ♂ may also have been *suffusa*. Eggs obtained 1897 (*Ent. Rec.*, ix., p. 304).] (α) 70 imagines bred—67 typical, 3 slightly suffused, none followed ♀. The colour of ab. *suffusa* is due to an extension of the bluish-grey scales over the whole wing area; there are no melanic scales. The aberrations appear to be caused by disease, or perhaps by certain meteorological conditions acting on pupæ with deficient vitality (Riding, *Ent Rec.*, x., pp. 263-264). (β) The experiment was repeated in 1898, and 40 imagines were bred from *suffusa* ♂ × *suffusa* ♀ parentage. All these were typical *ulmata*, not one resembled the ♀ parent. There were not even unusual blotches on any of the specimens (*Ent. Rec.*, xi., p. 290).

VII. Dimorphism in one sex.

Although rather outside the scope of this chapter, we may note that information is badly needed of the percentages of dimorphic progeny in those species in which the dimorphism is confined to one sex. The problem involving the cause of the maintenance of this dimorphism in one sex, might also, in some cases at least, with sufficient experimental trials, be more or less satisfactorily solved. In *Spilosoma mendica*, this dimorphism is confined to the ♂s in which there are two forms—*mendica* (dark), and *rustica* (light), but rarely occurring in the same locality, that is, it is racial, whilst in *Dryas paphia* it is the ♀ that is dimorphic—*paphia* (brown), and *valesina* (greenish-black), and in *Colias edusa* also the dimorphism is in the ♀—*edusa* (orange), *helice* (white), and in these the dimorphic forms occur together, *i.e.*, the dimorphism is aberrational. But we have few detailed experiments giving useful information on the various points arising out of a study of this dimorphism. At present we can only find the following :—

1. Colias edusa ♂ × helice ♀.—(α) Four ♀s laid between 850 and 900 eggs in August, 1900. Larvæ fed up quickly, and pupation took place in September. The imagines emerged in October, and totalled 302 ♂s and 235 ♀s = 537 of both sexes. Tabulated, these worked out as follows :—

Total specimens.. ♂s	302		.... 56·2%
typical.. ♀s	125	235........	23·3%
helice.. ♀s	110		20·5%
	537		100·0
Female results..typical	125		.... 53·2%
helice	110		.... 46·8%
	235		100·0

(Frohawk, *Entom.*, xxxiv., pp. 3-5.)

β. A ♀ *helice*, captured in the south of France by Chapman, laid freely in England, and a long series of imagines was bred by Main and Harrison, the percentage of the *edusa* and *helice* forms of the females working out as follows :—

Total specimens.. ♂s=	79		.... 53%	
type.. ♀s=	19	71........	13%	47%
var... ♀s=	52		34%	
	150		100	

Of the ♀ type=	19	.... 27%
variety=	52	.... 73%
	71	100

PLATE V.

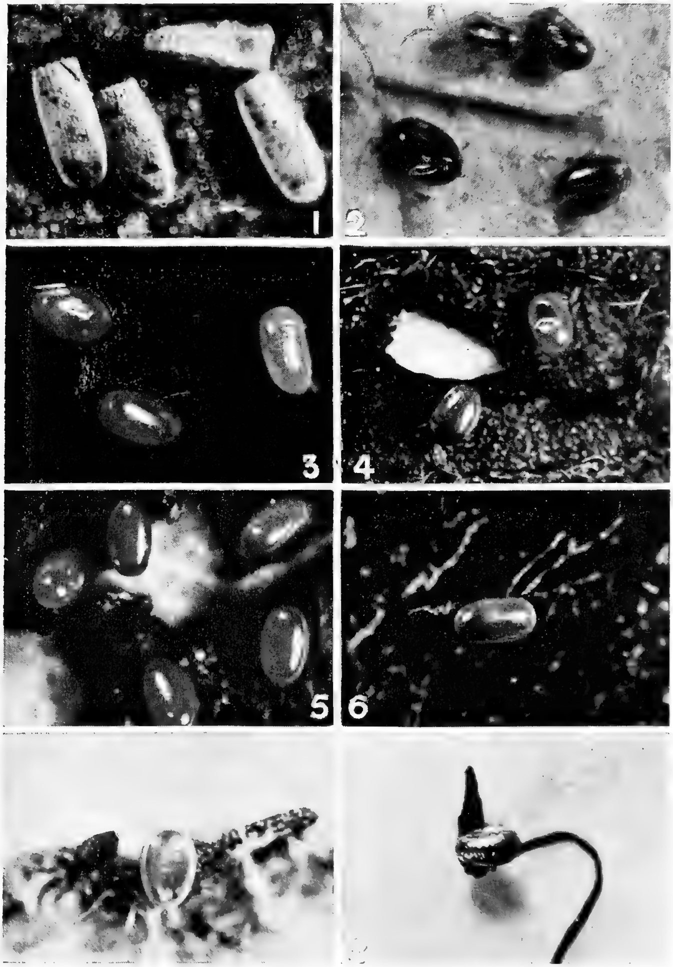

Photo A. E. Tonge.

EGGS OF AGDISTID AND PLATYPTILIID PLUMES × 20.

Natural History of the British Lepidoptera, 1906.

[For explanation see back.]

Plate V.

(To be bound facing p. 69.)

Eggs of Agdistid and Platyptiliid Plumes × 20.

Fig. 1.—*Adactylus bennetii, in situ* on leaf.

Fig. 3.—*Platyptilia gonodactyla, in situ* on leaf.

Fig. 5.—*Platyptilia isodactylus, in situ* on leaf.

Fig. 7.—*Marasmarcha lunaedactyla, in situ* on leaf.

Fig. 2.—*Marasmarcha tuttodactyla*, on paper.

Fig. 4.—*Capperia heterodactyla, in situ* on leaf.

Fig. 6.—*Oxyptilus parvidactyla, in situ* on hairs of *Hieracium*.

Fig. 8.—*Buckleria paludum, in situ* on hair of sundew.

THE SPHINGO-MICROPTERYGID STIRPS.

(*Continued from Vol. I., p. 546.*)

Superfamily IV*a*: ALUCITIDES.

Historical account of the Alucitides.

Linné, in 1758, first grouped (*Syst. Nat.*, xth ed., p. 296) the plumes under the name "*Alucitae*," which he diagnosed as: "Alis digitatis fissis ad basin," and, on p. 542, quite at the end of the lepidoptera, he describes *Alucita monodactyla*, *A. didactyla* (in *Lonicera xylosteo*),* *A. tridactyla*, *A. tetradactyla*, *A. pentadactyla* and *A. hexadactyla*. Several authors—Petiver, Ray, Frisch, Réaumur, Rösel, etc.—had previously figured various species, and references to these are to be found in the synonymy of the earliest writers who used the primitive form of so-called binomial nomenclature, *e.g.*, Réaumur figures and describes *monodactyla* (*Mémoires*, etc., i., p. 323, pl. xx., figs. 12-15), *pentadactyla* (p. 322, pl. xx., figs. 1-4), and *hexadactyla* (p. 324, pl. xix., figs. 19-21); Rösel figures (*Ins. Belust.*, i., phal. 4, t. 5)—*pentadactyla*, etc. In the *Fauna Suecica*, 2nd ed., p. 370, Linné, without further diagnosis of the group, mentions as Swedish species—*Alucita monodactyla*, *A. didactyla* (in *Geo rivali*),* *A. tesseradactyla*, *A. tetradactyla*, *A. pterodactyla*, *A. pentadactyla* and *A. hexadactyla*, whilst, in 1767, in the *Systema Naturae*, xiith ed., p. 899, he mentions *A. monodactyla*, *A. didactyla*, *A. tridactyla*, *A. tesseradactyla*, *A. tetradactyla*, *A. pterodactyla*, *A. pentadactyla* and *A. hexadactyla*. Linné would appear from this to exclude *A. tridactyla* as a Swedish insect, although, strangely, he gives the exact diagnosis of *tridactyla* from the *Systema Naturae*, xth ed., p. 542, for his *tetradactyla* of the *Fauna Suecica*, 2nd ed., pp. 370-371. In 1761, Poda uses (*Ins. Mus. Graecensis*, p. 94) the Linnean generic name *Alucita* for *pentadactyla*, in his list of the species in the Gratz museum. In 1762, Geoffroy, for no apparent reason whatever, and in full knowledge of Linné having named the group "*Alucitae*" (as shown by his references), renamed (*Hist. des Insectes*, ii., p. 90) the plumes, "*Pterophorus*," figuring (pl. xi., fig. 6) *pentadactyla* as "Le pterophore" and diagnosing *Pterophorus* as:

Antennæ filiformes. Lingua spiralis, alæ ramosæ, ramis pilosis. Chrysalis nuda, horizontalis.

He describes three species (without technical names), *viz.*, *pentadactyla* (with reference to Réaumur, *Mémoires*, i., pl. xx., figs. 1-2), *monodactyla* (with reference to pl. xx., figs. 12-15), and *hexadactyla* (with reference to pl. xix., figs. 19-21). In 1763, Scopoli (*Ent. Carn.*, p. 256) also dealt with the group, referring to Linné's species, and using the latter's name "*Alucitae*" for it. He maintained, however, *Phalaena* in a generic sense, and described *Phalaena didactyla*, *P. bipunctidactyla*, *P. pterodactyla*, *P. tridactyla* and *P. hexadactyla*. In 1764, Müller gives (*Faun. Ins. Fridrichsdalina*, p. 59) descriptions of seven plumes, under the name *Alucitae* [although, strangely enough, he diagnoses the group (p. xix) under the name *Pterophorus*], *viz.*, *Alucita monodactyla*, *A. didactyla*, *A. pterodactyla*, *A. tesseradactyla*, *A. tetra-*

* This error as to foodplant was corrected in the *Fauna Suecica*, 2nd ed., p. 370, where "Lonicera xylosteo" is changed to "Geo rivali."

dactyla, *A. pentadactyla* and *A. heterodactyla*, whilst, in 1771, De Geer describes and figures (*Mém. Hist. Insectes*, ii., p. 260) *Alucita didactyla*, L., and *A. pterodactyla*, L., which were renamed by Retzius (*Gen. et Spec. Insect.*, p. 35), in 1783, *albofasciatus* and *fuscus* respectively. In 1772, Bechmann gives (*Linn. Syst. Nat. in Epit.*, p. 168) under *Phalaena Alucita*—*didactyla*, *pentadactyla* and *hexadactyla*. In 1775, Fabricius followed (*Syst. Ent.*, pp. 671-672) Geoffroy, in the use of *Pterophorus*, and unaccountably refers some twenty species of Tineina (*sens. lat.*) to *Alucita*. He diagnoses *Pterophorus* as :

Palpi lineares. Lingua exserta, membranacea. Antennæ setaceæ –*Pterophorus monodactylus*, *P. didactylus*, *P. tridactylus*, *P. tesseradactylus*, *P. pterodactylus*, *P. pentadactylus* and *P. hexadactylus*.

In 1775, Schiffermüller and Denis published the *Schmett. Wien.* (republished in 1776 as the *Systematisches Verzeichniss*), and enumerated (pp. 144-146) under the name *Alucitae*, the following species :—*Alucita ochrodactyla* (Blass röthlichgelbes Geistchen), *A. didactyla*, L., *A. trichodactyla* (Braunes weissgestrichtes Geistchen), *A. calodactyla* (Dunkelbraun, und oraniengelbgemischtes Geistchen), *A. rhododactyla* (Heckrosen Geistchen, larv. *Rosa canina*), *A. pterodactyla*, L. (Le Pterophore brun, Geoff., larv. *Convolvulo arvensi*, pl. i*a*, fig. 8; pl. i*b*, fig. 8), *A. leucodactyla* (larv. *Pulmonaria officinale*), *A. megadactyla* (Weisslichtes braunlichtgeflecktes Geistchen), *A. pentadactyla*, L., and *A. hexadactyla*, Linn. On p. 320, these authors further add *A. chrysodactyla* (Braunes Geistchen mit goldglänzen den Querstrichchen), *A. mictodactyla* (Flachsblüthfarben, bleichroth und braungemischtes Geistchen), *A. gonodactyla* (Bräunlichtweisses Geistchen mit einem düstern Dreyeckfleckchen), *A. galactodactyla* (Milchrahmfarbenes Geistchen mit einem düstern Puncte). In 1776, Sulzer described and figured (*Geschichte der Insecten*, p. 163) three species—*Alucita diptera* (=*gonodactyla*), *A. tetradactyla* (=*monodactyla*), *A. paradoxa* (evidently not a plume), whilst, in 1777, Scopoli gives (*Introductio Hist. Nat.*, p. 428) the following generic diagnosis :—

Alæ saltem posticæ laciniatæ. Pedes longi—*Alucita*, Schiffermüller.

Although Scopoli cites no types, he evidently restricts the genus to the long-legged plumes, *i.e.*, to the superfamily we are here treating, and excludes the Orneodids. In 1779, Leske gives (*Anfangsgr. Naturg.*, p. 464) only *pentadactyla* to illustrate his *Phalaena Alucita*; in the same year Blumenbach notes (*Handb. Nat.*, p. 372) *hexadactyla* as typical of *Alucita*. In 1781, Barbut makes (*Genera Insect. Linn.*, etc.) *pentadactyla*, Linn., the type of *Alucita*, whilst, in the same year, Göze collected (*Ent. Beit.*, iii., pt. 4, pp. 171 *et seq.*) the various species already described, with their synonymy, but he appears to use no discrimination in the references attached to the same name. He dealt with 22 names as species. In 1785, Geoffroy, in *Fourcroy's Ent. Paris.*, ii., p. 256, named the species he described in 1762 (*Hist. des Insectes*, ii., p. 90) *pentadactyla* and *didactyla* (=*monodactyla*). In 1787, Fabricius followed (*Mantissa*, pp. 258-259) his species-grouping of 1775 for *Alucita* and *Pterophorus* (see *suprà*) but included the following species in the latter genus, *viz.*, *Pterophorus monodactylus*, *P. ochrodactylus*, *P. didactylus*, *P. calodactylus*, *P. tridactylus*, *P. rhododactylus*, *P. tesseradactylus*, *P. pterodactylus*, *P. migadactylus*, *P. pentadactylus* and *P. hexadactylus*. We know that, between 1776 and 1787, Fabricius had been to Vienna and seen the insects in Schiffermüller's collection. Among others that he notes as having seen are—*ochrodactyla*, *didactyla*, *calodactyla*, *rhododactyla*, *leucodactyla* (which he refers with doubt to his *tesseradactyla*), *pterodactyla*, *megadactyla* (which name he writes *migadactylus*), and *hexadactyla*. Some of his own descriptions under these names disagree so absolutely with Schiffermüller's diagnoses, that one suspects either (1) that Fabricius had no clear idea of the Alucitid species, and mixed up several closely-allied ones together, or (2) that Schiffermüller himself had, by this time, specimens of different species under the same name. The excellence of one or two of Fabricius' disagreeing descriptions, *e.g.*, *calodactylus*, *ochrodactylus*, etc., favour the latter alternative. It is quite clear, for example, that Fabricius' short description of *ochrodactylus* has nothing to do with Schiffermüller's insect of this name, in spite of the Fabrician reference, and is nothing but the grey form of *monodactyla**; similarly, his diagnosis of *calodactylus* is that of the Amblyptiliid species known so long as *acanthodactyla*, Tr., whilst Schiffermüller's *calodactyla* was evidently a Platyptiliid, and is so figured by Hübner. The Fabrician descriptions, therefore, cannot be taken as satisfactorily determining the identity of certain of Schiffermüller's types.

In 1789, de Villers published his *Linnaea Entomologia Fauna Suecicae*, etc., and here deals (vol. ii., pp. 530-535) with the Linnean Alucitids—*A. monodactyla*, *A. didactyla*, *A. tridactyla*†, *A. tesseradactyla*, *A. pterodactyla*, *A. pentadactyla* and *A. hexadactyla*, giving critical notes on each, and the species referred to these names by different authors; he then adds diagnoses of *fuscodactyla*, de Geer, *bipunctidactyla*, Scop., and *heterodactyla*, Müll., whilst farther on (vol. iv., pp. 546-547) he adds *A. galactodactyla*, *A. rhododactyla*, *A. migadactyla* and *A. ochrodactyla*. In 1791, Schwarz (*Neu Raupenkal.*, i., pp. 146, 336) describes the life-history of *Phal. Alucita pentadactyla*. In 1794, Fabricius gave (*Ent. Syst.*, iii., pt. 2, pp. 345-349) another list of the known Alucitid species, which he now places at 12, *viz.*, *Pterophorus monodactylus*, L., *P. ochrodactylus*, W.V., *P. didactylus*, L., *P. calodactylus*, W.V., *P. leucodactylus* (now referred to as a South American species), *P. tridactylus*, L., *P. rhododactylus*, W.V., *P. tesseradactylus*, L. (=*leucodactyla*, W.V.), *P. pterodactylus*, L., *P. albodactylus*, *P. migadactylus* (*megadactyla*), W.V., and *P. pentadactylus*, L. The errors of determination made in 1787, and referred to (*suprà*) appear to be repeated, *e.g.*, *ochrodactylus*, Fab., does not =*ochrodactyla*, W.V.; *tesseradactylus*, L., is probably not correctly referred to *leucodactyla*, W.V., certainly the larva of *tesseradactyla*, as later determined, does not feed on *Pulmonaria officinalis*.

Latreille, in 1796, cites (*Prècis*, p. 148) no species, but gives the following generic diagnoses:

Orneodes (*Phalaena*, Linn., *Pterophorus*, Geoff., Fab., Oliv.): Antennules antérieures obsolètes; postérieures longues, recourbées, couvertes d'écailles, paroissant quelquefois bifides: second article long, le dernier presque aussi long,

* Charpentier found *ochrodactyla*, Hb., in Schiffermüller's collection under the name *ochrodactyla*, and we know that many of Hübner's figures were made from Schiffermüller's collection.

† De Villers already draws attention (p. 533) to the difficulty of determining what species Linné meant by *tetradactyla*; he quotes the Linnean description of the *Fauna Suecica* under this name, and shows that it belongs to the *tridactyla* of the *Systema Naturae*, xth ed., and there leaves it. His *pterodactyla* is evidently the whitish form of *monodactyla* not *pterodactyla*, L.=*fuscus*, Retzius.

nu. *Caractéres Habituels*: Aîles très-divisées, formant un éventail autour du corps; celui-ci court. Pattes fort épineuses.

PTEROPHORUS, Geoff., Fab., Oliv. (*Phalaena*, Linn.): Antennules antérieures obsolètes; postérieures courtes, recourbées, menues subulées, couvertes d'écailles, de trois articles, dont le premier plus grand, les autres presque égaux. *Caractères Habituels*: Corps étroit, alongé. Aîles très-écartées du corps, en forme de bras, étroites, divisée. Pattes très-épineuses.

This is the first distinct separation of the Orneodids from the Alucitids. In 1797 or 1798, Cuvier gives (*Tabl. Élémentaire*, etc., p. 603) *pentadactyla* as the type of *Alucita*, Linn. = *Pterophorus*, Fab. He writes:

Les Ptérophores (*Pterophorus*, Fab.), *Alucita*, Linn., sont de petites phalénes dont les aîles sont divisées en un certain nombre de digitations semblable à autant de plumes—*Ph. pentadactyla*.

In 1801, Lamarck cites (*Sys. Anim. sans Vert.*, p. 288) *pentadactyla* to *Pterophorus*, and in the same year, Illiger diagnosed (*Sys. Verz. der Wien.*, 2nd ed., pp. 126 *et seq.*) the superfamily as follows:

ALUCITÆ, Linn. (PTEROPHORUS, Fab.).—LARVA pedibus sedecim instructa, parva, segnis, lata, pilosa. METAMORPHOSIS ut Papilionum, tela nulla. PUPA plano alicui filorum duorum opum adhærente. IMAGO admodum tenuis ac gracilis, alis, saltem posticis, in plumulæ (dactylos) fissis, pedibus longissimis—*Alucita ochrodactyla*, *A. didactyla*, *A. chrysodactyla*, *A. trichodactyla*, *A. calodactyla*, *A. rhododactyla*, *A. mictodactyla*, *A. gonodactyla*, *A. pterodactyla*, *A. galactodactyla*, *A. leucodactyla*, *A. megadactyla*, *A. pentadactyla*, *A. hexadactyla*.

Illiger, wrongly we have no doubt, refers *ochrodactylus*, Fab., to that of the *Sys. Verz.*, 1st ed. (see *anteà*), he also further suggests that *didactyla*, Linn., *Syst. Nat.*, xiith ed., p. 899; *Fauna Suec.*, 2nd ed., p. 370, is not to be referred to *didactyla*, Linn., *Syst. Nat.*, xth ed., p. 542, but to *rhododactyla*, W.V., a conclusion that cannot be accepted. He further refers Linné's *pterodactyla* (*fuscus*) to the convolvulus-feeding *pterodactyla*, *Sys. Verz.*, but rightly points out that Fabricius is in error in referring Geoffroy's figures of *monodactyla* to the *didactyla* of Linné, and one suspects his *galactodactyla* to be another form of *monodactyla*. The foodplant of *leucodactyla* is again repeated as being *Pulmonaria officinalis*, and, if so, the species should be determined with certainty.

In 1802, Schrank gives (*Fauna Boica*, ii., 2, pp. 139-140) the following species in the genus *Alucita*—*A. trichodactyla*, W.V., 145, no. 3 = Schaeff., *Icon.*, 93. 7 (*i.e.*, presumably, *didactyla*, Linn.); *A. pterodactyla*, W.V., 297, tab. i., fig. 8 (*i.e.*, *monodactyla*, Linn.); *A. megadactyla*, W.V., 146, no. 8 (possibly *spilodactyla*, Curt., although *gonodactyla*, W.V., was later figured by Hübner as this species, and it was determined as *nemoralis*, H.-S., by Werneburg); *A. pentadactyla*, W.V., 146, no. 9 (*i.e.*, *pentadactyla*, Linn.). It was also, in 1802, that Latreille made (*Histoire Nat.*, iii., p. 418) the Alucitids, the 6th (and last) family of his classification. He noted them as follows:

PTEROPHORII.—Ailes divisées, étroites. Deux à quatre palpes. Une trompe. Antennes simple, sétacées. Corps long. Pattes longues, épineuses.

Genus: *Pterophorus*.—Palpes guère plus longs que la tête, également écailleux. Corps fort alongé. Ailes très-étroites—*Pterophorus didactylus*, F.

Genus: *Orneodes*.—Palpes fort longs; le second article garni de grandes écailles; le dernier long, presque nu. Ailes divisées en un grand nombre de pièces, formant l'éventail—*Pterophorus hexadactylus*.

It may be noted that Latreille, like Fabricius, erroneously uses *Alucita* for certain Tineid lepidoptera. In 1805, Latreille (*op. cit.*, xiv., pp. 257-258) rediagnosed the two genera into which he had divided the plumes, and illustrated them by the inclusion of a number of species as follows:

Pterophorus.—Palpes de la longueur de la tête, également fournis d'écailles: ailes alongées, étroites—*P. monodactylus*, *P. didactylus*, *P. pentadactylus*, *P. rhododactylus*, *P. albodactylus*.

Orneodes.—Palpes plus longs que la tête; second article plus grand, garni d'écailles; le dernier alongé, presque nu; ailes en éventail—*O. hexadactylus*.

This grouping Latreille maintained, in 1809 (*Gen. Crust. et Ins.*, iv., pp. 233-4). In 1806, Hübner (*Tentamen*, p. 2) gives us the following:

Phalanx IX: Alucitæ.
Tribus I: *Indubidatae*.
1. Pterophoræ—*Pterophora pentadactyla*
2. Ripidophoræ—*Ripidophora hexadactyla*

but this is only of importance from the fact that it must have been published long before most of the figures of his plumes in the *Eur. Schmett.*, *Alucitae*, pl. i.-vii., figs. 1-38. The exact dates of publication of these plates are doubtful, but were possibly as follows:

Plates 1-2—1804.—Referred to by Laspeyres in his review of Illiger's edition of the *Wiener Verzeichniss*, in 1805 (Illiger's *Magazin*, iv., pp. 16-68). Also referred to by Haworth, in 1811 (*Lepidoptera Britannica*, pp. 475 *et seq.*).

Plates 3-6—1811-1817.—Referred to by Charpentier, in 1818 (*Verzeichniss der europäischen Schmett.*, p. 92); also noted by Hübner himself in 1822 (*Syst.-alphabet. Verzeichniss*).

Plate 7—1823.—Not mentioned by Hübner in his *Syst.-alphabet. Verzeichniss*, in 1822, but was offered for sale December 22nd, 1823, in prospectus issued by Hübner on that date of the books he had for sale.

The contents of the plates are as follows:—Plate 1: *Alucita pentadactyla*, *A. galactodactyla*, *A. mictodactyla* (*bipunctidactyla*), *A. pterodactyla* (*monodactyla*), *A. leucodactyla*.* Plate 2: *Alucita megadactyla*† (*gonodactyla*), *A. calodactyla*‡ (*zetterstedtii*), *A. rhododactyla*, *A. trichodactyla*, *A. hexadactyla*. Plate 3: *Alucita ochrodactyla*, *A. phaeodactyla*, *A. ptilodactyla* (highly coloured *pterodactyla*=*fuscus*).

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* This is a very doubtful figure. Haworth refers it to one of the lemon- or sulphur-coloured species (*osteodactyla*). It is usually referred to *tetradactyla* and Hübner's own reference of the species (*Verz.*, p. 431) to *Aciptilia* suggests most strongly that it was meant for this species.

† The *megadactyla* of Hübner is no doubt the *gonodactyla* of Schiffermüller and not the latter's *megadactyla*, agreeing exactly with his description of the former and disagreeing just as completely with his description of the latter which is noted as "whitish" in colour. One suspects some mixing of species here, for, after the description of a white species from the collection, it is noted by Fabricius as having dark-spotted legs, which gives colour to Werneburg's conclusion that the insect might be *nemoralis*, H.-Sch. The supposition of mixing is further borne out by Charpentier, who, in 1821, states that Hübner's *megadactyla* corresponds with the *megadactyla* of the Vienna collection. Charpentier possibly makes a slip when he states that Schiffermüller's *gonodactyla* is only a worn example of the same author's *calodactyla* (*zetterstedtii*, Zell.) (an error that could easily occur at that time between such closely-allied species as *gonodactyla* and *zetterstedtii*).

‡ *Calodactyla* of Hübner is undoubtedly a Platyptiliid and agrees absolutely with Schiffermüller's diagnosis; whilst Charpentier noted (in 1821) that Hübner's figure agrees with the insect in the Vienna collection. On the other hand, *calodactyla*, Fab., is described as toothed on the inner margin, and is undoubtedly the species known as *acanthodactyla*, Tr., and Hübner draws both his *cosmodactyla* and *acanthodactyla* with such a tooth. A specimen of *zetterstedtii*, Zell., in the Frey collection is almost identical with Hübner's figure of *calodactyla*, to which species we have no hesitation in referring the Hübnerian figure. In the *Verzeichniss* also, Hübner places *calodactyla* and *petradactyla* with the untoothed Platyptiliids, whilst the toothed *cosmodactyla* and *acanthodactyla*, he places with the Oxyptilids under the group name *Amblyptiliae*.

Plate 4: *Alucita tephradactyla* (very yellow), *A. trichodactyla*, *A. carphodactyla*, *A. scarodactyla*. Plate 5: *Alucita acanthodactyla* (=*punctidactyla*, Haw.), *A. ptilodactyla* (*pterodactyla*=*fuscus*), *A. microdactyla*. Plate 6: *Alucita polydactyla*, *A. dodecadactyla*, *A. hexadactyla*. Plate 7: *Alucita adactyla*, *A. petradactyla* (=*zetterstedtii*), *A. cosmodactyla* (*acanthodactyla*, Tr.). It is to be noted that Hübner's *calodactyla* is placed with *megadactyla* (*gonodactyla*), *petradactyla*, *ochrodactyla* and *rhododactyla*, in the *Verzeichniss*, all, according to the figures, without the inner-marginal tooth, and true Platyptiliid species.

In 1805, Laspeyres (*Ill. Mag.*, iv., pp. 20 *et seq.*), reviewing Illiger's edition of the *Vienna Catalogue*, offers many criticisms, and refers to Hübner's plates i and ii. He observes that (1) The Fabrician *P. ochrodactylus* cannot be that of Schiffermüller as the diagnoses disagree. (2) The *didactyla* of Linné and Schiffermüller are most probably different. (3) The Hübnerian *megadactyla* (fig. 6) is apparently only a sexual variety of his *calodactyla* (fig. 7).* He further notes that the Hübnerian *megadactyla* is very different from the Fabrician *migadactylus*, the description of which would very well fit Hübner's *galactodactyla*† (fig. 2), but Laspeyres evidently overlooks the words "pedes albi, fusco maculati" in the Fabrician description, which do not fit *galactodactyla*, nor, as a matter of fact, any of the truly "white" European species, and renders Werneburg's reference to *nemoralis* just possible, though *nemoralis* is not a "white" species in any sense.

In 1811, Haworth described (*Lep. Brit.*, pp. 475 *et seq.*) the group under the name *Alucita*, as:

> Antennæ setaceæ. Palpi duo lineares. Lingua exserta membranacea. Corpus pedesque gracilissimè elongati, alis sedentis, expansis; anticis bifidis, rarissime 5-6 partitis: posticis 3-6 partitis, laciniis plumæformibus: volatu tardiore, vespereque—*Alucita pentadactyla*, *galactodactyla*, *pterodactyla*, *fuscodactyla*, *bipunctidactyla*, *monodactyla*, *tetradactyla*, *tridactyla*, *leucadactyla*, *lunaedactyla*, *pallidactyla*, *migadactyla*, *trigonodactyla*, *rhododactyla*, *calodactyla*, *punctidactyla*, *tesseradactyla*, *didactyla*, *heterodactyla*, *parvidactyla*, *hexadactyla*.

We have already noted that Haworth refers to plates i and ii of Hübner's *Sammlung Europäischer Schmett.*, and that his other references suggest that he knew Hübner's plates well; there is little doubt that Hübner's plates iii-vi were published after 1811 and before 1818, possibly in 1816-1817, a most important matter with regard to the synonymy of some of Haworth's species.

In 1815, Oken divides (*Lehrb. Zool.*, i., p. 679) the plumes into two genera:

> 1. ALUCITA (*Pterophorus*)—*pentadactyla* (described), *monodactyla*, *didactyla*, *trichodactyla*, *pterodactyla*, *megadactyla*.
> 2. ORNEODES—*hexadactyla*.

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* All the early authors seem to have recognised that *calodactyla*, Hb.=*calodactyla*, W.V., is a Platyptiliid, and closely allied to *gonodactyla*, W.V.=*megadactyla*, Hb.

† Long before seeing this criticism of Laspeyres, we had already referred it to *spilodactyla*, Curt., a species the latter did not know. Fabricius' additional remark about the legs, possibly obtained from another insect (none of the white species having fuscous-spotted legs), is equally inapplicable to *spilodactyla*, Curt., and *galactodactyla*, W.V., Hb.; besides Schiffermüller was not likely to describe *galactodactyla* twice, first as *megadactyla* and then as *galactodactyla*.

In the same year, Leach gives (*Edinburgh Encyclopaedia*, ix., p. 135) the following grouping:

Tribe VII: ALUCITIDES (*Pterophorites*, Latreille): Wings divided, or formed of feathers united at their base.

Genus ccccLxxiii: *Pterophorus*, Geoffroy, Latreille, Fabricius. *Alucita*, Hübner, Schrank, Scopoli.—Sp. 1. *Pentadactylus.** 2. *Didactylus*, etc.

Genus ccccLxxiv: *Alucita*, Hübner, Scopoli. *Pterophorus*, Geoffroy, Fabricius. *Phalaena* (*Alucita*), Linné, Villers. *Orneodes*, Latreille.—Sp. 1. *Hexadactyla*, Latr., Fab., Linn., Hb.

Samouelle, in 1819, published (*Entom. Useful Compendium*, pp. 255-256) the slightest possible modification of Leach's classification, as follows:

Fam. XI: ALUCITIDÆ, Leach (PTEROPHORITES, Latr.).—Wings divided, or formed of feathers united at their base.

Genus: *Pterophorus*, Geoff., Latr., Fabr., Leach. *Alucita*, Hübner, Schrank, Scopoli. *Phalaena-Alucita*, Linné.—Palpi small, from their base ascending, not longer than the head, shortly and nearly equally squamose; anterior wings composed of two, posterior of three, feathers. Pupa naked, suspended by a hair—*Pterophorus pentadactylus.*

Genus: *Alucita*, Hübner, Scopoli, Leach. *Pterophorus*, Geoff., Fabr. *Phalaena-Alucita*, Linn., Villers. *Orneodes*, Latr.—Palpi produced much longer than the head; the second joint very squamose; the last joint naked, erect. Pupa folliculate—*Alucita hexadactyla.*

Zincken, in his article "Alucita" in *Ersch and Gruber's Allgemeine Encyclopädie*, iii., p. 274 (1819), cites only *pentadactyla*, Linn. = *tridactyla*, Scop., as an example of the genus. In 1821, Oken alters (*Nat. Schulen*, ii., p. 177) the genus *Alucita* to *Pterophorus*, without assigning any reason for the change, and cites *pentadactylus* to the genus. In the same year, Charpentier compared the plumes in the Vienna collection with the descriptions in the *Syst. Verzeichniss* of Schiffermüller, and a series of footnotes has been made by Zincken as to his determinations. He states (*Die Zünsler, Wickler*, etc., pp. 174 *et seq.*) that the *calodactyla*, *rhododactyla*, *pterodactyla*, *leucodactyla*¶, *megadactyla*†, *ochrodactyla*, *mictodactyla*, *galactodactyla*‡, and *hexadactyla* in the Schiffermüllerian collection are quite accurately figured under these names, by Hübner, and may be considered as determining the *Syst. Verz.* species bearing these names, except in the case of *megadactyla* which disagrees with Schiffermüller's original description, supported largely by that made from it by Fabricius. He further notes that *pentadactyla* was absent from the collection, that *didactyla*§ (*S.V.*, p. 145, no. 2) perfectly agreed with *chrysodactyla* (*S.V.*,

* This is cited in the index margin, and therefore = Leach's type.

¶ *A. leucodactyla* is the *tetradactyla* of Linné, and must fall before the older name (Zincken). This is our opinion, the foodplant being wrongly cited as *Pulmonaria officinalis*.

† *A. megadactyla*, S.V., is the *tesseradactyla* of Linné, and when he says the hindwings are divided into 4 plumules, it is an oversight of the same nature as that which led him to say the hindwings were divided into 5 plumules (Zincken). Zincken is wrong—(1) Linné does not say this except by etymological implication. (2) Linné's *tesseradactyla* appears to be quite distinct from *megadactyla* (= *gonodactyla*). It is interesting however, as being the first occasion on which *tesseradactyla*, Linn., is referred by any author to a known species.

‡ The larva of *A. galactodactyla* feeds on *Arctium lappa* (Zincken).

§ Hübner's *trichodactyla* = Linné's *didactyla*, therefore *trichodactyla*, *chrysodactyla* and *didactyla* of Schiffermüller = *didactyla*, Linné, and must fall as synonyms thereof, so also must Illiger's reference (*Syst. Verz.*, 2nd ed.) of *didactyla*, Linn., under *rhododactyla*, which is a distinct species (Zincken). The close alliance of the Oxyptilids in the imaginal stage suggests caution in accepting this statement in its entirety.

p. 320, no. 11), that *trichodactyla* (*S.V.*, p. 145, no. 3) also appeared to agree with *chrysodactyla* (*S.V.*, p. 320, no. 11), and that this species is figured by Hübner (pl. ii., fig. 9 ; pl. iv., fig. 18) as *trichodactyla*. He further states that *gonodactyla* (*S.V.*, p. 320, no. 13) is a worn example of *calodactyla*, another point that illustrates the close alliance of the two. He also notes that he found a specimen from Silesia, in the cabinet, labelled by Schiffermüller "*odontodactyla*," and that this agreed with Hübner's *acanthodactyla** (figs. 23 and 24). [Zincken's footnotes here quoted were evidently made without a personal inspection of Schiffermüller's specimens and must be considered accordingly.]

This is one of the most important and difficult of the papers that come within our purview. Fabricius and Hübner, before Charpentier, are both credited with having had access to the Schiffermüllerian collection and to have described and figured species therefrom. The short crisp diagnoses of Schiffermüller, in the *Syst. Verzeichniss*, are marvels in their way, and leave an expert with a very definite idea, in most cases, of what the author meant. Fabricius, the first author who is credited with having examined the specimens, might, so far as some of his descriptions tally with the original diagnoses, as well have performed the operation with his eyes shut, and, in spite of the excellence of some of them, one is forced to conclude either (1) that other of Fabricius' examinations were of the most cursory nature, and hence purposeless, (2) that he really mixed up allied species which he had no capacity to distinguish, or (3) that the species were already mixed before he saw them, and his descriptions of *migadactylus* and *ochrodactylus* bear out this latter view. The marvellous unanimity that prevails between the Schiffermüllerian diagnoses, the Hübnerian figures, and the Charpenterian notes, suggests that, in almost every case, the insects bearing the Schiffermüllerian names are actually figured by Hübner under the same name. The only doubtful insect is, as pointed out above, *megadactyla*, S.V. Schiffermüller's description and position suggest *spilodactyla*, Curt., the Fabrician description made therefrom also corroborates this view, except for a detail in the description, *viz.*, "pedes albo, fusco maculati," which alone would make this determination impossible. Laspeyres considers the description applies to *galactodactyla*, Hb., W.V., a species Schiffermüller and Fabricius both, however, described. Hübner figures as *megadactyla* the dark grey form of *gonodactyla*, and Charpentier says that this tallied with the Schiffermüllerian specimen he saw, and this species has legs as described by Fabricius, but is not white as described by him nor does it agree at all satisfactorily with Schiffermüller's diagnosis. Werneburg opines that it is *nemoralis*, a just possible solution, as the species wears "white," and *gonodactyla* might easily be confused with it, but the Fabrician description does not otherwise agree. At any rate, it is quite clear that when Hübner figured *megadactyla* he had *gonodactyla* before him, that at the time of Charpentier's examination such a specimen bore this name in the Schiffermüllerian collection, that this specimen was not the one described by Schiffermüller, nor that described by Fabricius under this name. We still believe that the original *migadactyla*, Schiff., was *spilodactyla*, Curt., and that this specimen was

* The original specimens from which Hübner's figs. 23 and 24 were made are in my collection (Zincken).

described by Fabricius, the addition of a worn Platyptiliid (? *nemoralis*) to the series in Schiffermüller's collection accounting for the " pedes albo, fusco maculati," in his otherwise good description, and the removal of the original specimen (as also that of *pentadactyla*), and the addition of Platyptilias in good condition, some years afterwards, accounting for Hübner's figure and Charpentier's remark of satisfaction thereon.

We now come to the most important paper written on the classification of the plumes to date. Hübner, in 1825, offers (*Verzeichniss*, pp. 428 *et seq.*) the following detailed grouping of the Alucitids :—

Phalanx IX. ALUCITÆ.—Recognisable by their feather-like wings, long legs, and slender abdomen.

Tribus I. INTEGRÆ.—The wings entire, moderately broad and long, the legs delicate, the abdomen long.

Stirps I. PANPTEROTES.—The wings lance-shaped, scarcely obtuse.

Fam. A. OBNUBILÆ.—The wings shaded with grey.

Coitus 1. AGDISTES.—The wings marked with united dark spots—*Agdistis adactyla*, Hb., *Alu.*, 32-34.

Tribus II. TRIFIDÆ.—The forewings once, and the hindwings twice, cleft.

Stirps I. PTEROPHORÆ.—The wings feather-like, the forewings more variegated than the hindwings.

Fam. A. OBTUSÆ.—The forewings rather broad at the apex, almost beak-like, hindwings not uniform.

Coitus 1. PLATYPTILIÆ.—The forewings posteriorly broad and obtuse—*Platyptilia calodactyla* et *megadactyla*, Schiff., *Verz.*, Alu. A, 4, 8 ; Hübn., *Alu.*, 7, 6. *P. petradactyla*, Hübn., *Alu.*, 37, 38. *P. ochrodactyla*, Hübn., *Alu.*, 12, 13. *P. rhododactyla*, Schiff., *Verz.*, Alu. A, 5 ; Hübn., *Alu.*, 8.

Coitus 2. AMBLYPTILIÆ. — The forewings almost gaily chequered and brightly marked—*Amplyptilia* acanthodactyla*, Hübn., *Alu.*, 23, 24. *A. cosmodactyla*, Hübn., *Alu.*, 35, 36. *A. trichodactyla, didactyla* et *chrysodactyla*, Schiff., *Verz.*, Alu. A, 3, 2, 11 ; Hübn., *Alu.*, 9, 18. *A. phaeodactyla*, Hübn., *Alu.*, 14, 15.

Fam. B. CUSPIDES.—The forewings almost curved and pointed, cleft nearly half-way.

Coitus 1. STENOPTILIÆ.—The forewings narrow, speckled with scattered black spots — *Stenoptilia mictodactyla*, Schiff., *Verz.*, Alu. A, 3 ; Hübn., *Alu.*, 3. *S. ptilodactyla*, Hübn., *Alu.*, 16, 25. *S. pterodactyla*, Linn., *Syst.*, Phal., 458 ; Hübn., *Alu.*, 4. *S. scarodactyla*, Hübn., *Alu.*, 21, 22. *S. tephradactyla*, Hübn., *Alu.*, 17. *S. carphodactyla*, Hübn., *Alu.*, 19, 20. *S. microdactyla*, Schiff., *Verz.*, Alu. A, 12 ; Hübn., *Alu.*, 26, 27.

Coitus 2. ACIPTILIÆ.—The plumes at the tip somewhat pointed, almost without markings — *Aciptilia galactodactyla*, Schiff., *Verz.*, Alu. 14 ; Hübn., *Tin.*, 2. *A. pentadactyla*, Linn., *Syst.*, Phal., 459 ; Hübn., *Alu.*, 1. *A. theiodactyla* (*leucodactyla*), Hübn., *Alu.*, 5.

Tribus III. MULTIFIDÆ.—Both fore- and hindwings divided into six plumules.

Stirps I. RHIPIDOPHORÆ.—All the wings fanshaped, each six-plumed.

Fam. A. VARIEGATÆ.—The wings with partly chequered plumes, and marked with terminal spots.

Coitus 1. EUCHIRADIÆ. — The plumules banded with brownish-grey and blackish-brown, the terminal spots

* This by a *lapsus calami* is spelt *Amplyptilia*.

black—*Euchiradia hexadactyla*, Linn., *Syst.*, Phal., 460; Hübn., *Alu.*, 10, 11 *et* 30, 31. *E. dodecadactyla*, Hübn., *Alu.*, 29. *E. polydactyla*, Hübn., *Alu.*, 28.

In 1827, Curtis gave (*Brit. Ent.*, fo. 161) a short classification of the British plumes (adding five species to Haworth's list) under the group name *Pterophorus*, which he divides into Sections A and B. His summary is as follows:

A. Abdominal ray not lobed—*tetradactylus*, *ochrodactylus*, *pentadactylus*, *galactodactylus* (*albodactylus*), *spilodactylus*, *tridactylus*, *citridactylus*, *leucodactylus*, *pterodactylus*, *monodactylus*, *tephradactylus*, *bipunctidactylus*, *fuscodactylus*, *migadactylus*, *phaeodactylus*, *lunaedactylus*.

B. Abdominal ray producing a bundle of scales forming a lobe on the internal margin—*didactylus* (= *heterodactylus*), *rhododactylus*, *trigonodactylus*, *calodactylus*, *tesseradactylus*, *punctidactylus*, *microdactylus* (= *parvidactylus*).

The type of *Pterophorus*, he cites as *pentadactyla*, Linn. Later, in 1833 (*op. cit.*, fo. 471), he diagnoses the genus *Adactylus*, describing it in full from the characters offered by *bennetii*, but citing as type *Alucita adactyla*, Hb., whilst in fo. 695 *hexadactyla* is cited as the type of *Alucita*.

In 1833, Treitschke gives (*Die Schmett.*, etc., ix., pt. 2, pp. 225 *et seq.*) another out-of-date grouping, in the face of Hübner's well-known work. He places all the plumes in *Alucita*, which he divides* into four families as follows:

Fam. A.—The imago with entire undivided wings—*adactyla*, Hb.

Fam. B.—The imagines with broad forewings, cut out sickle-like on the hind margin, with one short cleft, the lobes drawn close together; the hindwings consisting of three plumules—*ochrodactyla*, Hb., *rhododactyla*, Fab., *tesseradactyla*, Linn., *calodactyla*, Hb., *graphodactyla*, Tr., *acanthodactyla*, Hb., *cosmodactyla*, Hb.

Fam. C.—With narrow, more deeply cleft forewings, club-like towards the hind-margin; the hindwings divided into three plumules—*didactyla*, Linn., *brachydactyla*, Koll., *phaeodactyla*, Hb., *mictodactyla*, Hb., *pterodactyla*, Hb., *ptilodactyla*, Hb., *lithodactyla*, Tr., *septodactyla*, Tr., *tephradactyla*, Hb., *icarodactyla*, Tr. (*scarodactyla*, Hb.), *microdactyla*, Tr.

Fam. D.—Wings deeply cleft, the forewings into two, the hindwings into three, plumules—*pentadactyla*, Linn., *galactodactyla*, Hb., *xanthodactyla*, Tr., *tetradactyla*, Linn.

In 1834, Stephens made an attempt to apply Hübner's classification to the British plumes, and grouped (*Illus. Brit. Ent. Haust.*, iv., pp 370 *et seq.*) them as follows:

1. Undivided wings, short truncate palpi, minute spurs to hinder tibiæ—*Agdistis* (*bennetii*).

2. Anterior wings divided into two or three feathers, the posterior into three—*Pterophorus*.

   A. Posterior wings without an appendage on the inner margin.

      a. Anterior wings broad, deeply cleft, pale—*Aciptilia pentadactylus*, *spilodactylus*, *galactodactylus*.

      b. Anterior wings narrow, deeply cleft and acute, generally without any distinct markings—*Stenoptilia bipunctidactylus*, *fuscodactylus* (*pterodactylus*), *monodactylus*, *tephradactylus*, *tridactylus*, *niveidactylus*, *tetradactylus*, *carpodactylus*, *ochrodactylus*, *leucodactylus*, *lunaedactylus*, *pallidactylus*, *migadactylus*, *similidactylus*.

   B. Posterior wings with an appendage on the inner margin.

      a. Anterior wings broad and acute—*Platyptilia trigonodactylus*, *rhododactylus*, *calodactylus*.

* Like Linné, Barbut and the other early authors, Treitschke uses the term "genus" in a "superfamily" sense, dividing the genus into "families," etc. so also did Zeller (see *posteà*).

b. Anterior wings narrow, falcate and varied—*Amblyptilia tessaradactylus*, *punctidactylus*, *cosmodactylus*, *didactylus*, *heterodactylus*, *microdactylus* (=*parvidactylus*).

Stephens, however, in his Appendix to this volume, applies, in detail, the Hübnerian classification to the British species, in order to illustrate (p. 403) the propriety of establishing a larger number of genera, and then gives (p. 424) the following list:

Phal. IX. ALUCITÆ.
Tribus 1. INTEGRÆ.
Stirps i. PANPTEROTES.
Fam. A. OBNUBILÆ.
Agdistes
bennetii
TRIBUS 2. TRIFIDÆ.
Stirps i. PTEROPHORÆ.
Fam. A. OBTUSÆ.
Platyptilia
calodactyla
tetradactyla
rhododactyla
Amblyptilia
acanthodactyla
cosmodactyla
trichodactyla
phæodactyla
Fam. B. CUSPIDES
Stenoptilia
ptilodactyla
pterodactyla
tephrodactyla
carphodactyla
Aciptilia
galactodactyla
pentadactyla
theirodactyla

In 1838, Duponchel fell as far behind as ever, diagnosing (*Hist. Nat.*, xi., pp. 631 *et seq.*) the group under the name *Pterophorites*, which he divided into two genera—(1) PTEROPHORUS—*P. pentadactylus*. (2) ORNEODES—*O. hexadactylus*—remarking that these differed entirely in their manner of life and transformations. He then divides his genus *Pterophorus* (*i.e.*, the whole superfamily *Alucitides*) into the following groups:

1. Les quatre ailes entières ou non divisées—*adactyla*.

2. Ailes antérieures larges, falciformis, brièvement, fendues en deux et recouvrant les ailes postérieures au repos. Celles-ci divisées en trois parties qui ressemblent plus ou moins à des plumes—*ochrodactylus*, *calodactylus*, *cosmodactylus*, *rhododactylus*, *tesseradactylus*, *graphodactylus*, *acanthodactylus*, *pterodactylus*.

3. Ailes antérieures étroites, plus profondément bifides que les précedentes, courbées en crosse, et ne recouvrant pas les postérieures au repos; les trois divisions de celles-ci en forme de plumes—*didactylus*, *brachydactylus*, *phaeodactylus*, *mictodactylus*, *pterodactylus*, *ptilodactylus*, *lithodactylus*, *septodactylus*, *tephradactylus*, *icarodactylus*, *microdactylus*, *carphodactylus*, *aetodactylus*, *lithoxylodactylus*, *zophodactylus*.

4. Ailes antérieures composées de deux plumes et les postérieures de trois; tout les cinq bien distinctes au repos—*pentadactylus*, *galactodactylus*, *spilodactylus*, *xanthodactylus*, *tetradactylus*, *ischnodactylus*.

He observes that three species—*amaurodactylus*, *capnodactylus*, and *miantodactylus*—mentioned by Fischer von Roeslerstamm are unplaced, because unknown to him.

In 1840, Westwood, apparently ignorant of the work of his immediate predecessors, gives (*Introd. Mod. Class. Insects*, ii., p. 115) the following grouping, under the name *Alucitidae*, Leach (*Pterophorites*, Latreille):

AGDISTES, Hb. (*Adactylus*, Curt.).—Wings entire—*A. bennettii*, Curt.

PTEROPHORUS, Geoff. (*Alucita*, Schr.).—Anterior wings 2-, posterior 3-lobed—*P. A. pentadactyla*, Linn. 27 sp.

ALUCITA, Scop. (*Orneodes*, Latr.).—All the wings 6-lobed—*P. A. hexadactyla*, L., 3 sp.

In 1841, Zeller gave (*Isis*, 1841, pp. 875-888) what appears to be an excellent review of the literature of the subject to date, preceded (*op. cit.*, pp. 756 *et seq.*) by a detailed classification of the superfamily under the name *Pterophoridae*. His grouping worked out as follows:

PTEROPHORIDÆ, Zell. (*Pterophorites*, Latr., *Alucitidae*, Leach, Stphs., Westd. *Pterophorus*, Geoffr., Fabr. *Phalènes-tipules*, Degeer. *Phalaena-Alucita*, Linn., *Syst. Vindob.*)—Alæ anteriores fissæ vel partitæ vel integræ fissura indicata.

I. PTEROPHORIDÆ PROPRII.*—Alæ anteriores bifidæ vel integræ fissura indicata.

Genus 1: ADACTYLA, Zell. (*Agdistis*, Hüb., "Cat." *Alucita* Fam. A., Tr.).—Alæ lanceolatæ integræ anteriorum fissura indicata.

Genus 2: PTEROPHORUS, Geoffr., Fabr., Stphs. (*Phalaenae-Alucitae*, Linn. *Alucita*, Schrk., Tr.).—Alæ anteriores bifidæ, posteriores subtripartitæ.

Group 1: PLATYPTILUS, Zell. (*Platyptilia*, Hb., "Cat.").
Sect. *a.*—*P. rhododactylus*, S.V.
Sect. *b.*—*P. capnodactylus*, F. v. R. *in litt.*
Sect. *c.*—*P. ochrodactylus*, Hb.
Sect. *d.*—*P. zetterstedtii*, Zell. [with var. *gonodactyla*, S.V. (=*tesseradactyla*, Tr., *megadactyla*, Hb.), and var. *nemoralis*, Zell. (=*macrodactyla*, Fehr, *in litt.*). Not. 1. *Phal. tesseradactyla*, Linn. Not. 2. *Alucita petradactyla*, Hb.], *fischeri*, Zell. (*hemidactyla*, Mus. Schiff.), *metzneri*, Zell.
Sect. *e.*—*P. acanthodactylus*, Hb., Tr., *cosmodactyla*, Tr. [with var. *cosmodactyla*, Hb. et var. *spilodactyla*, Kaden.). Not. 1. *Aluc. ulodactyla*, Zett.].

Group 2: OXYPTILUS, Zell. (*Amblyptilia*, Hb.).—*O. tristis*, Zell., *pilosellae*, Zell., *obscurus*, Zell., *hieracii*, Zell. [Not. 1. *Phal. Alu. didactyla*, Linn. Not. 2. *Pteroph. leucodactylus*, F.], *trichodactylus*, Hb.

Group 3: PTEROPHORUS, Zell. (*Stenoptilia*, Hb.).
Sect. *a.*—*P. ehrenbergianus*, Zell., *phaeodactylus*, Hb.
Sect. *b.*—*P. miantodactylus*, F. v. R., *in litt.*
Sect. *c.*—*P. mictodactylus*, S.V., Hb., *graphodactylus*, Tr., *fuscus*, Retz. (*ptilodactyla*, Hb., Tr.).
Sect. *d.*—*P. lithodactylus*, Tr., *septodactyla*, Tr.
Sect. *e.*—*P. pterodactylus*, Linn. (*fuscus*, Geoffr.).
Sect. *f.*—*P. scarodactylus*, Hb. (*icarodactyla*, Tr.), *tephradactylus*, Hb., *osteodactylus*, Zell. (*microdactyla*, Zett.), *carphodactylus*, Hb., Tr., *microdactylus*, Hb., Tr.
Sect. *g.*—*P. brachydactylus*, Koll., Tr.

Group 4: ACIPTILUS, Zell. (*Aciptilia*, Hb.).
Sect. *a.*—*A. galactodactylus*, Hb., Tr. [Not. *Pter. albodactylus*, Fab.].
Sect. *b.*—*A. xanthodactylus*, Tr.
Sect. *c.*—*A. obsoletus*, Zell.
Sect. *d.*—*A. xerodactylus*, Metz., *in litt.*, *baliodactylus*, F. v. R., *in litt.*, *tetradactylus*, Linn. (*Aluc. leucodactyla* et *Acipt. theiodactyla*, Hb., *Phal. didactyla*, Scop.).
Sect. *e.*—*A. ischnodactylus*, Tr.
Sect. *f.*—*A. pentadactylus*, Linn., Hb., Tr.
Sect. *g.*—*A. paludum*, Zell.

II. ALUCITINA.—Alæ singulæ sexpartitæ.

Genus 1: ALUCITA, Linn., S.V., Hb., Stphs. (*Pterophorus* parte, Geoff., Fab. *Orneodes*, Latr., Tr. *Euchiradia*, Hb.).—*A. grammodactyla*, Zell. (*hexadactyla*, Hb., figs. 10, 11 ?), *hexadactyla*, Linn., Hb., Tr., *polydactyla*, Hb., Tr., *dodecadactyla*, Hb., Tr. [Not. *Aluc. poecilodactyla*, Stphs.].

In 1845†, Duponchel maintained (*Cat. Méth.*, pp. 380 *et seq.*) the old grouping. He subdivides his *Pterophorites* into (1) *Pterophorides*, (2) *Orneodides*. In the first section only two genera are given:

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* In spite of this comprehensive subdivision Zeller describes all the species of this group in detail under the two generic names—*Adactyla* (*hübneri*) and *Pterophorus* (all the other species).

† Wrongly dated 1844, published 1845.—L. B. PROUT.

1. Adactyla, Zell.—Les quatre ailes entières—*A. huebneri*, Curt. (*adactyla*, Tr.).

2. *Pterophorus*, Geoff.—Ailes supérieures divisées en deux branches, et les inférieures en trois—*P. rhododactylus*, *capnodactylus*, *ochrodactylus*, *zetterstedtii*, etc.

In the second group he has only one genus :

1. *Orneodes*, Latr.—*O. hexadactylus*, *O. polydactylus*, *O. grammodactylus*, *O. dodecadactylus*, *O. poecilodactylus*.

In the *Isis* for 1847, Zeller gives (pp. 38-39 and pp. 902-909) further notes on various species, but still maintains the same classification, In 1852, however, he revised the superfamily (*Linn. Ent.*, vi., pp. 319 *et seq.*). He got no further, however, with his classification than his suggestions of 1841, although he dealt more fully with the synonymy, and altered many of the names he had previously used. He still called all his large divisions "genera," subdividing them, however, into named groups, many of which are biologically of subfamily or tribal value. His extended work summarises as follows—

I. Pterophorina.
  1. Agdistis, Hb. (*Adactyla*, Zell.).—*A. frankeniae*, Zell., *meridionalis*, Zell., *heydenii*, Zell., *adactyla*, Hb., *paralia*, Zell., *bennetii*, Curt., *tamaricis*, Heyd.
  2. Pterophorus, Geoff. (*Alucita*, Schrank, Tr.).
    A. Platyptilia, Hb. (*Platyptilus*, Zell.).—*P. rhododactylus*, S.V., *capnodactylus*, F.v.R., *ochrodactylus*, Hb., *isodactylus*, Zell., *gonodactylus*, S.V., *zetterstedtii*, Zell., *nemoralis*, Zell., *fischeri*, Zell., *metzneri*, Zell., *acanthodactylus*, Hb.
    B. Oxyptilus, Zell. (*Amblyptilia*, Hb.).—*O. kollari*, Mann *in litt.*, Stn., *tristis*, Zell., *distans*, Zell., *laetus*, Zell., *wahlbergi*, Zell., *caffer*, Zell., *pilosellae*, Zell., *hieracii*, Zell., *ericetorum*, Zell., *trichodactylus*, Hb., *obscurus*, Zell., *marginellus*, Zell.
    C. Pterophorus, Zell. (*Stenoptilia*, Hb.).
      Group *a.*—*P. ehrenbergianus*, Zell., *phaeodactylus*, Hb., *miantodactylus*, F.v.R., *mictodactylus*, S.V., *serotinus*, Zell., *loewii*, Zell., *aridus*, Zell., *coprodactylus*, Sta., *plagiodactylus*, Sta., *graphodactylus*, Tr., *fuscus*, Retz., *stigmatodactylus*, Zell., *mannii*, Zell.
      Group *b.*—*P. lithodactylus*, Tr.
      Group *c.*—*P. pterodactylus*, L.
      Group *d.*—*P. scarodactylus*, Hb. (?), Zell., *lienigianus*, Zell., *tephradactylus*, Hb., *inulae*, Zell., *carphodactylus*, Hb., *microdactylus*, Hb., *osteodactylus*, Zell.
      Group *e.*—*P. brachydactylus*, Koll.
    D. Aciptilia, Hb. (*Aciptilus*, Zell.).
      Group *a.*—*A. galactodactylus*, Hb.
      Group *b.*—*A. spilodactylus*, Curt. (*obsoletus*, Zell.), *A. xanthodactylus*, Tr., *xerodactylus*, Mtzn., *baliodactylus*, F.v.R., *tetradactylus*, L., *malacodactylus*, Zell., *ischnodactylus*, Tr., *pentadactylus*, L., *albidus*, Zell., *nephelodactylus*, Eversm.
      Group *c.*—(*Diacrotricha*).—*A. fasciola*, Zell.
      Group *d.*—*A. paludum*, Zell., *A. siceliota*, Zell., *A. baptodactylus*, Zell.
  3. Deuterocopus, Zell.—Alæ anteriores semitrifidæ (=bifidæ, lacinia inferiore bifida). Posteriores tripartitæ, digito tertio abbreviato, etc. —*D. tengstroemi*, Zell.

II. Alucitina, Zell.
  1. Alucita, Linn., Zell.
      Group *a.*—*A. grammodactyla*, Zell., *polydactyla*, Zell., *dodecadactyla*, Hb.
      Group *b.*—*A. zonodactyla*, Zell., *desmodactyla*, Zell., *palodactyla*, Zell., *hexadactyla*, Linn., *cymatodactyla*, Zell.

In 1855, Herrich-Schäffer diagnoses (*Sys. Bearb.*, v., pp. 361

et seq.) the superfamily under the name *Pterophorina*. He refers to Zeller's work, points out the isolated character of the superfamily, and the analogy presented by certain Crambids. He throws doubt on *isodactylus*, *xerodactylus*, *mannii*, *marginellus*, *laetus*, *kollari*, *inulae*, *metzneri* and *bennetii*, and considers that Zeller's European species can be reduced to 54, although, by the addition of *cosmodactyla*, *lutescens*, *distinctus*, *confusus* and *agrorum*, he makes a total list of 59 European species. He asserts the unreliability of many of the early species, and specially singles out the work of British authors as being particularly badly done. His criticism appears to be based, less on his first-hand knowledge of these authors than, on Stainton's most unsatisfactory *Catalogue* of 1854, in which, with every possible chance of referring to the collections of Stephens, Curtis, Wood, etc., and comparing their species with the descriptions, he preferred to sink many of their species, *e.g.*, *pterodactyla*, *bipunctidactyla*, etc., and to rename others, *e.g.*, *calodactyla*, etc. Herrich-Schäffer's synopsis of the genera reads as follows:

I. Wings undivided .. .. AGDISTIS.

II. Forewings bifid, hindwings trifid.

1. Only the apical third of the forewings divided, both the lobes with a wide border and projecting anal angle, the innermost lobe of the hindwing with tooth of thick black scales on the middle of its inner margin .. PLATYPTILUS.
2. The terminal half of the forewings divided, the innermost lobe of the hindwings, with thick, black scales, at its end on both sides (or in *O. tristis* in the middle of its inner margin as in the preceding genus) .. OXYPTILUS.
3. The apical third of the forewings divided, the two lobes tolerably pointed with very oblique outer margin and rounded off anal angle. The lobes of the hindwings without any distinct marking by scales .. .. .. PTEROPHORUS.
4. The great part of the outer half of the forewings divided, the lobes of all the wings similarly linear .. .. ACIPTILIUS*.

Herrich-Schäffer then gives the following groupings of the species in the various genera:

Genus I. AGDISTIS, Hb., *Verz.*, Zell., *Linn. Ent.*, vi., p. 321.

1. Alæ anteriores ciliis costalibus albis, margine interiore cano—*adactyla*, Hb., *heydenii*, Zell.
2. Alæ anteriores albidioribus, margine interiore non albidiore.
   A. Cilia vix pallidiore; puncta costalia et punctum plicæ posterius obsoletissima—*meridionalis*, Zell.
   B. Cilia fundo magis flavescentia; puncta costalia et plicæ bene expressa—*frankeniae*, Zell., *tamaricis*, v. Heyd.

Genus II. PLATYPTILUS, Zell.

1. Lobus alarum posteriorum interior medio albus, pone medium dentatus; alarum anteriorum cilia basalia solum in apicibus loborum amborum fusca—*rhododactylus*, W.V.
2. Lobus alarum concolor, pone medium dentatus, alarum anteriorum cilia basalia undique nigra—*capnodactylus*, F.v.R., *metzneri*, Zell.
3. Lobus alarum posteriorum interior concolor, ante medium aut in medio dentatus.
   A. Palpi et fasciculus frontalis capite duplo longiora—*ochrodactylus*, Hb.
   B. Palpi et fasciculus frontalis vix capitis longitudine prominuli.
      a. Cilia alarum anteriorum linea dividente integra—*nemoralis*, Zell., *zetterstedtii*, Zell., *gonodactylus*, Schiff., *fischeri*, Zell.
      b. Ciliorum alarum anteriorum linea dividens in lobo interiore bi-, in anteriore semel-interrupta—*acanthodactylus*, Hb., *cosmodactylus*, Hb.

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* Spelt *Aciptilius*, p. 363, and *Aciptilus*, p. 381.

Genus III. Oxyptilus (with detailed description)—*trichodactylus*, Hb., *ericetorum*, Zell., *hieracii*, Zell., *pilosellae*, Zell., *obscurus*, Zell., *tristis*, Zell., *distans*, Zell., *marginellus*, Zell., *laetus*, Zell., *kollari*, Mann.

Genus IV. Pterophorus, Zell.

1. Fasciculus frontalis conicus—*miantodactylus*, F.v.R.
2. Frons squamis compressis, subquadrata.
   i. Palpi squamis appressis triangulares, alæ anteriores apice acuto, puncto ante fissuram pallidius ciliatam simplici aut gemino nigro; punctis limbi loborum amborum nonnullis.
      A. Cilia basi alba, punctis nigris, uno (duobus in *P. loewii*) in angulo anali anterioris, duobus versus apicem interioris.
         a. Lobus anterior innotatus.
            α. Cilia costalia lobi anter. alba—*fuscus*, Retz., *loewii*, Zell., *mannii*, Zell., *stigmatodactylus*, Zell.
            β. Cilia costalia lobi anter. alarum anter. non alba—*aridus*, Zell., *serotinus*, Zell.
         b. Lobus anterior lineola longitudinali nigra.
            α. Margo anterior innotatus—*mictodactylus*, W. V., *plagiodactylus*, F.v.R., *lutescens*, H.-Sch.
            β. Margo anterior lineola alba ad $\frac{2}{3}$—*coprodactylus*, Zell.
      B. Cilia dimideo basali acute fusca—*graphodactylus*, Tr.
   ii. Palpi subcylindrici, articulo tertio lineari, prominulo.
      A. Tibiæ mediæ medio et apice nigro incrassatæ—*lithodactylus*, Tr.
      B. Tibiæ mediæ simplices.
         a. Cilia base indeterminate pallidiora, anguste obscurius secta—*phaeodactyla*, Hb., *agrorum*, Led.
         b. Cilia fundo paullo obscuriora, alæ anteriores puncto ad fissuram.
            α. Griseus, gilvus, griseo-cinnamomeus corpore concolore—*pterodactylus*, Linn.
            β. Flavidogriseus, corpore albidosulphurea — *distinctus*, H.-Sch.
            γ. Lutescentes fusco-irrorati, corpore, concolore—*lienigianus*, Zell., *inulae*, Zell., *tephradactylus*, Hb.
            δ. Pallide sulphurei, corpore concolore—*microdactylus*, Hb., *carphodactylus*, Hb., *osteodactylus*, Zell.
      C. Cilia alarum anteriorum albo-secta, basi non obscuriora; tibiæ mediæ simplices—*brachydactylus*, Koll.

Genus V. Aciptilus, Zell.

1. Fuscus, ciliis alarum anteriorum albo-sectis—*siceliota*, Zell., *paludum*, Zell.
2. Fuscus, alarum anteriorum lobo interiore niveo—*baptodactylus*, Zell.
3. Pallidi, ciliis fusco-sectis—*xanthodactylus*, Tr., *spilodactylus*, Curt., *confusus*, H.-Sch., *galactodactylus*, Hb.
4. Straminei, alis posterioribus et ciliis obscurioribus.
   i. Corpus sulphureum—*baliodactylus*, F.v.R., *tetradactylus*, Linn., *malacodactylus*, Zell.
   ii. Corpus alis concolor—*ischnodactylus*, Tr.
5. Niveus—*pentadactylus*, Linn.

In 1856, Frey divided (*Die Tin. und Pteroph. der Schweiz*, pp. 397 *et seq.*) the plumes into two families, the Pterophoriden and the Alucitiden, but, as the genus *Agdistis* was not then known to be represented in Switzerland, he included all the true plumes in the genus *Pterophorus* which he diagnosed as follows:

Capilli appressi, interdum in conulum frontalem producti; ocelli nulli; antennæ breves, filiformes, articulis elongatis, infra ciliatis, basali longo, claviformi; haustellum longum, nudum; palpi labiales mediocres vel breviusculi, porrecti, subporrecti vel adscendentes, articulo medio magno (interdum squamis hirsutis), tertio brevi. Alæ anteriores elongatæ, plus minusve bifidæ; posteriores subtripartitæ, mediocriter vel longe ciliatæ; anter. cellula discoidalis, elongata vel mediocris, perfecta aut imperfecta vel nulla; vena subcostalis in laciniam anteriorem ramos quinque vel quatuor emittit aut simplex exit; mediana trifida in laciniam posteriorem (interdum bifida); poster. in digitum primum exeunt rami duo vel unus, in secundum tres vel duo, in tertium unus (interdum duo)—*Pterophorus*.

rhododactylus, S. V., *ochrodactylus*, Hb., *gonodactylus*, S. V., *zetterstedtii*, Zell., *bollii*, Frey, *fischeri*, Zell., *acanthodactylus*, Hb., *cosmodactylus*, Hb., *distans*, Zell., *pilosellae*, Zell., *hieracii*, Zell., *ericetorum*, Zell., *obscurus*, Zell., *phaeodactylus*, Hb., *serotinus*, Zell., *coprodactylus*, Zell., *plagiodactylus*, F.v.R., *graphodactylus*, Tr., *fuscus*, Retz., *lithodactylus*, Tr., *pterodactylus*, L., *scarodactylus*, Zell., *tephradactylus*, Hb., *carphodactylus*, Hb., *microdactylus*, Hb., *osteodactylus*, Zell., *brachydactylus*, Koll., *baliodactylus*, F.v.R., *tetradactylus*, L., *pentadactylus*, L.

In 1859, Doubleday issued the 2nd ed. of his *Synonymic List*, which has no real value to us except so far as his settlement of certain points of nomenclature, *e.g.*, the reference of *pallidactyla*, Haw., to *ochrodactyla*, Hb., of *monodactyla*, Haw., doubtfully to *isodactylus*, Zell., of *calodactylus*, Stphs., to *acanthodactyla*, Hb., of *cosmodactylus*, H.-Sch. to *punctidactylus*, Stphs., of *heterodactyla*, Haw., doubtfully to *hieracii* (=*teucrii*), Sta., of *similidactylus*, Dale, to *lithodactyla*, Tr., etc. With regard to the specially British species, he possibly knew some of the original types, and, of the others, he would at least know what names were in common use in British cabinets for certain species. Stainton's grouping (*Manual*, ii., pp. 439 *et seq.*) is, in every sense, unsatisfactory. With a full knowledge of the work done by Hübner, Zeller, and Herrich-Schäffer he could give us nothing better than the following:—

1. With undivided wings—Adactyla—*A. bennetii.*
2. Forewings with the hind margin more or less deeply cleft; hindwings almost divided into three—Pterophorus—*P. rhododactylus*, *ochrodactylus*, *isodactylus*, *trigonodactylus*, *zetterstedtii*, *acanthodactylus*, *punctidactylus*, *parvidactylus*, *hieracii* (*teucrii*), *pilosellae*, *phaeodactylus*, *bipunctidactylus*, *loewii*, *plagiodactylus*, *fuscus*, *lithodactylus*, *pterodactylus* (=*monodactylus*), *lienigianus*, *tephradactylus*, *osteodactylus*, *microdactylus*, *brachydactylus*, *galactodactylus*, *spilodactylus*, *baliodactylus*, *tetradactylus*, *pentadactylus*, *paludum*.

In 1862, Wallengren published (*Kongliga Svenska Vetenskaps Akademiens Handlingar*, iii., pp. 1-25) his well-known paper in which he still divided all the plumes into two family groups:—

1. Pterophoridæ—Forewings with merely indicated cleft, or divided into 2 or 3 lobes.
2. Alucitina—All the wings six-lobed.

He gives a very good summary of the Scandinavian species, dealing with the synonymy of the Linnean species and adding the following generic tabulation:—

- I. The lobes of the wings dissimilar, the anterior ones broader than the hind ones.
  - A. Forewings at rest entirely concealing the hindwings, the dorsum being rolled under and receiving them throughout its length, sometimes even the costa similarly incurved.
    - 1. All the tibiæ slender.
      - *a*. The ♂ antennæ finely dentate; those of ♀ indistinctly ciliated. The cilia of the last (*i.e.* dorsal) lobe of the hindwing unusually long. The spurs of the hind tibiæ of distinctly different length ... Pterophorus.
      - *b*. Antennæ shortly ciliated, at least in ♂. The cilia on last, *i.e.*, dorsal, lobe of the hindwings normal, rather short. The spurs of hind tibiæ of equal length ... Leioptilus.
    - 2. All the tibiæ at apex, and all the tarsi in middle, thickened. The antennæ of both sexes ciliate ... Oidæmatophorus.
  - B. Forewings at rest covering the hindwings flatly, sometimes enfolding them by the margin of the inner (*i.e.* dorsal) edge being bent down.

1. The scales of the frons produced into a more or less elongate cone or tuft. (The tornal lobe of the forewings distinct.)
   - *a*. The inner (*i.e.*, dorsal) edge of the forewings entire, not toothed. Antennæ ciliate — AMBLYPTILUS.
   - *b*. The inner (*i.e.*, dorsal) edge of the forewings entire, not toothed.
     - i. Forewings in repose covering the hindwings flatly throughout. The palpi evenly cylindrical. Antennæ ciliate — PLATYPTILUS.
     - ii. Forewings in repose enfolding the hindwings by the bending under of the extreme dorsum. Palpi with the median joint enlarged. The antennæ of the ♂ ciliate — MIMÆSEOPTILUS.
2. The hairs on the frons appressed not forming any conical projection. (Antennæ ciliate.)
   - *a*. The lobes of the forewings with noticeable posterior angle. The palpi (joints) of uneven thickness; the median joint thickened with hairs. Tarsi short, the hind tibiæ thickened — CNÆMIDOPHORUS.
   - *b*. The anterior lobe of the forewings not angulate. The third lobe of the hindwing towards the apex with black scale-cilia. The median joint of the palpi at most with a short hair-tuft beneath — OXYPTILUS.

II. The lobes of the wings elongate, very narrow, of almost even width — ACIPTILUS.

The species included in the various genera are as follows:

1. CNÆMIDOPHORUS, Wallgrn.—*C. rhododactylus*, W.V.
2. PLATYPTILUS (Hb.), Zell.
   - α. Frontal tuft rather long. Palpi with the terminal joint rather long, somewhat drooping. Tibiæ slender—*P. ochrodactylus*, Hb.
   - β. Frontal tuft short. Palpi with the terminal joint rather short, porrected. Tibiæ with the end rather thickened—*P. zetterstedtii*, Zell., *P. nemoralis*, Zell., *P. gonodactylus*, W.V., *P. tesseradactylus*, Linn.
3. AMBLYPTILUS, Hb.—*A. acanthodactylus*, Hb.
4. OXYPTILUS, Zell.
   - I. Forewings with white markings on the upperside. Hindwings with the underside of the first plumule furnished with a white spot at the apex.
     - α. The tips of the cilia on the hinder margin of the first lobe of the forewing dusky—*O. pilosellae*, Zell., *O. hieracii*, Zell., *O. ericetorum*, Zell., *O. obscurus*, Zell.
     - β. The tips of the cilia on the hinder margin of the first lobe of the forewings white—*O. didactyla*, Linn.
   - II. Forewings with dull yellowish markings on the upperside. Hindwings with the underside of the first plumule unspotted at the tip—*O. bohemanni*, Wallgrn.
5. MIMÆSEOPTILUS, Wallgrn.—*M. mictodactylus*, W.V., *M. serotinus*, Zell., *M. pterodactylus*, Linn., *M. paludicola*, Wallgrn.
6. OIDÆMATOPHORUS, Wallgrn.—*O. lithodactylus*, Treits.
7. PTEROPHORUS, Geoff.—*P. monodactylus*, Linn.
8. LEIOPTILUS, Wallgrn.
   - I. The anal angle of the hind lobe of the forewings indistinct, obtuse, and hardly visible—*L. scarodactylus*, Zell., *L. tephradactylus*, Hb., *L. microdactylus*, Hb., *L. osteodactylus*, Zell.

II. No trace of the anal angle of the hind lobe of the forewings—*L. brachydactylus*, Koll.

9. ACIPTILUS, Hb.—*A. tetradactylus*, Linn., *A. pentadactylus*, Linn.

In 1869, Jordan gave (*Ent. Mo. Mag.*, vi., pp. 119-125, 149-152) a translation of the generic diagnoses of Wallengren's *Skandinaviens Fjädermott*, and referred the British species to the following genera:—

CNÆMIDOPHORUS—*C. rhododactylus.*
PLATYPTILUS—*P. dichrodactylus, bertrami, isodactylus, zetterstedtii, gonodactylus.*
AMBLYPTILUS—*A. acanthodactylus, cosmodactylus.*
OXYPTILUS—*O. pilosellae, teucrii, obscurus, laetus* (=*distans*).
MIMÆSEOPTILUS—*M. plagiodactylus, serotinus, hodgkinsoni, loewii, fuscus.*
? genus—*phaeodactylus.*
OIDEMATOPHORUS—*O. lithodactylus.*
PTEROPHORUS—*P. pterodactylus* (=*monodactylus*).
LEIOPTILUS—*L. lienigianus, tephradactylus, microdactylus, osteodactylus, brachydactylus.*
ACIPTILUS—*A. galactodactylus, spilodactylus, baliodactylus, tetradactylus, pentadactylus.*
? genus—*paludum.*

He also includes *Chrysocorys festaliella* in the group.

Staudinger and Wocke (*Cat.*, 2nd ed., pp. 341 *et seq.*) gave the following grouping:

AGDISTIS.—*A. frankeniae*, Zell., *meridionalis*, Zell., *heydenii*, Zell., *manicata*, Staud., *adactyla*, Hb., *paralia*, Zell., *tamaricis*, Zell., *bennetii*, Curt.
CNÆMIDOPHORUS.—*C. rhododactylus*, S.V., *cinnamomeus*, Staud.
PLATYPTILIA.—*P. capnodactyla*, Zell., *ochrodactyla*, Hb., *bertrami*, Roess., *similidactyla*, Dale, *gonodactyla*, Schiff., *farfarella*, Zell., *zetterstedtii*, Zell., *nemoralis*, Zell., *tesseradactyla*, Linn., *metzneri*, Zell.
AMBLYPTILIA.—*A. acanthodactyla*, Hb., *cosmodactyla*, Hb.
OXYPTILUS.—*O. kollari*, Sta., *tristis*, Zell., *distans*, Zell., *laetus*, Zell., *pilosellae*, Zell., *hieracii*, Zell., *maculatus*, Const., *ericetorum*, Zell., *didactylus*, Linn., *brunneodactylus*, Mill., *hofmannseggii*, Moesch., *parvidactylus*, Haw., *marginellus*, Zell., *bohemanni*, Wallgrn.
MIMÆSEOPTILUS.—*M. ehrenbergianus*, Zell., *agrorum*, H.-S., *rhypodactylus*, Staud., *phaeodactylus*, Hb., *miantodactylus*, Zell., *pelidnodactylus*, Stein, *serotinus*, Zell., *zophodactylus*, Dup., *islandicus*, Staud., *aridus*, Zell., *coprodactylus*, Zell., *nolckeni*, Tgstr., *plagiodactylus*, Sta., *lutescens*, H.-S., *graphodactylus*, Tr., *pterodactylus*, Linn., *paludicola*, Wallgrn., *stigmatodactylus*, Zell., *mannii*, Zell.
ŒDEMATOPHORUS.—*Œ. lithodactylus*, Treitschke, *giganteus*, Mann.
PTEROPHORUS.—*P. monodactylus*, Linn.
LEIOPTILUS.—*L. scarodactylus*, Hb., *lienigianus*, Zell., *tephradactylus*, Hb., *distinctus*, H.-S., *inulae*, Zell., *carphodactylus*, Hb., *microdactylus*, Hb., *coniodactylus*, Staud., *pectodactylus*, Staud., *osteodactylus*, Zell., *brachydactylus*, Tr.
ACIPTILIA.—*A. semiodactyla*, Mann, *galactodactyla*, Hb., *spilodactyla*, Curt., *phlomidis*, Staud., *confusa*, H.-S., *caspia*, Led., *volgensis*, Moesch., *subalternans*, Ld., *xanthodactyla*, Tr., *scarodactyla*, Zell., *decipiens*, Led., *icterodactyla*, Mann, *baliodactyla*, Zell., *calcaria*, Led., *parthica*, Led., *tetradactyla*, Linn., *malacodactyla*, Zell., *chordodactyla*, Staud., *ischnodactyla*, Tr., *desertorum*, Zell., *olbiadactyla*, Mill., *nephelodactyla*, Ev., *pentadactyla*, Linn., *paludum*, Zell., *siceliota*, Zell., *baptodactyla*, Zell.

In 1877, Heinemann and Wocke (*Die Schmett. Deutsch.*, iii., pt. 2, pp. 780 *et seq.*), define the group under the name *Pterophorina*, which they divide into the following genera without any intermediate subdivisions:—

AGDISTIS, Hb.—*A. adactyla*, Hb., *tamaricis*, Zell.
CNÆMIDOPHORUS, Wallgrn.—*C. rhododactylus*, Fab.
PLATYPTILIA, Hb.—*P. ochrodactyla*, Hb., *bertrami*, Rössl., *gonodactyla*, S.V., *farfarella*, Zell., *zetterstedtii*, Zell., *nemoralis*, Zell., *isodactylus*, Graaf, *metzneri*, Zell., *tessaradactyla*, L.
AMBLYPTILIA, Hb.—*A. acanthodactyla*, Hb., *cosmodactyla*, Hb.

Oxyptilus, Zell.—*O. kollari*, St., *tristis*, Zell., *distans*, Zell., *pilosellae*, Zell., *hieracii*, Zell., *ericetorum*, Zell., *didactylus*, L., *parvidactylus*, Haw.

Mimæseoptilus, Wallgr.—*M. phaeodactylus*, Hb., *pelidnodactylus*, Stein, *serotinus*, Zell., *zophodactylus*, Dup., *aridus*, Zell., *coprodactylus*, Zell., *plagiodactylus*, St., *lutescens*, H.-Sch., *graphodactylus*, Tr., *pterodactylus*, Linn., *paludicola*, Wallgrn., *stigmatodactylus*, Zell.

Oidæmatophorus, Wallgrn.—*O. lithodactylus*, Tr., *rogenhoferi*, Mann.

Pterophorus, Wallgrn.—*P. monodactylus*, Linn.

Leioptilus, Wallgrn.—(*a*) *L. scarodactylus*, Hb., *lienigianus*, Zell., *tephradactylus*, Hb., *distinctus*, H.-S. (*b*) *L. inulae*, Zell., *carphodactylus*, Hb., *microdactylus*, Hb., *osteodactylus*, Zell., *pectodactylus*, Staud. (*c*) *L. brachydactylus*, Tr.

Aciptilia, Hb.—*A. galactodactyla*, Hb., *spilodactyla*, Curt., *confusa*, H.-S., *xanthodactyla*, Tr., *baliodactyla*, Zell., *tetradactyla*, L., *malacodactyla*, Zell., *ischnodactyla*, Tr., *pentadactyla*, L., *paludum*, Zell., *baptodactyla*, Zell.

Meyrick, in 1886, gives (*Trans. Ent. Soc. Lond.*, p. 6) the following generic tabulation—

1.	Wings entire	Agdistis.
	,, fissured	2
2.	Hindwings bifid	Cenoloba.*
	,, trifid	3
3.	Forewings quadrifid	Heptaloba.
	,, trifid	Deuterocopus.
	,, bifid	4
4.	Forewings with vein 9 present	5
	,, ,, ,, absent	10
5.	Hindwings with black scales in dorsal cilia	6
	,, ,, without ,, ,, ,, ...	8
6.	Forewings with vein 3 present	Platyptilia.
	,, ,, ,, ,, absent	7
7.	Forewings with vein 10 stalked with 11	Sphenarches.
	,, ,, ,, ,, ,, ,, 8	Oxyptilus.
8.	Forewings with vein 10 present	Mimæseoptilus.
	,, ,, ,, ,, absent	9
9.	Forehead with cone of scales	Marasmarcha.
	,, without ,, ,, ...	Lioptilus.
10.	Forewings with vein 7 present	11
	,, ,, ,, ,, absent	12
11.	Posterior tarsi tufted above on joints	Pterophorus.
	,, ,, not tufted ,, ...	Oedematophorus.
12.	Forehead with cone of scales	Doxosteres.
	,, without ,, ,, ...	13
13.	Wings without cell	Cosmoclostis.
	,, ,, ,, ...	14
14.	Forewings with vein 11 from near 8, long, parallel	Trichoptilus.
	,, ,, ,, absent or rarely from point ..	
	,, ,, ,, 8 short divergent	Aciptilia.

In 1890, Meyrick included the Alucitides in his "Classification of the Pyralidina of the European fauna" (*Trans. Ent. Soc. Lond.*, 1890, pp. 429 *et seq.*). This paper is most remarkable for the *ex cathedra* manner in which the phylogenies of the various subdivisions are asserted with no detailed proof in support thereof. With this we propose dealing later. His tabulation of the genera reads as follows :—

1.	Wings entire	Agdistis.
	,, fissured	2
2.	Hindwings with more or less developed tooth of black scales in dorsal cilia	3
	Hindwings without black scales in dorsal cilia ..	5
3.	Forewings with veins 7 and 9 absent	Trichoptilus.
	,, ,, ,, ,, ,, present	4

* Since referred to the Pyralides (Durrant).

4. Forewings with vein 10 rising out of 8	.. ..	OXYPTILUS.
,, ,, ,, ,, separate ..	.. ..	PLATYPTILIA.
5. Forwings with all veins present ..	.. ..	STENOPTILIA.
,, ,, one or more veins absent	.. ..	6
6. Forewings with vein 10 separate ..	.. ..	7
,, ,, ,, ,, out of 8 or absent	.. ..	8
7. Forewings with vein 7 out of 8 ..	.. ..	GYPSOCHARES.
,, ,, ,, ,, separate ..	.. ..	ALUCITA.
8. Forewings with veins 3 and 7 absent	.. ..	PTEROPHORUS.
,, ,, ,, ,, ,, present	.. ..	9
9. Forewings with vein 11 out of 8 ..	.. ..	CRASIMETIS.
,, ,, ,, ,, separate ..	.. ..	MARASMARCHA.

The species placed in the various genera are as follows:

TRICHOPTILUS—*T. siceliota*, Zell., *paludum*, Zell.

OXYPTILUS—*O. laetus*, Zell., *distans*, Zell., *tristis*, Zell., *kollari*, Sta., *pilosellae*, Zell., *hofmannseggii*, Mösch., *parvidactylus*, Haw., *bohemanni*, Wallgrn., *marginellus*, Zell., *ericetorum*, Zell., *maculatus*, Const., *hieracii*, Zell., *teucrii*, Greening, *didactylus*, L.

PLATYPTILIA—*P. cosmodactyla*, Hb., *acanthodactyla*, Hb., *tesseradactyla*, L., *farfarella*, Zell., *gonodactyla*, Schiff., *metzneri*, Zell., *zetterstedtii*, Zell., *similidactyla*, Dale, *nemoralis*, Zell., *isodactyla*, Zell., *bertrami*, Rössl., *ochrodactyla*, Hb., *capnodactyla*, Zell., *rhododactyla*, F.

AGDISTIS—*A. satanas*, Mill., *adactyla*, Hb., *manicata*, Staud., *heydenii*, Zell., *meridionalis*, Zell., *frankeniae*, Zell., *paralia*, Zell., *tamaricis*, Zell., *bennetii*, Curt.

STENOPTILIA—*S. miantodactyla*, Zell., *pelidnodactyla*, Stein, *serotina*, Zell., *zophodactyla*, Dup., *islandica*, Staud., *arida*, Zell., *coprodactyla*, Zell., *nolckeni*, Tgstr., *plagiodactyla*, Sta., *lutescens*, H.-S., *graphodactyla*, Tr., *pterodactyla*, L., *paludicola*, Wallgrn., *stigmatodactyla*, Zell., *mannii*, Zell.

ALUCITA—*A. lithodactyla*, Tr., *gigantea*, Mn., *rogenhoferi*, Mn., *constanti*, Rag., *monodactyla*, L., *scarodactyla*, Hb., *lienigianus*, Zell., *tephradactyla*, Hb., *distincta*, H.-S., *inulae*, Zell., *carphodactyla*, Hb., *coniodactyla*, Staud., *pectodactyla*, Staud., *osteodactyla*, Zell.

MARASMARCHA—*M. ehrenbergiana*, Zell., *agrorum*, H.-S., *rhypodactyla*, Staud., *trimmatodactyla*, Christ., *phaeodactyla*, Hb., *cinnamomea*, Staud., *microdactyla*, Hb.

GYPSOCHARES—*G. baptodactyla*, Zell.

CRASIMETIS—*C. brachydactyla*, Tr., *amurensis*, Christ.

PTEROPHORUS—*P. caspius*, Ld., *volgensis*, Möschl., *spilodactylus*, Curt., *galactodactylus*, Hb., *subalternans*, Ld., *phlomidis*, Staud., *pentadactylus*, Linn., *confusus*, H.-S., *punctinervis*, Const., *xanthodactylus*, Tr., *xerodactylus*, Zell., *decipiens*, Ld., *baliodactylus*, Zell., *calcarius*, Ld., *parthicus*, Ld., *semiodactylus*, Mn., *marptys*, Christ., *tetradactylus*, L., *malacodactylus*, Zell., *chordodactylus*, Staud., *icterodactylus*, Mn., *ischnodactylus*, Tr., *desertorum*, Zell., *olbiadactylus*, Mill., *nephelodactylus*, Ev.

In his 1895 grouping of the British species (*Handbook*, pp. 430 *et seq.*) he gives a very similar tabulation of the genera into which he divides the group termed by him *Pterophoridae*. This reads as follows:—

1. Wings entire	..	9 AGDISTIS.
,, fissured	..	2
2. Hindwings with black scale-tooth in dorsal cilia	..	3
,, without black scale-tooth ..	..	5
3. Forewings with 7 and 9 absent	..	1 TRICHOPTILUS.
,, ,, ,, ,, present	..	4
4. Forewings with 10 out of 8	..	2 OXYPTILUS.
,, ,, 10 separate	..	3 PLATYPTILIA.
5. Forewings with all veins present	..	8 STENOPTILIA.
,, ,, one or more veins absent ..	..	6
6. Forewings with 10 separate	..	7 ALUCITA.
,, ,, 10 out of 8 or absent ..	..	7
7. Forewings with 3 and 7 absent	..	4 PTEROPHORUS.
,, ,, ,, ,, present	..	8

8. Forewings with 11 out of 8 .. .. 5 PSELNOPHORUS.
,, ,, 11 separate .. .. 6 MARASMARCHA.

The species placed in these genera are as follows—

1. TRICHOPTILUS —*T. paludum.*
2. OXYPTILUS—*O. distans, pilosellae, parvidactylus, hieracii, teucrii.*
3. PLATYPTILIA—*P. cosmodactyla, acanthodactyla, gonodactyla, zetterstedtii, isodactyla, bertrami, ochrodactyla, rhododactyla.*
4. PTEROPHORUS—*P. tetradactylus, baliodactylus, pentadactylus, galactodactylus, spilodactylus.*
5. PSELNOPHORUS—*P. brachydactylus.*
6. MARASMARCHA—*M. phaeodactyla, microdactyla.*
7. ALUCITA—*A. osteodactyla, tephradactyla, lienigianus, monodactyla, lithodactyla.*
8. STENOPTILIA—*S. pterodactyla, zophodactyla, bipunctidactyla.*
9. AGDISTIS—*A. bennetii.*

Hofmann gave, in 1895 (*Die deutschen Pterophorinen*, pp. 23 *et seq.*), the best generic tabulation of the superfamily that we have seen. It reads as follows:—

I. All the wings undivided .. .. AGDISTIS, Hb.

II. The forewings once, the hindwings twice, cleft.

A. The third feather of the hindwing with only one vein (stem *a*). The discoidal cell of the forewings closed by a vertical or only slightly outwardly inclining cross-vein. Feathers of hindwings differently shaped, or, if shaped alike, with two bands across tips of forewings.*

1. The tips of forewings with only one transverse band or without such; feathers of hindwing differently shaped. Forewings cleft to one-third. Lobes of forewings similarly shaped, *i.e.*, both having an anal angle.

a. The third feather of hindwing with a black scale-tooth in the inner marginal fringe close to the apex EUCNEMIDOPHORUS, Walsm.†

b. The third feather of the hindwing with a tooth or streak-like tuft of black scales in the centre of the inner-marginal fringe.

α. Palpi long and slender, with long terminal joint, forehead with a very long or sometimes rather short scale-tuft (occasionally very short) .. PLATYPTILIA, Hb.‡

β. Palpi laterally compressed with very short terminal joint; forehead with a smooth-scaled conical protuberance .. .. .. AMBLYPTILIA, Hb.

c. The third feather of hindwing without black scales and hind marginal fringe.

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* Nervure (stem) II of the forewings, in all the genera of group A, has five branches, except in *Marasmarcha*, *Trichoptilus*, and sometimes exceptionally in *Oxyptilus*, in which there are only four branches. Stem IV of the hindwings has, in all genera, with the exception of *Trichoptilus*, three branches, and, even in this genus, IV is sometimes present, even if very slender. (Hofm.)

† This is an error, Wallengren is the author of this name.

‡ In the genus *Platyptilia* the black scales of the inner marginal fringe of the third feather are very transient, being lost in flight, or are sometimes altogether wanting; in such cases, however, the long frontal tuft will serve to recognise the genus *Platyptilia* (Hofm.).

α. Palpi laterally compressed, second joint enlarged upwards, forehead with a conical, smooth-scaled protuberance .. .. STENOPTILIA, Hb.
β. Palpi strikingly short and slender .. .. .. MARASMARCHA, Meyr.

2. The lobes of the forewings with two pale transverse bands; feathers of hindwings similarly shaped. Forewings cleft to $\frac{1}{2}$; lobes of forewings differently shaped, upper one pointed, lower with obtuse anal angle, or of similar shape, and then both pointed.
   a. Vein II of forewings with 5 branches.* In the cilia of the costa and inner margin of the 3rd plumule differently shaped accumulations of black scales .. OXYPTILUS, Zell.
   b. Vein II of forewings with 4 branches as branch II_1 is wanting. In the cilia of the inner margin of the 3rd plumule not any or only a very insignificant accumulation of black scales† .. .. .. TRICHOPTILUS, Walsm.

B. The 3rd feather of the hindwings with two veins (stem V and *a*). Upper corner of discoidal cell acutely extended, cross-vein oblique, running downwards and inwards. Feathers of hindwings shaped alike, no transverse bands across the tips of the forewings.‡

1. The branch II_5 arises still from the cross-rib close to branch II_4; both branches run divergingly; forewings cleft to $\frac{1}{3}$. Upper and lower lobes differently shaped, the former acute, the latter with obtuse anal angle .. .. ALUCITA, Meyr.
   a. Middle tibiæ in the centre and at the end thickened with scales. Hind tibiæ with or without scale thickening .. .. ŒDEMATOPHORUS, Wllgn.
   b. Middle tibiæ thickened only at the end, hind tibiæ without scale thickening.
      α. Middle spurs of the hind tibiæ of unequal length .. .. PTEROPHORUS, Wallgrn.
      β. Middle spurs of the hind tibiæ of equal length .. .. LEIOPTILUS, Wallgrn.

2. The branch II_5 arises far distant from the discoidal cell, joining branch II_4, or is quite absent. Forewings cleft from over $\frac{1}{3}$ to $\frac{1}{2}$. Upper and lower lobes of similar form, running to a point, never with any trace of an anal angle.
   a. Stem II with 3 branches towards

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* Exceptionally there are only 4 branches of vein II present, but then II_2 is always absent, not II_1 (Hofm.).

† The only German species of this genus (*T. paludum*) has no black scales in the inner marginal cilia of the 3rd feather (Hofm.).

‡ Several genera of the group B have on the forewings of stem II only 4 or (in *Aciptilia*) still fewer or not any branches; on the hindwings stem IV has always only two branches (Hofm.).

the costa. Forewings cleft to not quite one-half. Second feather of hindwing with a broad white dash in the inner marginal fringe	PSELNOPHORUS, Wallgrn.
b. Stem II with only 1-2 short and quite faintly expressed branches towards the costa, or without any; forewing cleft to ½, the lobes very narrow, linear; second feather of hindwing without any distinction	ACIPTILIA, Hb.

The excellent work done by Fernald (*Pterophoridae of North America*, 1898) should have carried him farther than a slavish following of Meyrick, *e.g.*, comparison of the descriptions of the larvæ of *kellicotti* (p. 49), *monodactyla* (p. 51), and *paleaceus* (p. 46) should have prevented the species being lumped together in *Pterophorus*, and other details provoke similar criticisms. After defining (p. 13) the superfamily under the name *Pterophoridae*, he gives the following generic synopsis:

1. Hindwings with a cluster of black scales in the fringe of the third feather	2
Hindwings without a cluster of black scales in the fringe of the third feather	4
2. Anal angle present in second lobe of forewings ..	3
,, ,, absent ,, ,, ,, ,, ,, ..	TRICHOPTILUS.
3. Anal angle absent in first lobe of forewings.. ..	OXYPTILUS.
,, ,, present ,, ,, ,, ,, ...	PLATYPTILIA.
4. Feathers of hindwings similar and tapering uniformly	ALUCITA.
Feathers of hindwings unlike in form	5
5. Anal angle present on first lobe of forewings ..	STENOPTILIA.
,, ,, absent ,, ,, ,, ,, ...	PTEROPHORUS.

TRICHOPTILUS—*T. pygmaeus*, Walsm., *ochrodactylus*, Fish, *lobidactylus*, Fitch.

OXYPTILUS—*O. periscelidactylus*, Fitch, *delawaricus*, Zell., *ningoris*, Walsm., *tenuidactylus*, Fitch.

PLATYPTILIA—*P. pica*, Walsm., *cosmodactyla*, Hb., *acanthodactyla*, Hb., *edwardsii*, Fish, *carduidactyla*, Riley, *percnodactyla*, Walsm., *shastae*, Walsm., *fragilis*, Walsm., *orthocarpi*, Walsm., *albida*, Walsm., *albidorsella*, Walsm., *grandis*, Walsm., *cooleyi*, Fernald, *modesta*, Walsm., *petrodactyla*, Walk., *adusta*, Walsm., *albiciliata*, Walsm., *albicans*, Fish, *tesseradactyla*, Linn., *marginidactyla*, Fitch.

ALUCITA—*A. walsinghami*, Fernald, *belfragei*, Fish, *montana*, Walsm., *cinerascens*, Walsm.

PTEROPHORUS—*P. fishii*, Fernald, *homodactylus*, Walk., *brucei*, Fernald, *elliottii*, Fernald, *subochraceus*, Walsm., *helianthi*, Walsm., *stramineus*, Walsm., *angustus*, Walsm., *sulphureodactylus*, Pack., *mathewianus*, Zell., *paleaceus*, Zell., *agraphodactylus*, Walk., *inconditus*, Walsm., *parvus*, Walsm., *kellicottii*, Fish, *grandis*, Fish, *rileyi*, Fernald, *monodactylus*, Linn., *cretidactylus*, Fitch, *eupatorii*, Zell., *guttatus*, Walsm., *cineraceus*, Fish, *baroni*, Fish, *gratiosus*, Fish, *lugubris*, Fish, *grisescens*, Walsm., *inquinatus*, Zell.

STENOPTILIA—*S. pumilio*, Zell., *pterodactyla*, Linn., *exclamationis*, Walsm., *mengeli*, Fernald, *semicostata*, Zell., *coloradensis*, Fernald.

Dyar's grouping (*List of North American Lepidoptera*, pp. 44 *et seq.*) is nothing more than a reproduction of Fernald's work. He has in no wise attempted to allow his knowledge of the great differences presented by the earlier stages to prevent him from lumping *Oidaematophorus*, Wallgrn., and *Leioptilus*, Wallgrn., into *Pterophorus*, Geoff., which genus, therefore, becomes, in the American lists, a hotch-potch of species of widely divergent character.

In Staudinger and Rebel's *Catalogue*, 3rd ed., pp. 70 *et seq.*, the crudest possible divisions are adopted, and all Meyrick's errors, *e.g.*, the use of the American genus *Trichoptilus*, the lumping of *Oidaematophorus*, Wallgrn., *Leioptilus*, Wallgrn. and *Pterophorus*, Geoff., into one genus, etc., are perpetuated, in spite of the fact that an examination of Hofmann's work should have prevented this. The whole of the group is placed in the family *Pterophoridae*, which is, without subdivision into subfamilies and tribes, divided directly into the following genera:—

TRICHOPTILUS, Walsm.—*T. paludum*, Zell., *siceliota*, Zell.

OXYPTILUS, Zell.—*O. kollari*, Sta., *tristis*, Zell., *distans*, Zell., *pilosellae*, Zell., *hieracii*, Zell., ? *maculatus*, Const., *ericetorum*, Zell., *didactylus*, Linn., *leonuri*, Stange, *teucrii*, Jordan, *parvidactylus*, Haw., ? *marginellus*, Zell., *bohemanni*, Wallgrn.

PLATYPTILIA, Hb.—*P. rhododactyla*, Fab., *cinnamomea*, Staud., *capnodactyla*, Zell., *ochrodactyla*, Hb., *bertrami*, Rössl., *chapmani*, Tutt, *isodactyla*, Zell., *gonodactyla*, Schiff., *terminalis*, Ersch., *farfarella*, Zell., *zetterstedtii*, Zell., *nemoralis*, Zell., *tesseradactyla*, Linn., *metzneri*, Zell., *acanthodactyla*, Hb., *seeboldi*, Hofm., *moerens*, Snell., *cosmodactyla*, Hb.

ALUCITA, Linn.—*A. semiodactyla*, Mn., *galactodactyla*, Hb., *spilodactyla*, Curt., *phlomidis*, Staud., *nephelodactyla*, Ev., *pentadactyla*, Linn., *caspia*, Ld., *volgensis*, Mösch., *tuneta*, Staud., *subalternans*, Ld., *xanthodactyla*, Tr., *probolias*, Meyr., ? *apollina*, Mill., *adamas*, Const., *decipiens*, Ld., *icterodactyla*, Mn., *punctinervis*, Const., *raphiodactyla*, Rbl., *baliodactyla*, Zell., *marptys*, Chr., *calcaria*, Ld., *parthica*, Ld., *tetradactyla*, Ld., *malacodactyla*, Zell., *acarnella*, Walsm., *chordodactyla*, Staud., *wernickei*, Wocke, *ischnodactyla*, Tr., *desertorum*, Zell.

PSELNOPHORUS, Wallgr.—*P. brachydactylus*, Tr., *amurensis*, Chr.

MARASMARCHA, Meyr.—*M. ehrenbergiana*, Zell., *agrorum*, H.-S., *rhypodactyla*, Staud., *trimmatodactyla*, Chr., *phaeodactyla*, Hb., *fauna*, Mill.

GYPSOCHARES, Meyr.—*G. baptodactyla*, Zell., *olbiadactyla*, Mill., *hedemanni*, Rbl.

PTEROPHORUS, Geoffr.—*P. lithodactylus*, Tr., *rogenhoferi*, Mn., *constanti*, Rag., *giganteus*, Mn., *monodactylus*, Linn., *scarodactylus*, Hb., *lienigianus*, Zell., *tephradactylus*, Hb., *innocens*, Snell., *distinctus*, H.-S., *inulae*, Zell., *carphodactylus*, Hb., *pectodactylus*, Staud., *osteodactylus*, Zell., *microdactylus*, Hb.

STENOPTILIA, Hb.—*S. miantodactyla*, Zell., *pulchra*, Chr., *pelidnodactyla*, Stein, *pinarodactyla*, Ersch., *coprodactyla*, Zell., ? *lutescens*, H.-S., ? *nolckeni*, Tgstr., *zophodactyla*, Dup., *bipunctidactyla*, Haw., *islandica*, Staud., *caesia*, Snell., *hedemanni*, Snell., *vaccilana*, Snell., *luteocinerea*, Snell., *graphodactyla*, Tr., *pneumonanthes*, Schleich, *pterodactyla*, Linn., *paludicola*, Wallgrn., *mengeli*, Fern., *stigmatodactyla*, Zell., *mannii*, Zell., *emarginata*, Snell.

AGDISTIS, Zell.—*A. frankeniae*, Zell., *meridionalis*, Zell., *heydenii*, Zell., *ingens*, Chr., *adactyla*, Hb., *canariensis*, Rbl., *satanas*, Mill., *paralia*, Zell., *tamaricis*, Zell., *bennetii*, Curt., *staticis*, Mill.

Summarising the literature here reviewed, from the point of view of settling the generic nomenclature, it is quite clear that *Pterophorus*, Geoff. (1762), was created as a synonym of *Alucita*, Linn. (1758), to include exactly the same species, and in full knowledge of Linné's prior name. Poda's mere inclusion of *Alucita pentadactyla*, in the list of species in the Gratz museum, has less restrictive force than Scopoli's action, in 1777, when he retained *Alucita* for the "long-legged" plumes, whilst in 1779, Leske, and, in 1881, Barbut, took *pentadactyla* to illustrate *Alucita*, and thus fixed the type. Other contentions, more or less valid, have recently been brought forward (*Nomenclature of Lepidoptera*, 1896, p. 330) with the idea of fixing *pentadactyla* as the type of *Alucita*. In 1796, Latreille separated the "fan-winged" plumes under the name of *Orneodes*, from the "long-legged" plumes, under Geoffroy's synonym, *Pterophorus*, the latter group having been already determined as *Alucita* by Scopoli, and its type fixed by Leske and Barbut. The next step is taken by Hübner, who, in 1806, maintained *pentadactyla* as the the type of *Pterophora* (which we have shown falls as a synonym of *Alucita*) and cited *hexadactyla* as the type of *Ripidophora* (which thus becomes synonymous with *Orneodes*). Oken, in 1815, correctly divided the plumes into *Alucita* (type *pentadactyla*, described) and *Orneodes* (type *hexadactyla*) whilst in the same year, Leach cited their synonyms—*Pterophorus* and *Alucita*—with the same types. Before the publication of Hübner's *Verzeichniss*, therefore, only two generic points were determined, *viz.*, *Alucita* type *pentadactyla* and *Orneodes* type *hexadactyla*. Hübner, in this work, fixed *adactyla* as the type of *Agdistis*, and created the heterotypical genera *Platyptilia*, *Amblyptilia*, *Stenoptilia* and *Aciptilia*. As *Aciptilia* contained *pentadactyla*, the type of *Alucita*, it falls as a synonym of the latter, whilst *Euchiridia* (type *hexadactyla*), also newly described here, falls as a synonym of *Orneodes*. In 1833, Curtis created *Adactylus*, describing the genus from, and founding it on, *bennetii*, although he cites *huebneri* (*adactyla*, Hb.) as the type. Neither Stephens in 1834, nor Zeller in 1841, did anything in the way of fixing generic types, although the latter restricted *Amblyptilia* to *acanthodactyla*, Hb., and *cosmodactyla* Hb., and created *Oxyptilus* for the other section of Hübner's *Amblyptilia*. He also altered the spelling of *Platyptilia* to *Platyptilus*, and *Aciptilia* to *Aciptilus*, the latter automatically falling before *Alucita*. In 1852, he retained these Zellerian names, as also, in 1855, did Herrich-Schäffer, but with subfamily values, the groups being divided and subdivided into sections of modern tribal and generic values. Zeller also created *Diacrotricha* (type *fasciola*) and *Deuterocopus* (type *tengstroemi*). In 1862, Wallengren created *Cnaemidophorus* (type *rhododactyla*), *Oidaematophorus* (type *lithodactyla*), *Mimaeseoptilus* (for the *pterodactyla* group of Hübner's *Stenoptilia*), and *Leioptilus* for the *tephradactyla* group of the same genus. As, however, Meyrick, in 1890, limited *Stenoptilia* to the first of these two groups, *Mimaeseoptilus* fell as a synonym of *Stenoptilia*. Wallengren also fixed *acanthodactyla* as the type of *Amblyptilus* (*ilia*), Hb. He further maintained *Platyptilus* (*ilia*), Hb., for the group of species without a tooth on the inner margin of the forewing, followed Zeller in using *Oxyptilus* for the *pilosellae* group, which, however, he was advanced enough to divide into three sections. In 1864, Walker erected two genera, *Sochchora* (type *donatella*), *Utuca* (type *ochracealis*), and in 1865, a third, *Paelia* (type *lunuligera*), whilst, in 1880, Walsingham created *Trichoptilus* (type *pygmaeus*), and Wallengren altered the preoccupied *Cnaemidophorus* to *Eucnaemidophorus* and created *Pselnophorus* (type *brachydactyla*). The later genera will be readily followed in the generic summary attached hereto. We will only add that, in 1890, Meyrick made one of the most retrograde steps in the classification of the group. He appears to have been absolutely ignorant of the details of their early stages, and, on certain imaginal characters, lumped together the most diverse species. He maintained the American genus *Trichoptilus*, Walsm., for *paludum* and *siceliota*; placed all the species of the *Plaptyptiliinae* and *Amblyptiliinae* in the genus *Platyptilia*, Hb., joined under the generic name *Alucita*, Linn., the whole of the *Oidaematophorinae* and *Leioptilinae*, created *Marasmarcha* for species as divergent as *lunaedactyla* (*phaeodactyla*) and *microdactyla* (leaving *scarodactyla* with *lienigianus* in *Alucita*), created *Gypsochares* for *baptodactyla* and *Crasimetis* for *brachydactyla*, which thus fell before *Pselnophorus*, Wallgrn., whilst all the species of *Alucitinae* are lumped together under *Pterophorus*, Geoff. It is most unfortunate that Rebel should have followed in his and Staudinger's *Catalogue*, 3rd ed., such an unsatisfactory scheme. In the *Ent. Rec.*, xvii., p. 37, we suggested twelve new generic names for use in this work. The following appears to be (to date) a complete list of the generic names proposed for the Agdistid, Alucitid, and Orneodid moths :—

1758. ALUCITA, Linné.—Restricted by Scopoli, in 1777, to the long-legged plumes (thus excluding *Orneodes*). Type fixed as *pentadactyla* by Leske in 1779. [In Walsingham and Durrant's opinion the type was fixed as *pentadactyla* by Poda in 1761.]

1762. PTEROPHORUS, Geoffroy.—Created for same species as *Alucita*, Linné. Type fixed as *pentadactyla* by Geoffroy in 1762. Falls as a synonym of *Alucita*, having same conception and same type.

1796. ORNEODES, Latreille.—Created by Latreille for the plumes, with "many feathers" in the wings. Type fixed by Latreille, in 1802, as *hexadactyla*.

1806. RIPIDOPHORA, Hübner.—Type fixed by Hübner, in 1806, as *hexadactyla*, therefore falls as a synonym of *Orneodes*, Latr.

1806. PTEROPHORA, Hübner.—Type fixed by Hübner, in 1806, as *pentadactyla*, Linn., therefore falls as a synonym of *Alucita*.

1825. AGDISTIS, Hübner.—Created by Hübner, for *adactyla*, which is therefore the type.

1825. PLATYPTILIA, Hübner.—Restricted by various authors to the true Platyptiliids as now understood. Type never having been fixed, is now named as *gonodactyla*, W.V. (=*megadactyla*, Hb.).

1825. AMPLYPTILIA, Hübner.—Evidently, from the plural form used, a misprint for *Amblyptilia*. Restricted by Zeller to *acanthodactyla*, Hb., and *cosmodactyla*, Hb. Type fixed, in 1862, by Wallengren as *acanthodactyla*.

1822. STENOPTILIA, Hübner.—Restricted by Meyrick and others to the "*pterodactyla* (*fuscus*)" and "*bipunctidactyla*" groups. The type never having been fixed, is now named as *pterodactyla*, Linn. (=*ptilodactyla*, Hb.).

1825. ACIPTILIA, Hübner.—This is a synonym of *Pterophora*, Hb., 1806, since it contains *pentadactyla*, Hübner's type of the latter genus. It falls with *Pterophora* as a synonym of *Alucita*.

1825. EUCHIRADIA, Hübner.—Contains *hexadactyla*, type of Hübner's *Ripidophora*, which he gives a higher than generic value in 1825. It, therefore, falls before *Ripidophora*, with which it sinks as a synonym of *Orneodes*.

1833. ADACTYLUS, Curtis.—Type stated by Curtis to be *huebneri* (=*adactyla*, Hb.), of which he only knew the figure. All the characters of the genus are described from, and the genus is founded on, the newly-described *bennetii*, which must be considered the type.

1841. PLATYPTILUS, Zeller.—Created as an extension of *Platyptilia*, Hb., to include, in addition to species of latter genus, a part of Hübner's *Amblyptilia*. Type fixed now as *gonodactyla*, W.V. (=*megadactyla*, Hb.), so that it falls as a synonym of *Platyptilia*, Hb.

1841. OXYPTILUS, Zeller.—Created by Zeller for the Oxyptilid section of Hübner's *Amblyptilia*. Type now fixed as *pilosellae*, Zeller.

1841. ACIPTILUS, Zeller.—Created by Zeller as an extension of Hübner's *Aciptilia*. Type now fixed as *pentadactyla*, so that it falls with *Aciptilia* as a synonym of *Alucita*.

1852. Diacrotricha, Zeller.—Created for *fasciola*, which is therefore the type.

1852. Deuterocopus, Zeller.—Created by Zeller for *tengstroemi*, Zell., which is therefore the type.

1862. Cnæmidophorus, Wallengren.—Created by Wallengren for *rhododactyla*, which is therefore the type.

1862. Oidæmatophorus, Wallengren.—Created by Wallengren for *lithodactyla*, which is therefore the type.

1862. Mimæseoptilus, Wallengren.—Created by Wallengren for the "*pterodactyla (fuscus)*" and "*bipunctidactyla*" group of Hübner's *Stenoptilia*. The latter was limited by Meyrick in 1890 to the same group, thus making *Mimaeseoptilus* a synonym of *Stenoptilia*.

1862. Leioptilus, Wallengren.—Created, in 1862, by Wallengren, for the Leioptilid section of Hübner's *Stenoptilia*. Type now fixed as *tephradactyla*.

1864. Sochchora, Walker.—Erected for *donatella*, which is named the type.

1864. Utuca, Walker.—Erected for *ochracealis*, which is named the type.

1865. Pælia, Walker.—Erected for *lunuligera*, which is named the type.

1880. Trichoptilus, Walsingham.—Created by Walsingham for *pygmaeus*, which is therefore the type.

1881. Eucnæmidophorus, Wallengren.—Name created by Wallengren to replace the preoccupied *Cnaemidophorus;* type, *rhododactyla*.

1881. Pselnophorus, Wallengren.—Created by Wallengren for *brachydactyla*, which is therefore the type.

1885. Heptaloba, Walsingham. — Created for *argyriodactylus*, Walker, which is therefore the type.

1886. Marasmarcha, Meyrick.—Created for two species. Type fixed, in 1892, by Tutt as *phaeodactyla*, Hb. (=*lunaedactyla*, Haw.).

1886. Cosmoclostis, Meyrick. — Erected for a single species, *aglaodesma*, which is therefore the type.

1886. Sphenarchis, Meyrick. — Erected for a single species, *synophrys*, which is therefore the type.

1886.—Doxosteres, Meyrick.—Erected for a single species, *aenalis*, Walk., which is therefore the type.

1887. Tetraschalis, Meyrick.—Erected for *arachnodes*, which is therefore the type.

1890. Gypsochares, Meyrick.—Created by Meyrick for *baptodactyla*, which is therefore the type.

1890. Crasimetis, Meyrick.—Created for *brachydactyla*, which is therefore the type. Sunk by Meyrick, in 1895, as synonymous with *Pselnophorus*, Wallgrn.

1891. Atomopteryx, Walsingham.—Erected for *doeri*, which is therefore the type.

1891. Ochyrotica, Walsingham.—Erected for *fasciata*, which is therefore the type.

1891. Steganodactyla, Walsingham.—Erected for two species, of which *concursa* is noted as the type.

1891. Gilbertia, Walsingham.—Erected for *eques*, which is named the type.

1891. Karamaguia, Hampson.—Erected for *auxantidactylus*, which is therefore the type.

1891. Euroloba, Walsingham.—Created for *fuscicostata*, which is noted as the type.

1896. Crocydoscelus, Walsingham.—Created for *ferrugineum*, which is named the type.

1905. Gillmeria, Tutt.—*Ochrodactyla*, Schiff. (*dichrodactyla*, Mühlig), cited as type.

1905. Fredericina, Tutt.—*Calodactyla*, Schiff. (*zetterstedtii*, Zell.), cited as type.

1905. Capperia, Tutt.—*Heterodactyla*, Müll., de Vill. (*teucrii*, Jord.), cited as type.

1905. Adkinia, Tutt.—*Bipunctidactyla*, Scop., Haw., cited as type.

1905. Ovendenia, Tutt.—*Septodactyla*, Tr. (*lienigianus*, Zell.), cited as type.

1905. Buckleria, Tutt.—*Paludum*, Zell., cited as type.

1905. Adaina, Tutt.—*Microdactyla*, Hb., cited as type.

1905. Hellinsia, Tutt.—*Osteodactylus*, Zell. (*leucadactyla*, Haw.), cited as type.

1905. Emmelina, Tutt.—*Monodactyla*, Linn., cited as type.

1905. Merrifieldia, Tutt.—*Tridactyla*, Linné (*tetradactyla*, auct.), cited as type.

1905. Porrittia, Tutt.—*Galactodactyla*, Schiff., cited as type.

1905. Wheeleria, Tutt.—*Spilodactyla*, Curt., cited as type.

1863. Stenoptycha, Zeller.—Created for *coelodactyla*, which is therefore the type.

General biological characters of the Alucitides.

Réaumur, in 1734, gave (*Mémoires*, etc., i., p. 322) the insects belonging to this superfamily the name of "plumes"—"Les papillons dont les aîles imitent fort celles des oiseaux ; elles paroissent composées de veritable plumes." He says ; "Nous les avons mis à la suite des phalenes, ils en ont un des caracteres par leurs antennes à filets-coniques ; mais on ne laisse pas de les voir voler pendant le jour ; et d'ailleurs, la transformation des chenilles d'où ils viennent, se fait de la même maniere que celle des chenilles des papillons diurnes, comme nous l'expliquerons ailleurs. Ils pourroient donc aussi appartenir à la classe des papillons diurnes ; mais de tout cela, il resulte qu'on les peut regarder comme une classe particuliere que nous placerons pourtant ici à la suite des phalenes."

A superficial examination of the "plumes" might lead one to suppose that they formed a small group that might be divided into a genus or two, and this, indeed, has been done by many authors, as has been already shown. Small, however, as is the group, the divergence exhibited is exceedingly great, and there are few of the largest superfamilies that exhibit so varied structures in the larval, pupal, and, to a less extent, wing characters. In habits, too, they differ exceedingly—hybernating as imagines, larvæ, and, in the case of *Oidaematophorus*, at least, in the egg-stage (the larva fully formed within the egg), whilst the larval habits vary from purely internal feeders, the larvæ with simple tubercular structures, to exposed feeders, the larvæ with wart-like tubercles almost as complicated as those of Arctiids or Lymantriids. Like the latter, too, they carry over, in some cases, the wart-like structure to the pupal stage, this character being even more pronounced in some instances than in Lymantriid pupæ. The plumes, using the term in the broadest sense, fall into two very characteristic groups, which we have treated as superfamilies, in order to show that the *Agdistides* equal in biological value the *Alucitides*, under which title we group the rest of the plumes. For our general considerations we have discussed the two together in order to contrast their differences and compare their resemblances in the various stages.

The pupal and larval features are very important from the point of view of grouping the species *inter se*, and a study of these stages is absolutely necessary to form a sound basis for the generic divisions, whilst the characters found in these stages often separate widely species in which the neurational characters are very similar. Thus the Amblyptiliid pupa not only shows how distinct is *Amblyptilia* from *Platyptilia*, with which Meyrick erroneously unites it, but suggests a close alliance with *Marasmarcha* (*lunaedactyla*), which is usually placed in a quite different group, whilst a detailed knowledge of the life-histories must have prevented the same author from lumping into the same genus, such divergent species as *Marasmarcha lunaedactyla* and *Adaina microdactyla*, which have no point of contact in any stage—egg, larva, pupa or imago. The soundest work yet done on the classification of the plumes is undoubtedly that of Hofmann ("Die deutschen Pterophorinen," *Berichte des naturwissenschaftlichen Vereines zu Regensburg*, v., 1894-1895), with the general arrangement of whose work we are in close agreement. His knowledge of the early stages of many species has led him to avoid the greater pitfalls into which Meyrick has fallen through being unable to check the results obtained from a study of the imago by those obtained from study of the larvæ and pupæ. Taking his two main divisions (*op. cit.* separ. pp. 23 *et seq.*) as our *Agdistides* and *Alucitides*, and his two chief subdivisions of the latter as our *Platyptiliidae* and *Alucitidae*, we believe that his genera are well placed, yet he has no appreciation of the amazing difference of such larvæ and pupæ as those of *Leioptilus tephradactyla* and *Adaina microdactyla*, which he places in the same genus, nor of the gulf that exists between *Porrittia galactodactyla* on the one hand, and *Alucita pentadactyla* on the other, or between both these and *Wheeleria megadactyla* (*spilodactyla*) and *Merrifieldia tridactyla*.

It may be well, however, before entering into further detail, to consider at length the various stages of the Alucitids, so that the general morphology of these insects may be properly appreciated.

The Alucitid egg gives very little clue to the affinities of the superfamily; it is exceedingly simple and not a highly elaborated egg, and might have relationship with those of any of the more generalised superfamilies of lepidoptera; it is, however, very different from the imbricated eggs of Tortricids and many Pyralids. The egg is flat, roughly oval in outline, one end broader and thinner than the other, the narrower and thicker end being squared off, and carrying at its somewhat flattened end the micropyle; the shell is thin and transparent, the upper surface somewhat flattened or sunken, and practically devoid of ribs, pitting, and almost entirely of any structural surface modification, there being merely the slightest trace of a polygonal reticulation. Chapman notes (*Trans. Ent. Soc. Lond.*, 1896, p. 145): "The ovum is of oval section in every direction, a form that may most easily be described as that of an ordinary bird's egg, if laid on its side and then flattened. Those examined vary in size and in the proportion of their different diameters, but all have this general form; they are smooth, bright and polished, and have faint markings of a network tending to a hexagonal mesh. In some cases the narrowing towards the small end is not so evident, and in others, *e.g.*, *Adkinia bipunctidactyla*, the egg might almost be called cylindrical. . . . Although the Alucitid egg thus varies within wide limits, there is not the remotest suggestion in its structure of the Chrysocoridid egg (*Trans. Ent. Soc. Lond.*, **1896**, pl. vi., fig. 3), with which group an alliance has been supposed to exist. It is horizontal, but with sufficiently smooth surface to give some support to the idea that it belongs to the Anthrocerid stirps." The eggs are pale green or yellow in colour when first laid, and usually the oval stage is a short one, although *Oidaematophorus lithodactyla* hybernates in this stage (*teste* Chapman), the young larva developing rapidly in the shell and living therein until the spring. Roughly, the two main subdivisions into which the Alucitids fall exhibit their own oval peculiarities; those of the Alucitines have a flatter egg, more oval in outline, those of the Platyptiliines are rather larger, more cylindrical, with the micropylar end rather more truncate, whilst the allied Agdistid egg has an almost brick-shaped appearance, the micropylar end flattened and rather depressed, the nadir rounded; the margin of the square micropylar end being further specialised by having a raised and beaded border. Chapman gives the following tabulation of the sizes of eggs which he measured in 3 diameters:—

	LENGTH.	WIDTH.*	HEIGHT.*
Adactylus bennetii	·77mm.	·30mm., ·40mm.	·30mm., ·28mm.
Adkinia bipunctidactyla ..	·45mm. ·40mm.	·24mm. ·24mm.	·21mm. ·21mm.
Stenoptilia pterodactyla ..	·49mm.	·25mm., ·16mm.	·21mm., ·15mm.
Amblyptilia cosmodactyla (*acanthodactyla*)	·46mm.	·27mm., ·23mm.	·23mm., ·20mm.
Marasmarcha lunaedactyla (*phaeodactyla*)	·56mm.	·34mm.	·28mm.
Buckleria paludum	·38mm.	·24mm.	·24mm.
Capperia heterodactyla (*teucrii*)	·40mm.	·28mm.	·21mm.
Platyptilia gonodactyla ..	·60mm.	·36mm.	·30mm.
Platyptilia isodactyla	·54mm.	·33mm.	·27mm., ·21mm.
Fredericina calodactyla (*zetterstedtii*)	·52mm.	·30mm.	·26mm., ·18mm.
Oidaematophorus lithodactyla	·52mm. ·48mm.	·36mm., ·27mm. ·32mm., ·30mm.	·21mm. ·25mm., ·22mm.
Leioptilus tephradactyla ..	·41mm.	·28mm.	·20mm.
Ovendenia septodactyla (*lienigianus*)	·35mm.	·22mm.	·17mm.
Adaina microdactyla	·35mm.	·24mm.	·17mm.
Porrittia galactodactyla ..	·42mm.	·28mm.	·24mm.
Alucita pentadactyla	·48mm. ·51mm.	·33mm., ·30mm. ·36mm.	·23mm. ·30mm.
Wheeleria megadactyla (*spilodactyla*)	·45mm.	·30mm.	·24mm.

* This tabulation of egg-sizes takes account also of form. When two dimensions are given the outline is not oval, but ovoid. The points at which measurement has been made are not at places definable for all eggs, but are (1) widest, (2) at a point where the measurement is still side to side and not on actual end—largely a matter of guess and varying with each egg.

Hofmann observes (*Die deutsch. Pterophorinen*, etc., pp. 14 *et seq.*) that the head, mouthparts, antennæ, and ocelli of the larva show (without microscopical examination) no deviation from the forms usual in lepidopterous larvæ. The globular or heart-shaped head is usually very small, and can be easily withdrawn into the prothorax; the antennæ are very short, and the labium is often prolonged into a long spindle. The chitinous prothoracic shield and anal plate are very frequent in young larvæ, and, in some groups, are retained throughout life, whilst in others they disappear with the last moult. The spiracles are small but particularly noticeable, on account of their being placed much higher dorsally than is usually the case with other larvæ. The true legs are fairly normal; the prolegs, however, are very variable, in some groups long and thin, recalling those of certain Pyralids; the hooklets are arranged in a semicircle, the number of which vary in different species, *e.g.*, *Oxyptilus hieracii*, *O. pilosellae*, etc.; in some species the modification towards obsolescence in the prolegs is most marked, *e.g.*, *Adaina microdactyla*. He further notes that much of this larval diversity appears to depend less on a great generic difference, than on the mode of life of the larvæ; thus the allied *hieracii* and *pilosellae* on the one hand, and *scarodactyla* and *tephradactyla* in another direction, offer quite different larval types.

The plume larvæ present very great variation—from nearly smooth to very hairy—and this stage furnishes many excellent characters for classification, although, at present, it must be confessed the differences are not too thoroughly understood, and many of the adult larvæ are highly specialised. The more marked characters (not necessarily specialised or particularly Alucitid characters) that early force themselves on the notice of the student are: (1) The raised spiracles, a most striking feature, and a very constant one throughout the superfamily, but still subject to great variation. (2) The highly-developed covering of spicules (of course a generalised character) which is found pretty generally throughout the group, after the first moult, but is subject to great modification.* (3) The great difference in the position of the subspiracular tubercles in the Agdistids compared with those of the Alucitid larvæ. (4) The great difference in the character of the tubercles, varying from simple single-haired chitinous buttons, to complicated many-haired warts, or tall horn-like processes on which the setæ are borne. (5) The presence of accessory or secondary tubercular hairs, distinct from the usual tubercular groups, and the wart-like structures they generally form. (6) The presence of scattered skin-hairs (another character found in widely different superfamilies).

The peculiar raised character of the larval spiracles is most noteworthy. Those on the prothorax and 8th abdominal segment resemble those of other lepidopterous larvæ in being much larger than the others, and presenting the special peculiarities, therefore, more visibly. In most Alucitid species, the spiracles present a smooth, conical mound of some height, with the spiracle proper at the apex. This feature is more conspicuous, perhaps, in the Platyptiliine (smooth) than in the Alucitine (hairy) section of the group. This is not,

* The absence of spicules is unusual in lepidopterous larvæ, still their general absence in the first instar, and their well-developed character in the later instars, in this superfamily, is interesting.

however, without marked exceptions, for *Wheeleria megadactyla* (*spilodactyla*) has a chitinous cone whose base is nearly three times the width of the actual spiracle at top, and it stands up from the surface to a height quite equal to twice the diameter of the spiracular opening. In *Leioptilus tephradactyla* the height is greater, though the width of the base of the cone is proportionally less, despite the fact that it stands on a rather large chitinous plate. In *Ovendenia septodactyla* (*lienigianus*) the construction is very similar. In *Alucita pentadactyla* the opening of the spiracle is very large, but it is rather less raised. In *Merrifieldia tridactyla* (*tetradactyla*) the cone is short and narrow. In *Porrittia galactodactyla* it is very similar, but rather higher. In *Oidaematophorus lithodactyla* the spiracle is not unlike that of *Adkinia zophodactylus*, but the base is very transparent and colourless. In *A. zophodactylus* the raised base is hemispherical rather than conical, with the darker spiracle on top, hardly more in width than one-third the diameter of the hemisphere ; this is most marked in the thoracic spiracle. In *Stenoptilia pterodactyla* the cone is only about twice the width of the spiracle; in *Marasmarcha lunaedactyla* (*phaeodactyla*) the cone is wide and not so steep, approaching that of *Adkinia zophodactylus*, whilst that of *A. bipunctidactyla* is very similar to that of *Stenoptilia pterodactyla*. *Amblyptilia cosmodactyla* (*acanthodactyla*) has rather a wide lumen, and a narrow but fairly high cone ; *Eucnemidophorus rhododactyla* has also a wide opening and narrow cone. In *Capperia heterodactyla*, the spiracle is on a rather sharp, narrow cone, usually dark in colour. In the Platyptiliids (*sens. strict.*) the cone is narrow but tall for its width. In *Emmelina monodactyla*, strangely enough, the spiracle is very similar to that of *Platyptilia* (*gonodactyla* and *isodactyla*). In *Adactylus bennetii* the spiracles are characteristic, the conical base being rather dark tinted. The larva of *Adaina microdactyla* has very large prothoracic and 8th abdominal spiracles on high, wide, dark cones, the others smaller and less marked. This species illustrates to a remarkable degree how the spiracle may be modified in the younger stadia. In the first stadium, *i.e.*, the newly-hatched larva, each spiracle is a very large structure nearly half the width of the segment in diameter, and standing out from the surface for an even greater distance. It has a rather narrow neck, and beyond this expands into a large cup-shaped mass with fluted sides and a rather flat top. It has something the appearance as if the spiracle, as it exists in the adult, was represented by the portion to the top of the neck, and the portion beyond was a special development, and possibly this is so (Chapman).

The skin of the plume larvæ is finely spiculated, and these minute skin-points appear, as a rule, to be developed in the second stadium, and are usually present in some one or other form of development in most of the species. They seem to be universally distributed on the larval skin, and are often sufficiently well developed to lead one to assume that, with very little stimulation, they would develop into hairs, but even in the most highly developed spicules there is no joint, the spicule being continuous with the epidermal cell beneath. This spiculation is usually absent in the first instar, the newly-hatched larva being smooth, although larvæ of *Merrifieldia tridactyla*, and *Adactylus bennetii*, etc., have it marked more or less strongly in this stage, and that of *Oidaematophorus lithodactyla* has it sufficiently developed to give the larva quite a second stage appearance.

The gradations and variation exhibited in the secondary hairs, tubercles, and warts of Alucitid larvæ, has led Chapman to point out the following details (*in litt.*). He remarks: "From the primitive primary hair or tubercle, we find all sorts of gradations; we have the primary hair with or without a plate, with or without an elevation; we find it accompanied by one or more hairs that are distinctly secondary; we find the primary hair accompanied by one or more that cannot be distinguished from it, as well as by undoubted secondary hairs, and we find warts and bosses that are quite similar to those of Arctias. We further find various modifications of this, such as the hair-carrying wart being a more or less globular expansion at the summit of a narrow neck. Everything that we have here added to the primary hair is 'secondary.' Another group of secondary hairs (or tubercles) is formed by those that appear to be of precisely the same character as the primary ones, occurring at very definite situations, and differing from the primary ones only in not being of universal occurrence, but nevertheless appearing in species of widely different groups in the same situations. Of these, the plumes present several examples, especially those on two tubercles posterior to the spiracles on the abdominal segments of many species. The third class of secondary hairs are those distributed over the general skin-surface, without special reference to the tubercles proper, and often, apparently, in quite a haphazard and entirely asymmetrical manner."

With regard to the character of the primary tubercles (i, ii, iii, iv, v and vii) it is to be noted that they vary from simple single-haired chitinous buttons to complicated warts. Above the spiracles are three primary tubercles on each side, which are called i, ii and iii, and there are also two minute points which are probably of as generalised a character as are the primary tubercles, a very minute one, close to, and in front of, the spiracle, which may be called A, and another, very minute, in front of ii, which may be called O; i and ii are, as usual, situated as anterior and posterior trapezoidals, i nearer tne central line; iii is supraspiracular. The position of the primaries iv and v, is below the spiracle, where they are placed not only pretty close together, but usually on the same plate or forming a conjoined wart. In the Agdistid larva they are rather more widely apart, nearly at a level, with a distinct tendency in some species for the posterior, iv, to be the higher, whilst in the Alucitid larvæ the anterior, v, is always above the posterior iv (at an angle one to the other of about 45° to the larval resting-place). Besides these are vi (appearing after the first moult, and not a primary tubercle) and vii, below each other, and beneath iv+v, and there are, besides, one (or two) other accessory, post-spiracular groups—B_1 and B_2*, towards the back of each abdominal segment. The addition of extra hairs to the primary tubercles change them, in many species, into highly-specialised tubercular warts, and there appears in the larval tubercular structure of the Alucitids to be every intermediate stage in these tubercles between a single-haired tubercle and a very complicated many-haired wart. The only sub-primary tubercle present, on the abdominal segments, is vi; this is

* Dyar's iii*a* and iii*b* (*infrà*).

not present in the newly-hatched larva, but appears in the second instar and remains throughout larval life, often undergoing similar development to the primary.

In addition to the subprimary tubercles, there are, in a certain section of the plume larvæ, accessory tubercular hairs, that are to be found (1) Posterior to the spiracles, B_1 and B_2, (2) Behind the dorsal warts of the meso- and metathorax. These are certainly not present in the first instar, and not always developed in the second, but are to be found in the third or fourth instars in those species that develop them. In rank they are inferior to the subprimary setæ, and are, when developed, easily differentiated from the scattered secondary skin-hairs, for they are usually mounted on a raised skin area, after the manner of the primary and subprimary tubercular setæ, and like these may be developed into warts. Occasionally one or other of the areas, in which they are usually developed, gives rise to a small group of little hairs. The postspiracular accessories consist of two groups—(*a*) On the flange, slightly lower than the spiracle in level$=B_1$, (*b*) Rather above the spiracle in level$=B_2$. In some species the upper one only is developed, in others, only the lower, whilst a number of species have both, although one is then usually weaker than the other, the lower being usually less wart-like than the upper.

The modification of the primary and secondary tubercles into warts, in some species, is very remarkable. From the simple chitinous-based seta of *Platyptilia gonodactyla*, to the many-haired wart of *Capperia heterodactyla*, is a far cry, still farther to that of the beautiful warts of *Porrittia galactodactyla* and *Alucita pentadactyla*. There can be no doubt that there is a close connection between the character of the tubercles and the environment, and that whilst the internal-feeders have their primary and secondary tubercles reduced to the simplest forms, those of the external-feeders, varying, however, in degree, have the most complicated structures. The warts are essentially formed of the primary spiculated seta, surrounded by a number of short, smooth, bulbed secondary hairs,* very similar to the ordinary surface-hairs. The peculiar excrescences in Agdistid larvæ are, however, somewhat different in structure, the basal area, and not the hairs borne thereon, being the most modified. The hornlike processes of *Adactylus bennetii*, developed on the prothorax and 9th abdominal segment, are to be compared carefully with those of the other Agdistid larvæ (described *posteà*). In this species the prothoracic horns are extended forward over the head, and the caudal horn rises from the 9th abdominal segment, the whole *ensemble* of the larva being that of a miniature Sphingid. It is to be noted that the caudal horn does not rise from the 8th abdominal, as in the latter, the setæ of i and ii of this segment being in front of the horn, and in their correct position with regard to the spiracle.

In the Alucitid larvæ, the primary tubercular hairs are usually

* Somewhat similar hairs, with expanded tips, are not uncommon in other superfamilies of lepidoptera. Packard states (*Bombycine Moths of North America*, p. 12) that the Alucitid larvæ are spiny, and their peculiar excretory setæ, the "Drüsenhärchen" or glandular hairs of Zeller (*Linn. Ent.*, vi., p. 356) are similar, as Dimmock has observed, to the glandular, or long, hairs of plants; Miss Murtfeldt adding (*Psyche*, iii., p. 390) that "there is a very close imitation in the dermal clothing of the larvæ of *Leioptilus sericidactylus* to that of the young leaves of *Vernonia*, on which the spring and early summer broods feed."

long, pointed and tapering, finely spiculate along their shafts, whilst the secondary hairs are usually short, smooth, and somewhat clubbed at their tips, and, as we have noted, they surround the primary tubercular setæ when the tubercles are modified into wart-like structures. In some cases the primary hairs take on the smooth, clubbed character, usually supposed to be peculiar to the secondary hairs, and are difficult to distinguish therefrom. Apart, however, from the primary and secondary hairs arising on, and around, the tubercular structures, there are a number of secondary scattered hairs, variable in their development, that arise from the general skin-surface, apparently quite independently of the tubercles, and more or less irregularly, although usually more frequent in those parts that appear to want protection, and where there would appear to be a special stimulus to their growth. They may thus vary from a few irregular scattered hairs to an evenly-distributed coat, occupying the greater part of the skin-surface. They would appear to form a somewhat generalised feature, for they are found in all the Platyptiliine larvæ (except *Fredericina calodactyla = zetterstedtii*), whilst only the Merrifieldiid tribe of the Alucitines has them, all the other tribes, represented in Britain, on this side of the plume stirps, being without them. This character alone (apart from other important structural ones) raises *Alucita pentadactyla* and *Porrittia galactodactyla* far above *Wheeleria megadactyla* (*spilodactyla*), *W. niveidactyla* (*baliodactyla*), and *Merrifieldia tridactyla*, with which they have long been generically grouped, the three last-named presenting these secondary hairs (although they have almost disappeared in *M. tridactyla*), whilst the others are without them. Chapman further notes (*in litt.*) that, in the Platyptiliine larvæ (except that of *F. calodactyla* which has none), the secondary hairs are a kind of glorified skin-points—short, conical, without jointed base, and evenly distributed over the whole surface; in nearly all others the secondary hairs are *hairs*, and have limited and special distribution. The Stenoptiliids (as represented by *Adkinia bipunctidactyla*) are the most like Platyptiliids, but the hairs are clubbed. It is not surprising that, as soon as these characters were recognised, they should be utilised to get a wider view of the relationship of the Alucitids *inter se*, than that presented by a study of the imagines. Hofmann published (*Die deutsch. Pterophorinen*, pp. 12 *et seq.*) a somewhat detailed description of the larval tubercles, but grouped the larvæ on the superficial character of form into five types, which he described as follows :—

1. Larvæ of compressed form, short and thick, back little arched, attenuated in front and behind, with a small retractile head, and scarcely noticeable lateral flange—EUCNEMIDOPHORUS.
2. More elongated form, not unlike certain Tortricid larvæ – OXYPTILIDI.
3. Markedly shortened forms, back strongly arched, resembling certain dipterous (*Trypeta*) larvæ—ADAINIDI.
4. Larvæ compressed from above downwards, flat, with a strongly developed lateral flange ; rests closely appressed to the leaves of the foodplants—PORRITTIA.
5. Larvæ furnished with tall fleshy humps—AGDISTIDES.

He adds (*op. cit.*) a detailed note on the structure of the skin and its armature, distinguishing between the tubercular setæ and warts, and the hairs on the general body surface. He particularly notes the ventral warts, which he says " stand on both sides of the median line of the venter only on those segments unfurnished with legs, and are very small and simple, rarely double." He further remarks the change that occurs in the tubercles in the various stadia of certain Oxyptilids, *e.g.*, he observes that, "in the young larva of *Oxyptilus tristis*, they are small and single-haired, whilst in the fullgrown larva they are large and stellate-haired." He follows Schroeder in his nomenclature of the longitudinal lines, calling them respectively—dorsal, subdorsal, supraspiracular, spiracular, basal and subbasal stripes.

Dyar also made some suggestions in this direction (*Ent. Rec.*, xi., p. 40, pl. i., figs. 1-6) and gave the following table:

I. Warts present—hair-tufts instead of single tubercles.	
1. Secondary (*i.e.*, single scattered) hairs also present. Warts i and ii united (pl. i., fig. 1) .. Type 1.	TRICHOPTILUS* (*lobidactyla*).
2. No secondary hairs, though small secondary warts (iii*a* or iii*b*, or both iii*a* and iii*b*) may be present.	
a. Warts functional (pl. i., fig. 2) .. .. Type 2.	ALUCITA† (*lithodactyla*).
b. Warts degenerate (pl i., fig. 3) .. .. Type 2.	PTEROPHORUS‡ (*kellicotti*).
II. Warts absent—primary hairs single.	
1. Secondary hairs present, iii*a* somewhat more distinct than the others (pl. i., fig. 4) .. Type 3.	PLATYPTILIA§ (*rhododactyla*).
2. No secondary hairs, all tubercles primary (pl. i., figs. 5 and 6.) Type 4.	MARASMARCHA‖ (*microdactyla*), ORNEODES (*hexadactyla*).

Dyar makes the further remarks that (1) *Trichoptilus* has the same structure as *Oxyptilus*, and (2) Type 1 is the highest and Type 4 the lowest in degree of specialisation.

Dyar's grouping calls for many remarks. The union of the larva of *microdactyla*, in some respects the most highly specialised Alucitid larva, with *hexadactyla*, the type of the Orneodids, a quite distinct superfamily, discounts the grouping at once. The specialised degradation of warts in *Adaina* has nothing in common with the typical tubercular Orneodid larval structure. One observes, however, that on this slender material, Dyar has obtained the essential larval structures which distinctly upset Meyrick's suggested phylogeny (*Handbook*, p. 430), and support that of Hofmann. In our system his Type 1 is Platyptiliine; Type 2 (both forms) is Alucitine; Type 3 is Platyptiliine; Type 4 is also Platyptiliine. *Orneodes* is of course quite outside the superfamily.

Hofmann followed up (*Zeits. für Ent.*, iii. pp. 129 *et seq.*) his previous work, with a paper "Ueber die Anordnung der borstentragenden Warzen bei den Raupen der Pterophoriden," with an illus-

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* *Trichoptilus*, as here used, is evidently a very near ally, if not identical with, *Oxyptilus*. *Trichoptilus*, as used in Britain for *paludum*, has a somewhat different structure. We place *paludum* in *Buckleria*.

† *Alucita* here of course equals *Oidaematophorus*, Wallengren.

‡ The descriptions of the larva and pupa of this species (Fernald, *Pteroph. North America*, pp. 46-47) suggest that this species belongs to the Leioptilids, possibly to *Hellinsia*. The larva has certainly nothing in common, except that both are Alucitine with that of *monodactyla*, with which Fernald and Dyar place it.

§ This genus is of course *Eucnemidophorus*, Wallengren.

‖ The genus (*Adaina*) to which *microdactyla* belongs, is Alucitine, *Marasmarcha* is Platyptiliine.

trative diagrammatic plate, on which the tubercles* of a typical abdominal segment of the adult larvæ of *Eucnemidophorus rhododactyla* (fig. 4), *Aciptilia*† *tetradactyla* (fig. 5), *Leioptilus carphodactylus* var. *buphthalmi* (fig. 6), *Oxyptilus leonuri* (fig. 7), *Platyptilia gonodactyla* (fig. 8), and *Leioptilus distinctus* (fig. 9) are exhibited. He also shows a typical abdominal segment in the 1st larval stadium of *Pterophorus monodactyla* (fig. 12), etc. His figures, at any rate, broadly support his grouping, based on general characters. He further figures the tubercles of a thoracic segment of *Stenoptilia pelidnodactyla* (fig. 10), and of *Platyptilia gonodactyla* (fig. 11). His details of the Alucitid larval tubercles (*op. cit.*, iii., pp. 151 *et seq.*) are worthy of study.

We are indebted to Bacot and Chapman for the tabulation embodying the chief larval characters inserted here on separate sheet.

The fullfed larva, in preparation for pupation, rarely spins a definite cocoon, although this is done in the case of certain Platyptiliids, *e.g.*, *Platyptilia gonodactyla* and *P. isodactylus*, and also by at least one of the Leioptilids, *viz.*, *Adaina microdactyla.* Generally, however, the pupa is quite exposed, a silken pad alone being spun by the larva, into which the cremastral hooks are later fastened. Chapman gives (*Entom.*, xxxiii., pp. 82 *et seq.*) a most interesting account of the pupal suspension of the Alucitids. They may be suspended in all attitudes, *e.g.*, with the head upwards or downwards, on a vertical surface, the dorsum downwards under a horizontal one, etc. The suspension is made by the cremaster only, there is no silken belt, and the attachment is made to a silken pad by means of the cremastral area, consisting of two portions, a forward portion on the 8th abdominal segment, and a hinder portion on the 10th, the latter, however, stretching forward until the anterior cremastral hooks on the 10th appear to meet the posterior ones on the 8th segment. The larvæ of *Porrittia* (*Aciptilia*) *galactodactyla* pupate beneath a leaf, the pupæ are, therefore, often inverted, and pupation takes place after two days' quiescence. When the moult takes place, the larva holds on by the anal prolegs only, the props of the ventral prolegs standing out stiffly, but with the hooks free from, although touching, the silk.‡ The moulting is done rather rapidly, within about 15 minutes from the first efforts noticed. The rhythmic movements, beginning at the last segments, at first push the abdominal segments, about the 2nd to 6th, forwards within the larval skin, as evidenced by the tracheal threads, very plainly seen through the transparent skin being withdrawn from the pupal spiracles; when the larval skin has passed backwards about one segment, all the abdominal tracheæ are withdrawn more or less, the first not quite a full segment's length; the thoracic segments are

* These must be considered as purely diagrammatic, and none too accurate. Compare Dyar (*Ent. Rec.*, xi., pl. i., fig. 4) with Hofmann's fig. 4 as here indicated.

† Generic synonymy as used by Hofmann retained here.

‡ Chapman writes (*Ent.*, xxxiii., p. 83): "How this happens I did not ascertain. In many Pierids the body hangs arched away from the silken pad, preventing the ventral prolegs from touching it; but I do not know how this is managed in the Pierids, Papilionids, and Lycænids, where the prolegs touch the pad, as they certainly do in *Aciptilia* (*Porrittia*) *galactodactyla.* The anal prolegs hold well, so that they must be managed differently from the ventral ones. It is less difficult to understand how all the prolegs take no hold, as in pupæ in cocoons, etc."

S

R OF IV AND V.	ACCESSORY POST-SPIRACULARS.	CHARACTER OF VI.
Smal d at base. set	Absent.	Single-haired.
litto	Upper one only, and this ill-developed.	ditto
nto a wart.	Both upper and lower present.	Small wart.
litto	Both present, but weakly	ditto

Table of Larval Characters as shown in the last instar of Alucitid larvæ.

(To be bound opposite p. 106.)

	Prothoracic Plate.						Skin-Points.	Secondary Skin-Hairs.	Warts.	Primary Hairs (setæ).	Spiracles.	Relation of i and ii.	Character of iii.	Character of iv and v.	Accessory Post-spiraculars.	Character of vi.
	Azygos Wart.	Markings.	Suture.	Secondary Hairs or Skin-Points.	Hairs.	Depression.										
Adkinia zophodactylus	Absent.	Black mark, dark dots, lenticles.	With dark dots.	None.	Usual six.	Present, dark.	Small, spiny, closely-set, rather linear.	Few in number, patchy, very short, markedly knobbed.	Incipient.	Smooth, blunt, open-topped, slightly knobbed.	Short tubes.	Bases conjoined on thorax, usual trapezoidal arrangement in abdomen, well apart.	About equal to ii.	Conjoined at base.	Absent.	Single-haired.
bipunctidactyla	ditto	Black mark, dark dots, no lenticles.	ditto	Six or seven secondary each side.	ditto	Present, black.	ditto	Numerous, long, slender, very slightly thorned, knobbed.	ditto	Smooth, rather blunt.	ditto	ditto	ditto	ditto	Upper one only, and this ill-developed.	ditto
Stenoptilia pterodactyla (fuscus)	ditto	Black mark, dots, lenticles.	ditto	About twenty-six secondary each side.	ditto	Present, pigmented.	ditto	ditto but fewer in number.	Small warts developed.	Smooth; slightly swollen before pointed tip, ii long, slender and sharp.	ditto	Joined into single wart on thorax; trapezoidals on abdomen, well apart.	ditto	United into a wart.	Both upper and lower present.	Small wart.
Marasmarcha lunædactyla (phæodactyla)	ditto	Black mark, far back, trace of lenticles.	Present.	Several (varying) secondary on hind margin.	ditto	Inconspicuous, rarely pigmented.	ditto	Smooth, very knobbed at tip, still fewer than in *pterodactyla*.	Slightly less developed than in *pterodactyla*.	Smooth, blunt at tip, ii long, slender and sharp.	Short tubes enlarged at base.	ditto	About equal to i.	ditto	Both present, but weakly developed.	ditto
Amblyptilia cosmodactyla (acanthodactyla)	ditto	Black mark, dots, and lenticles.	With dark dots.	Four or five secondary on hind margin.	ditto	Present, black.	Smaller, and more delicate than in *bipunctidactyla*.	Smooth, swollen at tip; less numerous than in *bipunctidactyla*.	Incipient.	Smooth, slightly swollen just below pointed tip.	Short tubes.	ditto	Between i and ii in size.	Conjoined bases.	Both present, lower weak.	ditto (two hairs only in 3rd skin)
Eucnemidophorus rhododactyla	ditto	Absent.	Present.	None.	ditto	Apparently absent.	Small, chitinous points.	Numerous, scattered, very short and thick, knobbed tips.	No warts.	Smooth and tapering, ii truncate, blunt.	Quite low.	Bases conjoined, or nearly so, on thorax; trapezoidal, on abdomen, well apart.	Usual strength.	ditto	Both positions occupied by greatly-developed secondary hairs.	Single-haired.
Gillmeria pallidactyla (bertrami)	ditto	Coloured patch.	Skin points, suture indistinguishable.	No hairs, skin-points.	ditto	Some tinting.	Fairly developed, a certain proportion are enlarged and noted in next column.	Not true hairs. Very numerous, short, thick, tapering to point.	No warts.	Smooth, short and tapering.	Quite low, truncated cones.	Bases near, in transverse line on thorax, trapezoidals on abdominal, well apart, but bases more chitinous.	Like i or ii.	Separate bases.	Absent, no enlarged secondaries.	Two-haired.
ochrodactyla	ditto	Trace of colouring and of lenticles.	ditto	No hairs, skin-points.	ditto	Faint puckering.	ditto	ditto, but rather longer.	ditto	ditto	ditto	ditto	ditto	On one plate.	Absent.	Two- or three-haired.
Platyptilia gonodactyla ..	ditto	Coloured patches, several lenticles.	Present.	None.	ditto	Tinted and puckered.	ditto	Generally slender and fairly long.	ditto	Hairs medium, shorter than in *pallidactyla*.	ditto	Bases united on thorax, well apart on abdomen.	ditto	ditto	ditto	Generally two accessory, but sometimes only one and even four.
isodactylus	ditto	ditto	Marked.	None.	ditto	Present.	Comparatively weak.	Wanting on pale areas.	ditto	Slender; shorter than in *gonodactyla*.	ditto	ditto	ditto	ditto	ditto	One or two accessories.
Fredericina calodactyla (zetterstedtii)	ditto	ditto	Present.	None.	ditto	ditto	Fairly developed.	None.	ditto	ditto	A little higher than *gonodactyla*.	ditto	ditto	ditto	ditto	Two-haired
Buckleria paludum	ditto	Faint dark mark.	ditto	None.	ditto	Pigmented spot at position of.	Fine rather linear.	None.	ditto	Smooth.	Low tubes.	Conjoined on thorax; almost so at base on abdominals.	Between i and ii in size.	Rather apart, but on same plate.	Absent.	Single-haired.
Capperia heterodactyla (teucrii)	ditto	Doubtful dark mark.	With dots.	Secondary abundant.	ditto	Absent.	Strongly developed.	Numerous and scattered, tips knobbed, not thorned.	Strongly developed.	Smooth, blunt, slightly bifid tips, some sharp.	Tube of medium height.	United into single many-haired wart on thorax and abdomen, 2 specially long hairs.	Wart nearly equal to i+ii.	Conjoined into single wart.	Groups of enlarged secondary skin-hairs not forming strong warts.	Small wart.
Oxyptilus parvidactyla ..	ditto	Dark mark and dots.	Distinct with dots.	None.	ditto	Dark mark.	Well developed.	None.	Single hair.	Smooth, slender, sharp.	Conical.	Close together but not united.	Single long hair.	Close, but not conjoined.	Absent.	Moderate hair.
Wheeleria megadactyla (spilodactyla)	Present.	Not visible.	Faint suture with dots.	Secondary abundant.	Fringe in front, five warts.	Depressed black spot.	ditto	Rather fine and slender, knobbed at tip, fairly numerous and scattered.	Wel developed and raised, skin area chitinised.	Edges slightly serrated (not thorned), tip pointed.	Medium tall tubes, tapering upwards from base.	†Large compound wart on thoracics, trapezoidally placed warts well apart from each other on abdominals.*	Large wart, equal to i or ii.	Compound wart.	Both present, the upper a small but well-defined wart.	Wart, two hairs, other smaller ones.
baliodactyla	ditto	ditto	Not visible.	Many secondaries.	Six hairs distinct, but with many secondaries.	Apparently absent.	ditto	Variable in size, knobbed at tip, very few, restricted to thorax and lateral area of abdominal segments.	Well developed, with a larger chitinised skin area than in *spilodactyla*.	Edges more markedly serrated than in *spilodactyla*, but not thorned	Hardly as pronounced as in *spilodactyla*, but of same type.	†Large compound wart on thoracics, bases adpressed but not united in abdominals.*	ditto	ditto	Both present as warts, the lower the larger and better-defined wart.	Wart, two strong hairs, others smaller.
Merrifieldia tridactyla (tetradactyla)	ditto	ditto	Not visible.	Some broad, tipped secondaries.	Front fringe, five warts.	Apparently present.	Rather coarse chitinous points.	Very few, chiefly on thoracics and beneath, expanded at tip.	Well developed.	Well-marked serrations on hairs. Rather blunt.	Medium tall tubes tapering upwards from base.	†Large compound wart on thorax; bases apart in abdominals,* by intersegmental incision.	ditto	ditto	*Both present as warts, the lower the larger.*	One strong hair, *many smaller hairs.*
Oidæmatophorus lithodactyla ..	ditto	ditto	Not visible, but black dots present.	None.	ditto	Absent.	Very fine.	Absent.	Well developed.	Thorned (not serrated), tapering to point.	Low down.	†Large conjoined warts on thoracics; near, but separate, on the abdominals.	ditto	ditto	Both present and weak, the lower the stronger.	Large wart, three strong hairs.
Emmelina monodactyla	ditto	ditto	Not visible.	None.	ditto	Absent.	ditto	ditto	ditto	Coarse, irregularly serrated (rather than thorned), bifid at tips, not evenly pointed.	Rather more raised.	†Large conjoined warts on thorax; trapezoidally placed on abdominals, but not far apart.	ditto	ditto	Rather weaker than in *lithodactyla*.	Small Arctiid-like wart, three or four strong and five weak hairs.
Leioptilus tephradactyla ..	ditto	ditto	ditto	ditto	ditto	Absent.	Fine and rather weak.	ditto	Fairly developed.	Thorned, very fine serrations also; large hairs pointed.	Not much raised.	†Conjoined on thorax; but with subsegmental incision between abdominals.	Single hair.	Large compound wart, which with the accessory forms a fan of hairs.	Lower only, developed into wart of medium size.	Single fan wart.
Ovendenia septodactyla (lienigianus)	ditto	ditto	ditto	ditto	ditto	Absent.	Fine and pale.	ditto	ditto	Large thorns, serrations not noticeable.	Raised into tall tubes.	†Conjoined on thoracics; trapezoidal but quite close on abdominals in same longitudinal line, i smaller.	Small weak wart.	Large compound wart.	Lower only, a weak wart.	Small wart, moderate.
Adaina microdactyla	Absent.	ditto	Present.	Points as small plates.	Usual six.	Absent.	Coarse and dense, forming small plates dorsally.	ditto	None developed.	Simple hairs, pointed.	Somewhat raised, prothoracic and 8th abdominal conspicuous.	Slightly trapezoidal on thoracic, widely separated on abdominals.	Single hair (an additional minute hair near).	iv separated from v, v very weak.	Absent.	Single hair, two moderate accessories.
Hellinsia osteodactyla	ditto	Two small lenticles.	ditto	ditto	Three behind, four in front row.	Absent.	ditto	ditto	ditto	ditto	Slightly raised.	ditto	ditto	v weak.	Absent.	Good hair, several moderate accessories near.
Porrittia galactodactyla ..	Present.	Not visible.	Not visible.	None.	Fringe and five warts.	Absent.	Very fine, and transparent.	ditto	Well developed and regular.	Pointed and serrated, not thorned.	Tall.	†Conjoined on thorax; bases almost touching on abdominals.	With numerous hairs but weak.	Conjoined wart greatly developed.	Lower only, below level of spiracle, half size of iii.	Well-developed wart.
Alucita pentadactyla	ditto	ditto	Faintly seen.	ditto	Twelve to sixteen in fringe, others behind.	Absent.	Extremely minute and weak.	ditto	Strongly developed.	Pointed, minutely thorned or strongly serrated.	Much raised.	†Conjoined on thorax; trapezoidal but close together on abdominals, ii small.	Larger than i or ii, nearly equal to iv+v.	Conjoined wart.	Absent.	Modest wart.
Pselnophorus brachydactyla ..	ditto	ditto	Not visible.	ditto	Fringe and five warts.	Absent.	None.	ditto	ditto	Pointed, slightly thorned, bifid tips.	Very tall.	Conjoined on thorax, trapezoidal fairly separate on abdomen, but variable, secondaries very weak. ii and iii about equal.	Stronger than i or ii.	Large conjoined wart.	Lower present, directly behind iv and v.	Fan wart.

* In these species the trapezoidal tubercles are conjoined (or all but conjoined) in the younger larvæ of *tetradactyla* and *megadactyla* (*spilodactyla*), but, in the last instar, they are definitely separate, there being between them a strip of spiculated skin-surface. The observation requiring a good deal of care, and our materials being defective, we are not prepared to say more than that the same conditions probably obtain in *baliodactyla* and some others. We are fully aware that this separation of tubercles in the last instar, after being conjoined in the earlier ones, is an unusual and remarkable phenomenon (Bacot and Chapman).

† In these there are accessory tubercles behind i and ii on thorax.

now crowded forwards, and the stretching of the larval skin raises the front part of the larva from the surface in a curve. Shortly it is seen that the anal segments of the pupa still occupy those of the larva, and the skin, as it is pushed backwards, gathers in a roll on the 8th abdominal segment. The skin splits dorsally down the head and thoracic segments, but not quite to the hind margin of the 3rd one. The uncoiling of the antennæ from within the larval head is easily seen. The crest of hairs on the pupal wing enables it to be seen occupying its own segment in the larva, and rapidly expanding as it assumes its pupal direction and position : When once the skin splits it slips back rather rapidly, and one has to be alert to see what is happening ; it continues to form a roll round the 8th abdominal segment. Just before the posterior margin of the opening reaches here, the 9th and 10th segments are seen within the larval skin to be actively directing the extremity of the pupa dorsally, and pushing the dorsal part of the roll of larva-skin backwards; the pupal extremity thus curls forwards, with a definite step at each vermicular movement, and, before one quite expects it, it appears through the opening dorsally. It is not the stiff spike one knows in the mature pupa, but contorts itself as actively as the same segments in the most lively Tortricid or Tineid larva, bending not only at the incisions of the segments, but in their length. It then stretches and pushes over the side of the larva-skin, and reaches the silken carpet ; the remainder of the pupa then leaves the larva-skin and pushes it away.* The larval skin accumulates round the 8th abdominal segment and ventrally remains there, whilst dorsally, as noted above, it is pushed further back by the 9th and 10th segments, which thus escape from the dorsal slit in the larval skin, and find the silken pad to which the cremastral hooks on the 10th abdominal segment become fixed . . . . The cremastral hooks on the underside of the 8th abdominal segment, which, like the anal ones, are already stiff and chitinised, stand out like a brush and form an obstacle to the further progress of the larval skin backwards. One specimen, arrested at the critical moment when the cremaster was freed, had these hooks in a sort of pocket of the larval skin, of which the anterior lip was the roll of larval skin, the posterior the margin of the slit in the larval skin, and in some degree the roll of dorsal skin behind this and the inside of the bases of the anal prolegs of the larva. It has been noted that the last segments are very soft and mobile ; and the undersurface of the 8th abdominal, being sharply curved and made very convex by the dorsal movements of the 9th and 10th, spreads the cremastral hooks of its armature in a radiating manner, so that, taken together, they form a sort of knob in the pocket of larva-skin, and hold the pupa firmly and safely. It is evident that, when the end of the pupa seizes the pad of silk and the pupa then straightens itself, the radiating hooks will fall together and easily free themselves from the pocket. There is, however, a second string to the bow. One

* Chapman notes (*loc. cit.*, p. 84) : "The larva of *A. galactodactyla* has many stiff hairs, and it seemed that the larva, when inverted, maintained its position, and did not swing free, like a Vanessid, by the pressure of the hairs of the last segments posterior to the prolegs, against the surface of suspension. This does not explain, however, how the problem is met in the smoother larvæ, if, indeed, these do assume so difficult a position. *Agdistis*, for instance, takes usually a vertical attitude with head downwards."

pupa was so interfered with that it did not secure a grip with the hooks of the 10th abdominal, and then got the hooks under the 8th from their pocket; the pupa, nevertheless, did not fall, but was sustained by the adhesion of the thoracic larval skin to the front of the 5th and 6th abdominal segments, and was so sustained for a considerable time till the pupa reached the silk. It did not, however, do so very satisfactorily, and the hooks of the 8th segment failed to get a proper hold. It would seem that the proper use of this adhesion is to increase the pressure of the hooks of the 8th abdominal against the margin of the pocket, and, after the terminal hooks are engaged in the silk, to steady the pupa, whilst those of the 8th segment are freed from the larva-skin and fixed on the silken carpet.* We may here add that, different as are the Agdistid larvæ from those of other Alucitids, the pupæ are suspended in the same manner as those of all other Alucitids, *i.e.*, by the two cremastral groups, one of which is terminal, the other under the 8th abdominal segment. It is true the real place under 8 is difficult to make out, but seems to be the same in all.

The plume pupa is remarkable for its slenderness, the great length of the second and third pairs of legs, which are quite free from the abdominal segments, and which stand out, when it throws back the head and thoracic segments till the head is directed backwards, as it does when disturbed. Its general characters are very constant throughout the group, and are quite *sui generis*, so that there can be no doubt as to an Agdistid or Alucitid pupa when one has once observed its peculiarities. It is highly specialised, yet retains several of the most definite characters of the more primitive form of "the pupa-incompleta," *e.g.*, the ♂ pupa has four (4-7) free abdominal segments, and the ♀ three (4-6),† yet it is so attached as to be incapable of progression, being fixed by a cremaster that is developed on the 8th and 10th abdominal segments, the only other pupæ so far described, attached in this manner, being *Hypercallia* and *Anchinia*, which, however, are obtect pupæ of comparatively high type, and in no way related to the Alucitids. The Alucitid pupa has scarcely any capacity for lateral movement, yet it can bend itself completely over, so that the head points directly backwards.

As to the actual structure of the pupa, it is to be noted that it has a wide prothorax, no maxillary palpus, the antennæ and maxillæ adhere to the small frontal headpiece, separating from the other parts on dehiscence, the eyecovers going with the dorsal headpiece. The pupa

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* Chapman adds (*loc. cit.*, p. 85): "In *Hypercallia* and *Anchinia* the method of pupal suspension is precisely the same as in the Alucitids (Pterophorids), and, in these, the anal hooks are supplemented by some on the ventral aspect of the 8th abdominal segment in like manner. There can be little doubt that their use is the same as in the Pterophorids, both to secure safety at the time of moult and stiffness in the pupal position afterwards. Are these instances of the separate origin of complex apparatus and functions, in unrelated species, or is there any possible relationship? The pupæ are certainly otherwise so very different that such relationship must be distant."

† Chapman observes that the number of free segments of the pupa, being four in the ♂ and three in the ♀, agrees with that in the Tortrices. This, however, is not to be considered as evidence of near relationship, but only as implying that both have reached the same stage of pupal evolution, still it leaves it quite possible that such relationship does exist.

possesses a very special and elaborate set of terminal hooks, supplemented by a separate little group on the 8th abdominal segment, by means of which it fixes itself to a little pad of silk, and has thus acquired a habit which no other generalised pupa presents, *viz.*, it attaches itself by this cremaster and has no power of progression, although it may be noted that the peculiar cremaster of the Alucitids, consisting of an anal and a forward portion, is paralleled in *Elachista* and *Yponomeuta*, although it does not seem to indicate an alliance, whilst *Hypercallia* and *Anchinia* have the same habit of pupal attachment.

There is great variety in the surface of the pupa, some pupæ being quite simple and smooth, with a plain and delicate pupal skin, *e.g.*, *Adkinia zophodactylus*, others have various elaborate hooks, processes, and recurved spines, *e.g.*, *Marasmarcha lunaedactyla* (*phaeodactyla*) and *Amblyptilia cosmodactyla* (*acanthodactyla*), whilst yet others have a most confusing panoply of hairs, *e.g.*, *Wheeleria megadactyla* (*spilodactyla*). On the whole, the first two forms appear to belong to the Platyptiliine, the last to the Alucitine, side of the stirps. Apart from the thorough-going micro characters of the Alucitid pupa, it is separated not only from *Orneodes*, but also from *Chrysocorys*, by the extreme reduction of the dorsal headpiece. So reduced is this that its presence would be doubted in some species, but that, as stated above, it carries with it the eyecovers, as in typical micro dehiscence (Chapman).

The pupa, in other ways, affords many characters that are most unusual in lepidopterous superfamilies, although here and there paralleled, perhaps, in groups with which the Alucitids can have no really near relationship. Some of the most important of these points are: (1) The remarkable manner in which the larval tubercles are carried over into the pupal stage. In this particular the tendency is even greater than that exhibited in certain Lymantriid moths. (2) The carrying over of the peculiar raised larval spiracle to the pupal stage; sufficient variation, occurs in this to make it possibly of classificatory value. (3) The constancy with which certain transverse striations or corrugations are developed, more particularly on the dorsum of the larger abdominal segments. These also are subject to considerable modification, and are undoubtedly of classificatory value. (4) The mode of attachment of the pupa by the anal segment, supported by special development of the 8th abdominal segment. (5) The relations existing between the simple form of the larval and pupal tubercles and the larval habit of feeding within the foodplant, whilst connected with this are the cocoon-forming habits of *Eucnemidophorus rhododactyla*, *Platyptilia gonodactyla*, *Adaina microdactyla*, etc. (6) The presence or absence of hair-fringes on the wing-nervures and antenna-cases of the pupa. (7) The occurrence of secondary hairs (other than the primary tubercular hairs) on certain pupal areas, the corresponding areas of the larva not possessing hairs. These may not be true hairs, but dermal developments related to the hornlike processes developed in some of the pupæ from the general skin surface. (8) The development of dorsal and lateral ridges, either by the structural development of the dermis, or by the spreading of the hairs into a fan lying in a single plane. The classificatory value of these may be great; the lateral ridges are apparently more stable than the dorsal, and possibly of greater value. It is remarkable that those of *Porrittia galactodactyla* with, and *Alucita pentadactyla* without, these, would be sufficient, apart from other characters, to put them into different sections, although they have so long been included in the same genus. One surmises that pupal colour is of little classificatory value, and is more or less the result of response to environment, as most of the better-known species show a considerable range of variation. Even the spring larvæ of *Platyptilia gonodactyla*, which can be looked upon as internal-feeders, produce pupæ which exhibit a wide difference in the intensity of the colour and markings, as may be seen by reference to our detailed description of the same.

The Alucitid pupæ then fall roughly into two groups, the "smooth" and "hairy," the former being essentially characteristic of the Platyptiliine group, the latter of the Alucitine. The only marked exception is that *Capperia heterodactyla* (*teucrii*), towards the top of the former group, has a pupa that is so far specialised in the matter of hairs as not to be unlike that of *Alucita pentadactyla*, one of the most specialised of the latter. The characters derived from the other stages lead one to assume that this must be due to parallel development rather than any really close relationship. It must not be overlooked that *C. heterodactyla* is quite external in its larval and pupal habits.*

The Stenoptiliid pupa, as represented by *Adkinia zophodactylus*, is an extremely filmy delicate pupa, with the tubercles i-vii arranged in somewhat generalised form, each bearing a single minute clubbed baton-like hair. This pupa varies much in colour from green to deep red, as well as in the way in which these tints are combined, probably related to the position of the pupa on the stem or amongst the flowers of its foodplant. It is almost invariably inverted. It shows clearly the double dorsal flange (from prothorax to ii of 3rd abdominal) which is so marked in *Platyptilia*, and wanting or only to be found by some constructive looking for in most "hairy" pupæ.

In many respects *Marasmarcha* is closely allied to the Stenoptiliids, but in its pupa it is exceedingly remarkable, a highly-specialised dorsal ridge being present, and showing almost the same characters as in *Amblyptilia;* the ordinary tubercles are black and single-haired; the trapezoidals are well-developed on great halbert-shaped spines, a longitudinal ridge running down them to the 3rd abdominal; the spines are part of this ridge, and the tubercles are on the spines, but are not the spines. It would appear on pupal grounds that a close alliance exists between *Marasmarcha* and *Amblyptilia*. In the pupæ of both British species of *Amblyptilia* there is a highly-developed double dorsal ridge, lofty on the mesothorax, and passing down and culminating in a great hooked process (that carries the dorsal tubercles) on the 3rd abdominal segment, the hook being more marked in a forward direction in *A. cosmodactyla* (*acanthodactyla*) than in *A. punctidactyla*.

In spite of the exceptional hairiness of the pupa of *Capperia heterodactyla* (*teucrii*), it affords strong evidence that the Oxyptilids are not far removed from the group just considered, the pupa presenting a

* The distribution of pupal hairs and the development of the tubercular structures, considered alone, give some curious results. They tend to associate *Alucita pentadactyla*, *Emmelina monodactyla*, *Wheeleria megadactyla* (*spilodactyla*), etc., with *Capperia heterodactyla;* whilst *Leioptilus tephradactyla* and *Porrittia galactodactyla* are very similar.

strong longitudinal ridge as far as, but not beyond, the 3rd abdominal segment, but it is continued by the dorsal tubercles (i and ii) on the other segments, the hairs on the tubercles being arranged throughout in a fan-shape in a vertical antero-posterior plane. The Oxyptilid pupæ are more varied than those of any other group, or rather they include or combine characters that seem distinctive elsewhere, even to the extent of being characteristic as distinguishing Platyptiliine from Alucitine pupæ. The dorsal flanges (thorax to 3rd abdominal) are usually well-marked; some species are absolutely without secondary hairs, others have them on the wing-covers as markedly as in any Alucitines; several species have the dorsal tubercles raised as humps or spines that are not very different from those of *Amblyptilia* (*cosmodactyla*) and *Marasmarcha* (*lunaedactyla*). The pupa of *Capperia* (*heterodactyla*) reminds one of such a pupa as *Wheeleria megadactyla* (*spilodactyla*), whilst that of *Buckleria* (*paludum*) is not remotely different from *Eucnemidophorus* (*rhododactyla*), yet, imaginally, *B. paludum* is furthest from *E. rhododactyla*, from which such species as *Oxyptilus didactyla* are (imaginally) much less distant.

The pupa of *Eucnemidophorus rhododactyla*, shows the laterodorsal ridge carrying the combined trapezoidal tubercles, each with two hairs, one directed forwards and one backwards, whilst the setæ of iii, iv+v (double), vi and vii are also present. With the true Platyptiliids (*sens. strict.*) we find the smoothest pupæ; in that of *Platyptilia isodactylus** the tubercular hairs are microscopic, but longer than in the other species and are true pointed hairs, as also are the very minute ones of *Fredericina calodactyla* (*zetterstedtii*). On that of *Gillmeria pallidactyla* (*bertrami*) they are equally small, but are baton-like as in *Agdistis*, but, to the naked eye, it is as smooth as an Agdistid pupa; in that of *P. gonodactyla* also, there are no setæ except the minutest microscopic ones. The pupa of *Gillmeria pallidactyla* is so smooth that care is required to avoid concluding that the tubercular bristles are absent. The pupa of *Platyptilia isodactylus* and *P. gonodactyla* are peculiar in having no cremastral hooks on the 8th abdominal segment, correlative, no doubt, with their cocoon-making habits. *Gillmeria pallidactyla* (*bertrami*) and *G. ochrodactyla* have cremastral hooks on the 8th segment. The forward portion of the cremaster in these pupæ has the appearance of being on the 9th, and not on the 8th, segment, and to arise, in fact, from the genital protuberance in that segment. (We have not collated these with the pupæ of which we observed the pupal ecdysis.) *Fredericina calodactyla* (*zetterstedtii*) has also forward cremastral hooks (Chapman).

On the other side, we have the Alucitine or "hairy" pupæ, of which that of the "*megadactyla*" (*spilodactyla*) group is possibly the least specialised. The pupa of *Oidaematophorus lithodactyla* is characterised by the development of the hairs arising from tubercles i and ii into the form of a longitudinal fan-structure, set up vertically on the dorsum, a second standing out horizontally and forming a subspiracular fan-ridge by the development of the hairs on iv and v. The pupa of *Orendenia septodactyla* (*lienigianus*) is almost of the same type as that of *O. lithodactyla*; the two dorsal ridges, nearly the whole length of the pupa, support vertical fans, also a similar lateral fan-

* The hairs of this pupa are much like those of the Agdistid pupæ for size.

ridge formed by the hairs along the wing-costa, and the fan-hairs of iv and v are modified into a similar fan development. It is remarkable that the pupa of *Porrittia galactodactyla* is of the same type as that of *Oidaematophorus lithodactyla*, the only differences being that the dorsal tubercles are more distinct, and the hairs arising therefrom not so definitely in a vertical plane, and, therefore, form less distinctly the fan pattern; the lateral (subspiracular, formed of iv and v) fan-ridge is, however, equally well-developed with that of *O. lithodactyla*, the wing-edge having also a strong row of hairs. The pupa of *Wheeleria megadactyla* (*spilodactyla*) has no dorsal or lateral flanges, but there are many secondary hairs, especially along the hind margin of the segments, forming a ridge; tubercle i has two hairs (except on the 2nd and 3rd abdominal segments where it is large and carries several strong hairs); ii is single-haired; iii has two large and other smaller hairs, whilst iv + v forms one circular boss of hairs; hairs are also found on the wings, antennæ and legs. The pupa of *Alucita pentadactyla* is a hairy one, but of an entirely different type from that of *O. lithodactyla*; the tubercles have the hairs disposed in all directions and not fanwise, and iii is an important tubercle. The wings and antennæ have several rows of hairs, and, except the wing-row of hairs, there is no tendency to the formation of a lateral ridge or flange.

As to the evolution of the Alucitid pupa, Chapman notes (*anteà*, ii., p. 96) that the Alucitids are very exceptional in their pupæ. As we have noted, they rarely have a cocoon from which to emerge, and attach themselves by cremastral hooks to a silken pad that is paralleled only in a family with obtect pupæ, *viz.*, that consisting of *Hypercallia*, *Anchinia*, and their allies. They have preserved three free segments, either because they have never had occasion to lose them, but more probably because it enables them to make that remarkable somersault movement backwards, a movement no doubt useful in repelling or frightening enemies. They, as well as the Hypercallias, have cremastral hooks on the 8th abdominal segment, as well as the usual 10th, giving an extended and solid hold of the silken pad, and affording a special means of meeting the difficulties of the pupal moult. The Agdistid pupæ are typically Alucitid in the head sculpturing, in the free segmentation, in the method of attachment, and in dehiscence (the dorsal headpiece carrying the eyes, etc.); they differ, however, in being smooth and very elongated. The Alucitid pupæ, on the other hand, appear always to be short, very blunt forward, and often to be rough. There is a strong tendency to a longitudinal subdorsal ridge in the line of the trapezoidal tubercles, and this carries either bundles of hairs, or great horns of pupal tissue, the former being more common in those species with hairy larvæ, the disposition of the hairs on the larvæ and pupæ being much alike, the horned pupæ being more common in those species whose larvæ have simple tubercles. The pupa is usually fully exposed and generally fixed with its head downwards, although, in some species, it is enclosed in a puparium, *e.g.*, *Platyptilia gonodactyla*, whilst the pupæ of both broods of *P. isodactyla*, and the summer brood of *Adaina microdactyla*, lie free in the hollow made at the end of the tunnels in which they have been feeding. Chapman further adds (*in litt.*) that the important point that the pupal structure brings out, as regards the position of the family, is that the allies of the Alucitids are to be found among those with similar incomplete pupal structures, that it has, for example, attained no higher stage of pupal evolution than the Tortricids and other generalised groups with pupæ-incompletæ.

The imaginal characters are exceedingly important. The divided wings are supposed to form the most prominent character, but there are many "plumes" whose wings are not divided, and we suspect the specialised legs to be as characteristic of the stirps as the wings. The evolution of the wing has not yet been worked out, nor is the material available for such a study, although Walsingham's descriptions and figures (*Ent. Mo. Mag.*, xxvii., pp. 216-8, 241-4, 259-62; *Novitates Lepidopterologicae*, pl. xii.) of "New Genera of *Agdistidae* and *Pterophoridae*" are highly suggestive that among the plumes with undivided wings considerable variety may prevail, and, further, that those with divided wings have developed independently in more than one direction, and that the whole of the undivided-wing species at present known, except that they satisfy the definition that "the wings are not divided," do not all belong to the Agdistids, as Walsingham here suggests, *e.g.*, the genus *Atomopteryx* may be a primitive form of Agdistid, but one feels that *Ochyrotica* and *Steganodactyla* are not in any strict sense Agdistid. Walsingham practically recognises this (*op. cit.*, p. 217), for he notes that "*Ochyrotica*, although it has only seven veins in the hindwings which partake somewhat of the form of those of *Agdistis*, differs widely from it in the form of the palpi, in the possession of bifid scales with which the head is tufted, and in the distinctly spurred and tufted hindlegs, a character found in *Eucnemidophorus*, *Cosmoclostis*, and *Oxyptilus*," and adds that he "cannot but regard it as a connecting link between these genera and *Agdistis*, to which its affinities are more nearly inclined."

It must be assumed that the "divided" has sprung from the "undivided" wing, and, if this be so, we presume that Walsingham's statement that "*Steganodactyla* (*op. cit.*, p. 241) differs from *Agdistis* and *Ochyrotica* in the very distinctly excavate margins of the hindwings, which, unless we are dealing with a separate and parallel line of development, would appear to indicate *a retention of some indication of the lines of fissure* represented in the true *Pterophoridae*," will, in the idea italicised, hardly be accepted, the excavate areas indicating possible future lines of fissure, rather than the retention of indications of actual lines of fissure.

So far as hinted above, the plumes with undivided wings are referable to one of two types. (1) The Agdistid type, well illustrated by *Adactylus bennetii*, and of which *Atomopteryx*, judging by its neuration as figured by Walsingham (*Nov. Lepidopterologicae*, pl. xii., fig. 1), may be a primitive form, although it is most risky to form a critical opinion on the most accurate drawing.* The neuration of *Atomopteryx* is, how-

* It is to be noted that, in 1863, Zeller described a genus *Stenoptycha* (*Stett. Ent. Zeitg.*, 1863, p. 154) for *coelodactyla*, from Venezuela, rightly treating the genus as belonging to the "plume" stirps. Dyar has confused the Pyralid genus *Stenoptycha*, Hein., with this, and wrongly refers *Stenoptycha*, Zell., to the Pyralid stirps (*List North Amer. Lepidoptera* ,p. 430). In 1873, Zeller further described (*Verh. zool.-bot. Ges. Wien*, xxiii., pp. 327-329) the genus *Scoptonoma* for two Texan species *integra* and a closely-allied species, *interrupta*, which he also referred to the plumes. Guenée had already described *contortalis*, from Texas, under the name *Lineodes*, as a Pyralid. These three species Dyar unites in the same genus (*List Nth. Amer. Lep.*, pp. 394-395), and places the latter among the Pyralids.

ever, certainly very primitive. The essential character of the undivided Agdistid wing is the naked fringeless space found on the forewings in the position of the cleft occurring in the more normal members of the group, and the presence of a wedge-shaped area much more sparsely scaled than the rest of the wing, the area being formed by a line drawn from the apex of the wing to the base of the median nervure, and another from the base to the outer margin (at about one-half between the apex and anal angle). (2) The Platyptiliid type as illustrated by *Ochyrotica* and *Steganodactyla*.

On the other side, we have the genus *Heptaloba* (*Ent. Mo. Mag.*, xxi., p. 175), described for the Cingalese species *argyriodactyla*, in which the forewings are divided into two lobes to beyond the middle of the wing, the anterior and posterior lobes being then subdivided, the upper to half, the lower to more than half, its length, the fringes of the topmost division of the upper lobe running to a point at the apex, those of the three other divisions ending more abruptly. Walsingham says that it appears to be allied to *Amblyptilia*, having the first pair of spines on the hindlegs equal to each other in length as in that genus. *Deuterocopus*, created (*Linn. Ent.*, vi., p. 402) by Zeller, for *tengstroemi*, a Javan species, has three lobes to the forewings, the wings being described as "semitrifid, *i.e.*, bifid with the lower lobe bifid; the hindwings divided into three digits, the third shortened."

The wing evolution in the Palæarctic plumes, is not too simple.* The Stenoptiliids have a cleft forewing, the general form and outline of which is not unlike that of a divided Agdistid wing, the upper and lower lobes having an apical and anal angle developed, and, in this respect, it agrees with the Platyptiliids (*sens. lat.*), in which, however, the apical and anal angles are much more strongly developed, in *Gillmeria* becoming almost falcate in the upper lobe at apex, and in *Amblyptilia*, etc., having the anal angle of the lower lobe specially prolonged downwards; so marked are these characters that one almost suspects an independent development from a form represented by *Steganodactyla* rather than *Agdistis*. The forewing of the Oxyptilids is certainly a Platyptiliid (*sens. lat.*) derivative, specialised in the direction of the first lobe becoming narrowed, somewhat curved at the tip and terminating in a point, without a well-defined anal angle, whilst the excavate hind lobe has the apex somewhat produced, and a prominent anal angle. *Trichoptilus* and *Buckleria* appear to be extremes in this direction, the lobes being very slender, diverging, and without the anal angle on either.

But Walsingham notes (*Ent. Mo. Mag.*, xxvii., p. 216) a possible alliance of *Atomopteryx* with these genera, stating that though "this genus is undoubtedly allied to *Agdistis*, it approaches *Stenoptycha*, Zell., and *Scoptonoma*, Zell., not only in neuration, but also in the form of the palpi, which are less abrupt and rather more developed than in *Agdistis*. In the forewings there is an elongate triangular fold extending inwards from the apical margin, but much less transparent than in *Stenoptycha*, this character, as well as the shape of the forewings and the structure of the posterior legs, show that *Atomopteryx* may fairly be regarded as a connecting link between *Stenoptycha* and *Agdistis*." It is to be observed that *Atomopteryx* (in Walsingham's figure) has no naked fringeless space where the cleft of the anterior wings normally occurs in the group, and which is found in the Agdistids (*sens. strict.*).

* A parallel development in the Australian genus *Cenoloba*, now referred by Walsingham to the Pyralidina, as an Oxychoreutid, led this careful worker to describe the genus (*Ent. Mo. Mag.*, xxi., p. 176) as an Alucitid, the forewings being cleft into two lobes nearly to the middle, whilst the hindwings are widely cleft to a little more than half their length, also into two lobes.

The outline of the forewings of the Oidæmatophorids and Leioptilids does not appear, superficially, to be very unlike that of the Stenoptiliids. Really, however, there are many marked and characteristic differences, of which one may notice the tendency for the angular points to become obsolete, the upper lobe linear, and the fringes to extend far round the apices and the anal angles, and into the cleft, whilst, at the same time, the cleft tends to become deeper and the lobe more feathery, this type culminating in the beautiful and highly specialised wing of *Alucita pentadactyla*. The forewing of *Merrifieldia* is of the same type as that of *Alucita*, but is slightly modified so that the upper apex turns up sickle-like. It is to be noted that the more generalised wing-shape on this side—*Emmelina* (*monodactyla*), etc.—folds into a tube when the insect is at rest, very like that of *Agdistis*, and one suspects that the rolling may have produced weak lines in the folds that may have given the first step towards division. The development of the remarkable falcate apex in *Uroloba* (*Nov. Lep.*, pl. xii., fig. 8), a genus from Valparaiso, in which the short fissure is pushed up, as it were, close under the apex of the wing, is quite unique in our experience; the genus is apparently allied to the Leioptilids.

The evolution of the hindwing is such that it tends to divide into three plumules, the wing breaking up so that the apical (radial) and cubital areas are separated by a fissure, and the cubital and anal by another fissure, the latter being usually much more deeply cleft than the former. The first fissure, therefore, is caused by the obsolescence of the outer part of the median area (as in the forewing), the second by the obsolescence of the comparatively bare folded portion just above the anal area of the wing; the absence of nervures here may have produced an easier line of cleavage than in the median area, and this is evidently the first cleft formed. Of the known plumes with undivided hindwings, those of the Agdistid and Atomopterygid species are apparently on a distinct line of development, when compared with the Ochyroticid and Steganodactylid species. In the former, the outer margin is regularly concave, and the folds, marked by the future fissures, are well defined, whilst the hindwings of the latter have two more or less defined concave marginal hollows, suggesting already some progress towards suppression of the wing-areas that finally become fissures. We have already (*anteà*) pointed out that the forewings, palpi, and structure of the legs, indicate Agdistid and Platyptiliid affinities respectively. Even in *Ochyrotica* and *Steganodactyla*, as illustrated by *fasciata* on the one hand, and *concursa* and *connexiva* on the other, there is considerable difference (Walsingham, *New Genera of Agdistidae and Pterophoridae*, 1892, pl. xii., figs. 2, 3, 4), for the Steganodactylid species show much more scalloping than the Ochyroticid. In both, however, the seven nervures of the hindwings are separate. The deep scalloping is in the correct position of the clefts, *viz.*, between the median and cubital areas and the cubital and anal.

Examination of the Stenoptiliid hindwing shows, not only that the plumules are dissimilar in form, but that the first and second have both distinct apical points and anal angles, whilst the fissure between them is very wide but not very deeply cleft; the two corresponding feathers in the Platyptiliids are not dissimilar except that the apex of the first plumule is considerably cut back on the costa, the fissures are very similar in both groups and the neuration practically identical; the Oxyptilid wing, has, however, been much modified, the plumules being much narrower, and the fissures rather more deeply cut, the neuration, however, is of the same type except that the modification of the wing has thrown the points at which some of the nervures reach the margin into rather different positions. In the Trichoptilids, apparently, the most extreme modification on this branch occurs, the plumules being so slender as to be almost filiform. Side by side with this development in the character of the hindwing plumules in the Platyptiliids and Oxyptilids is the peculiar and characteristic appearance of the bunch or bunches of black scales on the third plumule. They are restricted to this side of the phylum, and little is known of their character and function. They do not appear so low down as the Stenoptiliids, and they are lost again by the time they reach the most specialised Trichoptilids, *e.g.*, *Buckleria* (*paludum*). In the Oidæmatophorids on the Alucitine side of the phylum, the first fissure of the hindwings is more deeply cleft and the plumules more linear than in the Stenoptiliid and Platyptiliid genera, showing a less generalised form than the latter, whilst in the Leioptilids they are still more lineated. In the Alucitines (*e.g.*, *Alucita pentadactyla*) the plumules are of the same linear form, and the neuration is modified accordingly; the Alucitid branch carries two nervures into the third plumule, the Platyptiliid branch only one. Walsingham observes (*Ent. Mo. Mag.*, xxi., pp. 175-176) that the hindwings of *Heptaloba* (*argyriodactyla*), the forewings of which have already been noted (*anteà*) as possessing four lobes, have the normal three lobes,* the upper cleft extending very slightly beyond the middle, the lower cleft reaching nearly to the base, the posterior lobe being toothed with projecting tufts of scales on the inner margin.

One of the most important structural features of the Alucitid imago is the frenulum. We are indebted for our detailed knowledge of this organ in the Alucitids to Griffiths, who has discovered that the whole of the plumes divide up sharply into two sections, *viz.*, (1) The ♀ with one spina or "the one-spina group," (2) The ♀ with two spinæ or "the double-spina group." The former contains the Agdistids, Stenoptiliids, Oxyptilids, Amblyptiliids and Platyptiliids; the latter the Merrifieldiids, Oidæmatophorids, Leioptilids and Alucitids. On this point, Griffiths writes (*in litt.*): "The normal development of the frenulum in lepidoptera consists of a spina, single in the ♂, but double, at least, in the ♀, many species having in the latter sex a number of small and weak spinæ. In the Alucitids we find that, in numerous species, the ♀ has a single *spina*, as in the ♂, whilst in other species the *spina* is double. It, therefore, becomes possible to divide these interesting insects into two groups; those in which the *spina* of the ♀ is single, and those in which it is double. The measurements of the *spina*, given below, have been made with a micrometer ruled to hundredths and thousandths of an inch, and those for the length have been made under a Zeiss A.A. object glass, whilst those for diameter have been carefully made under a Zeiss C objective. It may be, however, that differences may occur both in length and thickness of the *spina* in individual specimens, therefore the comparison of these details might not in all cases be sustained if a large number of examples were examined. Where the *spina* of the

* Walsingham also observes (*op. cit.*) that "the first plumule of the hindwings does not 'become wider from the base to the tip,' as asserted by Walker, and there is more than one small squamous tuft on the posterior lobes of the hindwings."

♂ is not referred to below, it must be understood that there is nothing abnormal or noteworthy in its development."

Single-spina group.

	Length.	Diameter.
Adactylus bennetii : ♀ *spina* short but strong	$\frac{1}{24}$ in.	$\frac{1}{453}$ in.
Adkinia bipunctidactyla : ♀ *spina* slender, deeply grooved	$\frac{1}{27}$	$\frac{1}{680}$
Adkinia zophodactylus : ♀ *spina* very slightly shorter and more slender than in *bipunctidactyla*	$\frac{1}{28}$	$\frac{1}{690}$
Stenoptilia pterodactyla : ♀ *spina* longer but more slender than in *bipunctidactyla*, deeply grooved and sometimes slightly divided at the point. The grooving of the *spina* seems to indicate that the single form has been more recently acquired than in some other species, and this conclusion is supported by the occasional division of the points	$\frac{1}{22}$	$\frac{1}{728}$
Marasmarcha lunædactyla ; ♀ *spina* long and strong ..	$\frac{1}{22}$	$\frac{1}{486}$
Oxyptilus parvidactyla : ♀ *spina* similar in length to *heterodactyla* but more slender	$\frac{1}{32}$	$\frac{1}{850}$
Oxyptilus ericetorum : ♀ *spina* shorter and more slender	$\frac{1}{33}$	$\frac{1}{906}$
Oxyptilus pilosellæ : ♀ *spina* very long and slender ..	$\frac{1}{20}$	$\frac{1}{850}$
Oxyptilus distans : ♀ *spina* shorter than in *pilosellae* but similar in thickness	$\frac{1}{27}$	$\frac{1}{850}$
Oxyptilus tristis : ♀ *spina* longer and stouter than in *ericetorum*	$\frac{1}{28}$	$\frac{1}{820}$
Oxyptilus didactyla : ♀ *spina* longer and stronger than in most species of the genus	$\frac{1}{24}$	$\frac{1}{800}$
Oxyptilus hieracii : ♀ *spina* both longer and stronger than in *distans*	$\frac{1}{25}$	$\frac{1}{755}$
Capperia heterodactyla : ♀ *spina* shorter and stronger than in the above species of the genus ; it is also deeply grooved*	$\frac{1}{32}$	$\frac{1}{680}$
Buckleria paludum : ♀ *spina* very short and weak, deeply grooved†	$\frac{1}{40}$	$\frac{1}{1130}$
Buckleria siceliota : ♀ *spina* short and weak, but not so much so as *paludum*	$\frac{1}{31}$	$\frac{1}{850}$
Amblyptilia cosmodactyla (*acanthodactyla*) : ♀ *spina* still shorter, but stronger than in *rhododactyla*	$\frac{1}{26}$	$\frac{1}{680}$
Amblyptilia punctidactyla : ♀ *spina* longer and thicker than in *rhododactyla*	$\frac{1}{21}$	$\frac{1}{485}$
Eucnemidophorus rhododactyla : ♀ *spina* shorter and more slender, slightly grooved	$\frac{1}{22}$	$\frac{1}{755}$
Gillmeria pallidactyla : ♀ *spina* both long and strong, securely locked between strong scales on the costal and median nervures	$\frac{1}{19}$	$\frac{1}{566}$
Gillmeria ochrodactyla : ♀ *spina* long and strong, dark in colour	$\frac{1}{18}$	$\frac{1}{486}$
Platyptilia farfarella : ♀ *spina* shorter and more slender than in other species of the genus	$\frac{1}{27}$	$\frac{1}{850}$
Platyptilia gonodactyla : ♀ *spina* slightly longer and thicker than in *pallidactyla* (*bertrami*)	$\frac{1}{17}$	$\frac{1}{550}$
Platyptilia isodactyla : ♀ *spina* thick at base but quickly tapering and becoming slender	$\frac{1}{20}$	$\frac{1}{425}$
Fredericina calodactyla : ♀ *spina* moderately long and strong	$\frac{1}{21}$	$\frac{1}{618}$
Fredericina tesseradactyla : ♀ *spina* shorter than in many other species of the tribe	$\frac{1}{25}$	$\frac{1}{566}$

* A ♀ specimen in my collection is remarkably abnormal, having on one hindwing a single *spina* and on the other three more slender *spinae* (Griffiths).

† In *Buckleria paludum* the ♂ *spina* is very weak, grooved, the *retinaculum* a mere bunch of scales upon the costal nervure. Length $\frac{1}{32}$, diameter $\frac{1}{1130}$ (Griffiths).

Double-spina group.

	Length.	Diameter.
Merrifieldia tridactyla (*tetradactyla*): ♀ *spinae* short, closely adherent to each other	1/26	1/618
Wheeleria niveidactyla (*baliodactyla*): ♀ *spinae* much twisted, short, but much thicker than in *tetradactyla*	1/23	1/486
Wheeleria megadactyla (*spilodactyla*): ♀ *spinae* long and white in colour, clearly separated from each other	1/18	1/485
Alucita pentadactyla: ♀ *spinae* long, nearly equal in length and very closely adherent to each other ..	1/17	1/523
Pselnophorus brachydactyla: [♂ has a well-developed *retinaculum*.] ♀ *spinae* slender and of equal lengths	1/24	1/650
Porrittia galactodactyla: ♀ *spinae* shorter than *megadactyla*, and much more slender	1/23	1/566
Oidæmatophorus lithodactyla: [♂ *spina* strongly developed and long, the *retinaculum* strong.] ♀ *spinae* long, equal in length, this species has longer spinæ than any other British plume	1/16	1/566
Emmelina monodactyla: [♂ *spina* fairly thick, and locking into a strong cluster of scales on the median nervure.] ♀ *spinae* strongly developed	1/20	1/523
Leioptilus tephradactyla: ♀ *spinae* much twisted, not so slender as in *septodactyla* (*leinigianus*)	1/21	1/523
Ovendenia septodactyla (*leinigianus*): ♀ *spinae* slender, closely adhering together..	1/21	1/680
Hellinsia osteodactyla: ♀ *spinae* of equal length, shorter and more slender than those of *tephradactyla* ..	1/25	1/670
Adaina microdactyla: ♀ *spinae* slender and most closely adherent to each other, the two members being of equal length and impossible to separate under a low power. With C objective and application of pressure on the cover-glass they may be discriminated	1/26	1/680
Adaina scarodactyla: [♂ *spina* deeply grooved, bright brown in colour, *retinaculum* well-developed as two separate rings on costal nervure.] ♀ *spinae* bent in contour, but the points closely adherent, pressure of the cover-glass of slide was needed to separate them; they are very slender, short, but of equal length ..	1/26	1/755

This is a marvellous result, because it gives us a dichotomous division of the superfamily agreeing with our *Platyptiliinae* and *Alucitinae*, the Agdistids in this respect suggesting a branch of the former.

Meyrick states (*Trans. Ent. Soc. Lond.*, 1886, pp. 5-6) that "The structure of the antennæ is practically almost identical throughout the family." A suggestive note, however, by Chapman (*Proc. Sth. Lond. Ent. Soc.*, 1899, p. 15) tends to show that this is not altogether so. He writes: "The Pterophorids, in a few cases, *e.g.*, *Alucita pentadactyla* and *Marasmarcha phaeodactyla*, have antennal hairs between the scales dorsally, as in Plutellids, etc. In the majority of species examined, however, the hairs are dwindled and out of sight, or absent, so that the form is practically that of Obtectæ. The presence of the lower forms, however, adds to the improbability, already very great, that the Alucitids arise from any Pyralid, or other, form with obtect antennæ. The form in *A. pentadactyla* is a very unlikely one to be reached by further evolution, and is almost certainly ancestral from more generalised predecessors."

Meyrick has also stated (*Trans. Ent. Soc. Lond.*, 1886, pp. 5-6) that, in this superfamily, "the neuration presents the best characters for generic definition." This would probably be true if the characters of neuration in the group were not so wholly dependent on the modification of the wing-shape, but, as a matter of fact, Meyrick's results, as tested by other characters (especially those derived from the early stages), show that the neuration taken alone (or not properly interpreted) may be a most misleading character, as witness the union of two so divergent species as *microdactyla* and *lunaedactyla* (*phaeodactyla*) in *Marasmarcha*. As to the actual neuration of the Alucitids, Meyrick notes (*Trans. Ent. Soc. Lond.*, 1886, p. 3) that "it is necessary to examine the older and more ancestral genera, in which the fission of the wings has not proceeded far, to distinguish the Pyralid type of neuration,"* and adds that "in the more advanced form is found a rapid degradation, causing the obsolescence of most of the nervures, so that the affinity of these forms, if they stood alone, could not possibly be demonstrated. The progressive obsolescence of the veins takes place as follows, all the stages occurring in different genera: The fission of the wings, occurring opposite the middle of the cell, causes 5 and 6 in both wings to become very short, but these veins, with the transverse vein, though becoming very indistinct and feeble, do not disappear, except in the extreme type *Cosmoclostis*, where the fissure extends more than two-thirds of the length of the wing. In the forewings, 2 and 3 then become gradually coincident with 4, and 7, 9, 10 and 11 with 8; in the hindwings 3 becomes coincident with 4, and, in the extreme type, 2 also coincides with 4 and 8 with 7. The neuration is thus finally reduced to four simple independent veins in the forewings and three in the hindwings," etc.

The long and slender legs are very characteristic, the spurs being particularly noticeable. The fore tibiæ are provided with a tibial epiphysis on the inside towards the lower end, while the middle tibiæ have a pair of spurs at the end, and the hind tibiæ two pairs, one at the bottom, the other some distance up. The scaling, however, is sometimes a very marked feature, and the scales are sometimes collected into tufts around the bases of the spurs. The most extreme modification in this direction, however, is that presented by *Crocydoscelus ferrugineum*, Walsm. (*Trans. Ent. Soc. Lond.*, 1897, pl. ii., fig. 1), described (*op. cit.*, p. 35) as having "the anterior pair with a wide tuft at the end of the tibiæ; middle pair with a similar tuft; posterior pair with three outspreading fan-like tufts, the first small, near the base of the tibiæ, the other two much larger, arising above the base of the spurs; the inner spurs much longer than the outer, slightly clothed; the outer spurs densely clothed."

As a summary of the chief characters and features of the Alucitid imago, we quote Fernald's excellent description (*Pterophoridae of North America*, pp. 9 *et seq.*):

They are small, slim insects, with long slender legs and long narrow forewings, cut by a fissure extending in from the middle of the outer margin between veins 4 and 7, to from one-fourth to one-half of the length of the wing. The parts on each side of the fissure are called lobes, the anterior one being called the first, and the other the second, lobe. In some of the genera these lobes are narrow and pointed, while in others they are well-developed and present two well-marked angles on each, which are called the apex and anal angle. The normal number of veins in the forewings is 12, but this number is reduced in many of the species. Vein 1 is feebly forked at the base, at least in some of the species, and the cross-vein and veins 5 and 6 are very weak, often entirely invisible; 5 and 6 at equal distances

* A criticism of this view is published in the following chapter (*posteà*, p. 123).

from each other and from 4 and 7, extending to the fissure which ends between them. Veins 8 and 9 are stalked, and 10 sometimes arises from the same stalk, but is occasionally wanting. The hindwings have two fissures, the first extending in from the outer margin between veins 4 and 7 to about the middle of the wing; the second, between the inner margin veins and vein 2, extends to about the basal fourth. These divisions are called feathers (or plumules), the anterior one being called the first feather, the middle one the second feather, and the posterior one the third feather. The first feather in some species is somewhat spoon-shaped, rounded at the outer end, widest near the middle and narrower near the base. The costal vein bends down near the middle of its course, approaching very near to the subcostal. The costal vein ends in the costa when this feather tapers gradually to a point, and vein 7 ends in the point. When this feather is broad at the outer end, and has two angles corresponding with the apex and anal angle, the costal vein usually ends in the apex and vein 7 in the anal angle. The frenulum is single in the ♂ and divided in the ♀. The second feather in some species is widest towards the outer end, which is very oblique, but in others it is of the same form as the third feather. The median vein runs into this feather, giving off vein 2, which ends in the hind margin, vein 3 which ends in the anal angle of this feather, and vein 4 which ends in the apex. In the narrow tapering forms, vein 4 is wanting, and 3 runs to the end of the feather. The cross-vein, and also veins 5 and 6, are exceedingly fine, and scarcely visible under the most favourable circumstances. The third feather tapers gradually to the more or less blunt outer end, but, in some species, it has a very obtuse and rounded angle on its hind margin, which represents the anal angle of the wing. This feather has a strong vein running through the middle to the end, which is undoubtedly vein 1*b*. In some species, a weak vein may be seen above lying very near the edge of the feather, and in others a shorter vein below running to the hind margin of the feather a little beyond the anal angle. This, without doubt, is vein 1*a*, and, therefore, the three internal veins are represented in the *Pterophoridae*, but all three do not occur in any one species. The fringes are long and arranged along both sides of the feathers, giving them a strong resemblance to the feathers of a bird, thus making more complete organs of flight. In some species there are clusters of dark spatulate scales in the hind fringe of the third feather, and similar scales occur along the median vein on the underside of the wing. The basal part of the median vein on the upperside of the hindwings is not provided with a row of fine hairs, as in some families of moths. The head is of medium size, with the front smooth and vertical in some species, but more or less conical in others. The labial palpi are either porrect or curved upward and closely scaled, or more or less bushy. The maxillary palpi are entirely wanting. The proboscis is about as long as the head and thorax, and not clothed with scales at the base. The eyes are nearly hemispherical, naked, and without lashes or cilia. The ocelli are absent. The scales of the head lie smooth over the surface, giving it an even appearance; but in some species they form a more or less cone-shaped tuft, extending forward from the front. The antennæ are fine, filiform, and about two-thirds as long as the costa of the forewings. The basal segment is much larger than those beyond, and covered with scales, which sometimes form a pointed tuft at the end. The remaining segments are finely ciliated, those in the males being stronger than in the females. The thorax is of medium size, and its covering of scales smooth, without any indication of tufts or other characters. The tegulæ are of medium length, without long scales, hairs, or other unusual characters. The abdomen is long and slim, of nearly uniform size throughout in the ♂, but somewhat fusiform in the ♀. The genitalia of the ♂ consist of a pair of long, comparatively thin and broad exserted claspers and a prominent uncus. The legs are long and slim with cylindrical segments, except the femora which are somewhat compressed. The coxæ are about as long as the thorax, and stouter than the remaining segments of the legs. The fore tibiæ have a tibial epiphysis on the inside near the end, the middle tibiæ have a pair of unequal spurs at the end, and a similar pair at the outer third. The tarsi consist of five segments with a pair of claws at the end. There are no spines on any of the segments of the legs, but they are covered by scales that lie smooth and close to the surface. In some species, however, the scales are raised, forming an enlarged ring around the middle and hindlegs at the base of the spurs, and a similar ring occurs around the end of the fore tibiæ. In one species (*monodactylus*) there is a small tuft of scales on the hind tibiæ, opposite and within the middle spurs. The ground colour of the *Pterophoridae* is generally white, yellowish-white, or some shade of brown, occasionally without darker markings, though the forewings most frequently have a dark triangular spot resting on the costa and extending down to a point just within the end of the fissure. One or two light lines cross the lobes obliquely, and there is a dark spot on the cell a little before the middle of the wing, and another on the fold still nearer the base of the wing. The hindwings are of one uniform colour, and seldom have spots or lines of other colours.

There are many interesting facts relating to the habits of the Alucitids which might be noted here. In their hybernation they appear to be, on the whole, very uniform in their habits, the greater number hybernating as larvæ, and falling into three distinct groups: (1) The Platyptiliids (*sens. lat.*), which appear mostly to hybernate in the second stadium. (2) The Alucitids, which appear mostly to hybernate in the fourth stadium. (3) The exceptional Leioptilids—*Adaina* (*microdactyla*), *Hellinsia* (*osteodactyla*), and possibly one or two other allies—which hybernate fully grown. The first group, *i.e.*, those that hybernate as very small larvæ, are, so far as is at present known, all in their early larval stages, *i.e.*, preceding hybernation, internal feeders, boring as soon as hatched into the foodplant and forming a hybernaculum within the stem when fullfed in the second instar, *e.g.*, *Stenoptilia pterodactyla*, etc. It would appear, however, that the Platyptiliines do not so fully hybernate as some of their congeners—*Platyptilia isodactylus* being inclined to feed all the winter, in suitable weather, and *P. gonodactyla* making a start in the very earliest days of spring, etc.—yet they appear to go into winter-quarters in their second stadium. The second group has larvæ that are external feeders, when young, and most of these appear to pass the winter at about the fourth stadium; the young larvæ appear to eat furrows into the leaves without making an actual burrow, and hybernate on these, in some instances, *e.g.*, *Porrittia galactodactyla*, when they have fallen to the ground, for, strangely enough, they mostly feed on plants that die down in the winter. The third group is exceptional, *Adaina* (*microdactyla*) hybernating as a fullfed larva in the cavity that will become its puparium in spring; *Hellinsia* (*osteodactyla*), on the other hand, making a hybernaculum among the foodplant, but apparently leaving this (without, however, doing any more feeding) for pupation in the spring. One species, *Oidaematophorus lithodactyla*, hybernates in the egg-stage, but the young larva is developed within the egg very shortly after the latter is laid, and really the species hybernates as a young larva within the eggshell. The embryonic larva of this species is remarkable in having a highly spiculate skin-surface (resembling those of other species in their second or third instars), not that no other newly-hatched larva is spiculated, for those of *Adaina microdactyla*, *Merrifieldia tridactyla* (*tetradactyla*), *Adactylus bennetii*, etc., have some traces thereof, but in none of these is it so developed, even in the second instar, as in the newly-hatched larva of *O. lithodactyla*. There appears to be no plume that hybernates as a pupa, but two allied species on the Platyptiliine phylum (*Amblyptilia cosmodactyla* and *A. punctidactyla*), and one on the Alucitine phylum (*Emmelina monodactyla*) hybernate as imagines. The peculiar resting-habits of the imagines, *e.g.*, the hanging Platyptiliid, the doublefinger-post Emmelinid, etc., will be dealt with in our notes on the imaginal habits of the various species.

THE PHYLOGENY OF THE ALUCITIDES.

The position of the Alucitids and their phylogenetic relationships are problems that are still unsolved. From the time of Linné, they have been connected with the Orneodids, a conclusion which Chapman (*Trans. Ent. Soc. Lond.*, 1895, pp. 134 *et seq.*) was the first to challenge. Jordan suggested (*Ent. Mo. Mag.*, vi., p. 152) their connection with the Pyralids (*sens. lat.*), and Meyrick (*Trans. Ent. Soc. Lond.*, 1886, pp. 1 *et seq.*), Packard (*American Naturalist*, 1895, p. 563), Fernald (*Pter. North America*, p. 12), Staudinger and Rebel (*Catalogue*, 3rd ed., pp. 70 *et seq.*), have followed this view, the first-named having done considerable research work with the imagines in order to prove this supposition; nor has the genus *Chrysocorys*, which has also been treated by various authors as coming within the superfamily, any apparent relationship with the Alucitids, and Chapman states that the Alucitids present, as pupæ, no point of connection at all near to *Chrysocorys*, *Orneodes* and *Epermenia*, with which they have been at one time or other associated. All these little groups Chapman finds more or less closely allied, structurally, with the Pyraloids, but not with the Alucitids, the only common point in structure being that the Alucitid and Chrysocorydid pupæ have three free segments in the ♀ and four in the ♂, but as they show this, in common with many divergent superfamilies having pupæ-incompletæ, the point is not of much value. The Orneodid pupa agrees with those of the Pyraloids, in that the 7th abdominal segment of the ♂ pupa is fixed, but it offers an important point of difference from the Pyraloid pupa in that it has no trace of the maxillary palpus. It diverges, therefore, somewhat from the Pyraloid pupa, to which, however, it is much more closely allied than to the Alucitids, with the pupæ of which it agrees in this particular. The Alucitid and Epermeniid pupæ agree in that they are the only known pupæ with the free 7th abdominal segment that do not emerge as pupæ from the cocoon. They differ, however, in the fact that the Alucitid pupæ have acquired the habit, which no other group with pupæ-incompletæ has acquired, of attaching themselves by a cremaster.

As to the want of connection between the Alucitid pupæ and that of *Chrysocorys*, Chapman points out that the latter has a small maxillary palpus, a very narrow prothorax, and a fairly large headpiece (two Tineid characters), has the power of emerging from its cocoon, whilst no Alucitid pupa (in spite of the great variety exhibited) is at all like that of *Chrysocorys*, with its combination of hooked spines, recurved hairs, and projecting spiracles. The larval characters of *Chrysocorys*, too, are not suggestive of an Alucitid alliance, except by the approach of tubercles i and ii, and iv and v, so as to become almost united on either side; this character, however, is by no means common to all Alucitid larvæ. The peculiar, specialised, upright, Chrysocorydid egg is entirely different from the flat, smooth, generalised Alucitid egg, and removes the two groups far from each other. On the other hand, the egg of *Adactylus bennetii* is somewhat modified in the direction of a greater amount of surface sculpture. The structure of egg, larva and pupa, suggests strongly that the Alucitids are a very isolated group, and Chapman points out that "it seems impossible to derive them from the Adelid series at all, even if one starts as low down as the Micropterygids (=Eriocraniids) to allow for the divergence." So far as the true Pyralids are concerned, the pupæ of the Alucitids are exceedingly different. The former have a pupa that is true Macro in dehiscence, that has the abdominal segments 5 and 6, and only these, free, with 7 fixed in both sexes, has a dorsal headpiece, and maxillary palpi. The latter has a pupa that is a true Micro in dehiscence, has abdominal segment 4 free, and 7 also in the ♂, the dorsal headpiece is evanescent, and it has lost the maxillary palpi. Chapman concludes from these facts that "it is impossible for one of these forms to be derived from the other, and impossible for them to have a common ancestor higher up in the series than the Tineids (*sens. lat.*), more probably the ancestral form was much lower." As to the want of relationship of the Orneodids and Alucitids, Chapman says that the routes of their pupal evolution "have obviously been divided for so long a period that it is justifiable to describe them as in nowise related, less so, probably, than any two families of Macros." He summarises this (*Ent. Rec.*, vii., p. 270) by asserting that "between the Orneodids and Alucitids there is no relationship. The latter has not followed the line towards the Macros that has been taken by the *Pyralides*, but has struck out an entirely separate line of its own, and still retains nearly all the features of a Micro pupa. An interesting point, however, in connection with the Orneodid pupa is, that the one Micro character which the pupa of *Orneodes* has preserved and exaggerated, *viz.*, the large cephalic dorsal plate, happens, in Alucitid pupæ, to have taken precisely the contrary direction. In the latter it hardly exists, and is difficult to see, yet it does exist, and that so effectually, that, as in nearly all Micros, it carries the eye-cover with it on dehiscence."

It is chiefly on the neurational characters, as outlined by Meyrick, that the Alucitids have been attached to the Pyralids, but his own doubts (*infrà*) are very curious, and Chapman observes that the neuration affords no stronger ground for associating them with the Pyralids than with the Tortricids. In Pyralids the hindwings present three inner nervures, in the Alucitids there are only two. The subcostal nervure of the hindwing is, as in Tortricids, Pyralids, and various other groups, the strong, front, nervure that, with the cubitus, supports the wing. The median is present, but exceedingly weak, till beyond the cell. The only point that seems really common to the Pyralids and Alucitids, is the forking of 8 and 9 of the forewing. In the Tortricids, and many other groups, the forking that occurs in this part of the wing is that of 7 and 8. The Agdistids, among the plumes, and some species among the Tortricids, show that, in the lower forms of both Alucitids and Tortricids, there is no forking. Some apparent relationship might be shown with the Gracilariids, which form, however, in some respects, a higher group than the Alucitids, but, although the points of similarity might suggest a far-distant common ancestry, the idea is only brought forward as offering an alternative that is open to fewer objections than that of the Pyralids.

Meyrick's details on this point were published in 1886 (*Trans. Ent. Soc. Lond.*, pp. 1 *et seq.*). He states the opinion that the Alucitids (Pterophorids) constitute a family of the *Pyralides*, of similar value with the *Botydidae*, and other allied families, and that it might be placed together with the *Tineodidae* and *Oxychirotidae*, next the *Crambidae* and *Scopariidae*." He further shows that *Chrysocorys* is an Elachistid, and not to be included in the Pyralids (*sens. lat.*). He gives the following characters as uniting the Pyralids with the Alucitids (Pterophorids):—

Forewings with normally 12 veins, 1*a* and 1*b* present, 1*b* almost always simple at base, 5 belonging to system of lower median, 6 from middle of transverse vein, independent, 7 belonging to system of upper median, 8 supra-apical, 8 and 9 stalked, 12 free. Hindwings with normally 8 veins, 1*a*, 1*b* and 1*c* present, 5 belonging to system of lower median, 6 belonging to system of upper median, 8 in part closely approximated to 7, usually anastomosing with it beyond cell, posteriorly divergent.

Omitting the above characters shared by the Alucitids (Pterophorids) with the Pyralids, the following is given as a definition of the Pterophorids :—

No ocelli. No maxillary palpi. Abdominal uncus in ♂ well-developed. Forewings with vein 7 separate or absent. Hindwings with vein 6 separate from 7, 8 free but closely approximated to 7 on cell, lower median not pectinated. Wings usually fissured.

As bearing on the phylogeny of the group, Meyrick says (*op. cit.*, p. 4) : "The development of the uncus shows that the Alucitids are not derived from the Botydids, and the separation of vein 7 of the forewings, that they are not derived from the Pyralids, whilst the absence of any pectination of the lower median vein of the hindwings indicates that there is probably no immediate connection with the Crambids or Phycitids. From the other families they mostly differ by vein 8 of the hindwings not anastomosing with 7, and it is, therefore, probable that they do not originate from any known existing form, but from an external type closely approaching the ancestral form of the Pyralidina, and now apparently more nearly represented by the *Tineodidae*." This criticism would suggest that, even on neurational structure, the alliance with the Pyralids, even in the eyes of its supporters, is not very cogent.

Hampson's suggested alliance (*Ann. Mag. Nat. Hist.*, 6, xiv., p. 258) with the Ægeriids, Orneodids, and Tineids (*sens. lat.*), appears to be based on a much too general character (apart from his want of definition as to what is meant by the *Tineidae*). He diagnoses this rather heterogeneous group thus :

Forewing with vein 1*c* absent.

Forewing with vein 5 from the middle of the discocellulars, the other veins given off from the cell arising at nearly even distances on each side with it.

A close study of the early stages of the Alucitids, Ægeriids, Orneodids, and Tineids (even in the strictest sense), offers no substantiation of this grouping, on the contrary, all the details combine to disprove the suggestion of any real connection between them.

Bodine points out (*Trans. Am. Ent. Soc.*, xxiii., p. 35) that the antennæ of the Alucitids (Pterophorids) and Orneodids show a wide difference in their structure, and adds : "Those of the former family are distinctly of the Pyralid type, while the latter are just as distinctly of the Tineid type. I believe a further study of the characters of other organs will prove the Orneodids to be more closely related to the Tineids than to either the Pyralids or the Tortricids. The surface-marking is Tineid in form, and the scape has the long and slightly clavate shape so common among the Tineids." The antennæ of the Alucitids differ from those of the Pyralids, etc., in having hairs among the scales (see *anteà*, p. 118).

If the imaginal characters are unsatisfactory in helping to determine the phylogeny of the superfamily, the pupal characters (already discussed *anteà*, pp. 108 *et seq.*) are still more so, and, as we have noted, the pupal structure is so peculiarly *sui generis*, that it appears to be closely allied to no others, whilst its general structure, with four free segments in the ♂ , and 3 in the ♀ , is such that its allies must be among those with incomplete pupæ, and shows it to be, in this important factor, no higher than most of the superfamilies with pupæ-incompletæ. Its specialisations—carrying hairs, cremastral structure, etc.—have analogies in widely different superfamilies, where there can be no question of relationship. That the superfamily *Lithocolletides* is the only known group with pupæ-incompletæ, except the Alucitids, and in some degree the Anthrocerids, in which the eye-collar is difficult to detect in the pupa (*Trans. Ent. Soc. Lond.*, 1893, p. 106) does not appear to carry much weight as suggesting any alliance between these superfamilies, but there seems to be a great many analogies (if not homologies) between the Alucitids and Anthrocerids, two groups united by Dyar, and coming within the limits of Chapman's "Micros whose larvæ are external feeders." In these subfamilies there is a free mobility of the pupæ, except in the Alucitids, which are fixed by a cremaster, and yet remain typical "Micros" in the freedom of the 7th abdominal segment in the ♂ pupa, in their dehiscence, etc.

The evidence to be gleaned from the larval structure is as unsatisfactory from the phylogenetic standpoint as that of the pupal. The position of the primary tubercles shows the superfamily to be moderately low in development, whilst the wart specialisation suggests that few superfamilies have undergone more modifications in this stage. Chapman was the first to show (*Trans. Ent. Soc. Lond.*, 1894, pp. 335 *et seq.*) the analogies that existed between the families that were external feeders in the larval stage, and he noticed certain similarities which he considered important, without assuming real affinities, and he drew attention to the parallelism that existed between the Alucitids and the Anthrocerids, another group of the external-feeding lepidoptera with a pupa-incompleta. As to the position of the tubercles, we find that, in the Agdistids, iv is higher than v, whilst in all the rest of the superfamily the anterior v is always higher than the posterior iv, at an angle one to the other of about 45° to the larval resting-place. In this character the Alucitids agree with the Tortricids, and, strangely, the Pyralids (*teste* Chapman) split into two great divisions on it, *viz.*, the Crambid section (comprising the Pyraustids, Scopariids and Crambids) which have iv the higher, and the Pyralid (comprising the Pyralids and Phycitids) which have v higher as in the Alucitids and Tortricids. The rest of the primary tubercles are in the usual position for the more generalised groups, and one suspects that, on larval characters, there is little that can be determined of their immediate relatives outside the superfamily. We have already given (*anteà*, vol. i., pp. 116-117) Dyar's larval tabulation, by means of which the Alucitides fall within the limits of his Anthrocerina, and our own critical remarks on this follow, and there is no need to repeat the tabulations which we have there given. Suffice it to say that the evidence appears to us as sound now, in the face of our later studies, as it was at the time that these were published; neither are we in a position to seriously question the grouping, and think it as satisfactory as any phylogeny yet suggested. The evidence offered, so far as the phylogeny of the plumes is concerned, is distinctly negative rather than positive. We are in a position rather to prove that they cannot possibly be allied with certain groups which have been suggested as relatives, than to prove with what they are allied, and, in conclusion, can merely draw attention to the details already stated. We have already (*anteà*, vol. i., pp. 106-7) criticised Packard's suggestion (as set forth in an elaborate table, *American Naturalist*, 1895, p. 803) as to the derivation of the Pyralids from the Alucitids and the Alucitids from the Orneodids, a result which Chapman has shown to be pupally impossible (*Trans. Ent. Soc. Lond.*, 1896, pp. 129 *et seq.*; *Ent. Record*, vii., pp. 268 *et seq.*). Chapman makes (*op cit.*, p. 145) the Epermeniids and Orneodids typical members of the Pyralo-Eriocraniid stirps, whilst he excludes the Alucitids entirely from this series, and adds (see *anteà*, i., p. 110) that there is much in the structural characters of the larvæ that leads one to acquiesce in the claim made by Dyar for an alliance between the Alucitids and the Anthrocerids. The smooth Alucitid egg, he says, also supports very strongly the suggested alliance with the Anthrocerids. The development of the Alucitid cremaster, he considers, marks the Alucitids as one of the highest of the superfamilies in the *Incompletae*, and the reduction of the eyecollar (which is remarkably well-developed in the lowest superfamilies of the Sphingo-Micropterygid stirps) in the Alucitid and, to a less extent, in the Anthrocerid pupa, is another character that places them moderately high in the stirps. Our final reasons for placing the superfamily in this stirps are not perhaps altogether satisfactory, but, so far as they go, are infinitely superior to the off-hand opinion given by various lepidopterists without any facts relating to the structure of the insects under discussion to support them, that the Alucitids are related to the Pyralids, which, indeed, the structure of the superfamilies in all their stages suggests they are not, and, in finally placing them here, we will again quote Chapman, who states (*Trans. Ent. Soc. Lond.*, 1896, pp. 136-137): "Dyar places the Alucitids with the Anthrocerids and Cochlidids, and, both in structure and habits, the larva falls into that division as readily as into any other, at any rate it is almost certainly not a member of the Adelid, *i.e.*, the Pyralo-Eriocraniid series. Further, there are great differences in the pupæ of Alucitids and Pyralids, the latter having a pupa that is a true Macro in dehiscence, the 4th and 7th abdominal segments fixed in both sexes, and possessing no Micro characters except a dorsal headpiece (a character that goes very high up), maxillary palpi, and, in some families, appendages that project beyond the 4th abdominal segment. The Alucitid pupa, on the other hand, is a true Micro in dehiscence, has the 4th abdominal segment free in both sexes and the 7th also in the ♂, the dorsal headpiece is evanescent, and it has lost the maxillary palpi." As Chapman concludes that "it is impossible for one of these forms to be derived from the other," we consider ourselves more than justified in deriving the Alucitids from a low point on the Sphingo-Micropterygid stirps.

Within the group itself the evolution is not too certain. There can be little doubt that the *Agdistides* are of equal value to all the rest of the plumes (*Alucitides*) so far as we know them from the Palæarctic area. It is characterised by a large egg with specially elaborated structure at the micropylar end; by larvæ that do not specialise in the direction of the hairs of the tubercles, but in the development of fleshy tubercles associated as bases with the tubercles. The pupa is especially long, smooth and slender, and throws off almost all tendency to the humps that affect the larvæ. The remaining plumes, the *Alucitides*, divide more or less distinctly into two divisions, marked by definite characters in all their stages. These we have called the *Platyptiliidae* and *Alucitidae*, and they may be roughly separated on the following characters:

1. Platyptiliidæ.—*Egg:* More cylindrical. *Larva:* Shorter, thicker, more cylindrical; thoracic plate simple-haired; tubercles more simple and generalised; i and ii more or less separated; iv and v comparatively simple on common plate; supernumerary tubercles behind spiracles absent or illdeveloped; scattered secondary skinhairs abundant. *Pupa:* Smooth; tubercles usually points with simple setæ. *Imago:* Forewings with apical and hind angle to each lobe; hindwings with the first cleft not deeply cut; ♀ with single spina to frenulum. In hindwing the anal nervure only into third plumule.

2. Alucitidæ.—*Egg:* Flatter, more oval. *Larva:* Longer, flatter; thoracic plate abundantly haired, extra central tubercle at back; tubercles forming complicated warts; i and ii tending to approximate or fuse; iv and v, a wart on common base; supernumerary tubercles behind spiracles usually present; scattered secondary skinhairs few or absent. *Pupa:* Hairy; tubercles carried over as warts. *Imago:* Forewings with apical and hind angles of lobes obsolete or approaching obsolescence; hindwings with first cleft deeply cut; ♀ with double spina to frenulum. In hindwing another nervure as well as anal nervure into third plumule.

The larvæ of the first group are distinguished by the great tendency of the tubercular armature to remain simple, and for the development of abundant secondary hairs; whilst, in the second group, the tubercles tend to form complicated warts, and secondary skin-hairs are very rare or altogether absent. These qualifications are subject to certain modifications due to habit, *e.g.*, the external-feeding Oxyptilid larvæ (*Capperia heterodactyla*, etc.) on the Platyptiliid branch have well-developed warts, whilst the internal-feeding Leoptilines on the Alucitid branch (*Adaina microdactyla*, *Hellinsia osteodactylus*, etc.), are without them; Chapman, however, asserts the structure of the prothoracic armature as a critical larval distinction between the two groups. In the pupal stage the distinction between the two groups is even more pronounced. The Platyptiliids have comparatively smooth pupæ, although the peculiar skin-processes of *Marasmarcha* and *Amblyptilia*, and the almost definite armature of certain Oxyptilids, may appear to offer some exception, whilst the Alucitids are hairy and carry over, to a great extent, the complicated larval armature to the pupal stage; the latter possess, in addition, rows of hairs along some of the nervures of the wings, these are entirely wanting in the Platyptiliids. The characters presented by the frenulum and the anal nervure of the hindwing appear also to be quite conclusive in separating the imagines of the species belonging to the two groups.

Superfamily IV*a*: AGDISTIDES.

Family: Agdistidæ.

The Agdistids appear to separate from the remainder of the plumes as a group equal to the rest. This Agdistid section is characterised by (1) A large egg with specially elaborated structure at the micropylar end. (2) Larvæ that specialise by the formation of fleshy protuberances on the tubercular bases, the number of segments on which these are developed varying greatly in the different species. (3) An especially long, slender, and smooth pupa, that throws off nearly all the tendency to humps that so curiously affects the larva. [*Adactylus tamaricis* and *A. bennetii* often show some remains of the larval humps.

This separation is particularly warranted by the larval structure, not only by the development of the tubercular protuberances already noted, but also by the structure exhibited by the thoracic tubercles i and ii (which are nearly transversely arranged in both sections, and often, apparently, absolutely so in *Adactylus bennetii* and *Gillmeria pallidactyla*). These, usually in the Alucitids (*sens. lat.*), are placed slightly trapezoidally; in the Agdistids, however, they are not only very small, but are equally spaced, *i.e.*, i and i, i and ii, and ii and iii are about the same distance apart, whilst in the Alucitids i and i are widely apart, i and ii are close together (and usually conjoined), ii and iii widely apart, and so on, that is, whilst in the Agdistids the tubercles are individually and separately placed, in Alucitids they occur on each side as four pairs (omitting special notice of the accessory tubercles).

Hübner, in 1825 (*anteà*, p. 78), made the Agdistids equal in value to the rest of the plumes (rightly excluding the Orneodids) calling them *Integrae* and the rest of the Alucitids *Trifidae*. He also gave the tribal name *Agdistes* (the oldest plural name) to the group from which we have taken our own superfamily name, and diagnosed them (*Verzeichniss*, p. 428) as having—

> The wings whole, moderately broad and long, the legs delicate, the abdomen long; both the wings lance-shaped, scarcely obtuse, shaded with grey—*Agdistis* (*adactyla*).

Careful examination of the various stages leads one to assume that the Agdistids may come nearer to the Platyptiliid than to the Alucitid (*sens. rest.*) branch of the *Alucitides*. It is among the Platyptiliines one finds other plumes with "undivided wings"; these also have a specialised frenulum of similar structure; there is also rather more alliance in the general larval and pupal characters, and the egg is of the more cylindrical form.

It is almost impossible, in the present state of our knowledge, to differentiate the various characters on which the superfamily should be subdivided, for, at present, we have little detailed knowledge of the various species in their early stages, and practically no comparative studies have been made of them except those noted (*infrà*) of the larvæ and imagines. The superficial resemblance of the imagines has led authors up to the present time to place almost all the Palæarctic Agdistids into one genus, but the larval characters suggest that there is considerable subdivision possible within the family. These characters have been worked out on the larvæ of certain species at considerable length by Chapman, who summarises his facts as follows:

- I. All hairs clubbed.
  - 1. Tubercles iv and v level.—ADACTYLIDI.
    - A. Dorsal humps only on the prothorax and 9th abdominal segment —*Adactylus bennetii*, *A. staticis*,* larva from Harn er Salahin (Walsm. coll.).
    - B. Globular processes on thorax—larva from Chiclana (Walsm. coll.).
  - 2. Tubercles iv and v moved backwards and iv raised—AGDISTIDI.
    - A. Curious buttons on abdominal trapezoidals—*Ernestia lerensis*.
    - B. Tubercles i and ii on large conical or other processes.
      - *a*. On all abdominal segments — *Agdistis adactyla*, *A. frankeniae*, *A. heydenii*.

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* Chapman notes that *Adactylus bennetii* and *A. staticis*, which have been considered by some authors to be geographical races of the same species, exhibit considerable difference in their larval structure.

b. On certain segments; an azygos tubercle on prothorax—*Herbertia tamaricis*.

II. Hairs setiform, very long.

1. Tubercle iv level with spiracle†—? *satanas*.

In other respects *Adactylus bennetii* and *Herbertia tamaricis* are peculiarly specialised, *e.g.*, the larvæ of these species have the caudal horn single; those of all other species examined have it double; also, *H. tamaricis* has a central horn on the prothorax, a development found in the larva of no other species. Chapman, who made a special study of the Agdistid larvæ at Cannes in 1897, and has since made a critical examination of those in the Walsingham collection, has given us considerable detailed information. He observes that the larva of *Agdistis heydenii* is very warty, and shows the nature of the tubercular protuberances. In this species, on the meso- and metathorax are two protuberances (as in *H. tamaricis*), which each carry two hairs, with two smaller haired processes (? iii and iv) in line below them to spiracular level. The two hairs on the large tubercles are situated one before the other, pointed backwards, knobbed, and placed on transparent globes; the abdominal segments have regular trapezoidal tubercles (i and ii) with hairs directed backwards, on opaline globes (which contrast with the terra-cotta colour of larva). On the 8th and 9th abdominals, tubercles ii are approximated and form tall horns, which are quite distinct and separate, the larva thus having four horns. In *H. tamaricis*, the front horns (double) remain on meso- but are lost on metathorax; i and ii are small on the abdominal segments, and approximated except on 2 and 5, where they form peculiar processes like those seen on some Pyralid pupæ, *e.g.*, *Botys ruralis* (*verticalis*); on the 8th abdominal, i and ii are more pronounced, forming four black tubercles, whilst, on the 9th, they form a horn constricted at about half its length, after a swelling which represents two tubercles, and has a hair at each side, the horn has a second pair of hairs at its tip. Each of the two tall mesothoracic horns carries three tubercles, slight elevations with whitish tips, *viz.*, a higher anterior, a posterior, and a lateral one. On the abdominal segments, iii (immediately above spiracle), iv (a good way behind and rather below spiracle), and v (much below spiracle) each forms a small white point (? short hair). The anal segment has eight longish bristles. In the larva of *Adactylus staticis* the caudal horn, like the prothoracic, is double, the larva being otherwise free from warts, protuberances, etc. The spiracles of *H. tamaricis* are large and prominent, especially the prothoracic and 8th abdominal, which are set on small yellow knobs.

The detailed resemblance exhibited by the Agdistid larvæ to their foodplant for protective purposes is very striking. In the young larva of *Herbertia tamaricis*, the 2nd and 5th abdominal segments are brown, and the mesothorax partly so, the rest green with a brown dorsal mark, and so mimicking the tamarisk, as do a bug and a *Curculio*—with green and pink. In *H. tamaricis* the brown larva has usually traces of a reddish or orange spiracular band, and, occasionally, a fullfed larva retains the green coloration, reminding one very much, both in colour and protuberances, of the larva of *Geometra papilionaria* when it assumes its spring clothing. It has a yellowish-white subspiracular

† Founded on a single larva in Lord Walsingham's collection, possibly *satanas*, but just possibly not even an Agdistid (Chapman).

band, only marked at the incisions, except on the forward and hinder segments, and interrupted by rich brown patches, especially on the meso- and metathorax, and more or less to 5th abdominal. The 2nd and 5th abdominals are rich red-brown, and the humps on the mesothorax and 8th and 9th abdominals are brown, the front humps of the 2nd and 5th abdominals nearly black; there is a darker dorsal line, edged with paler, almost yellow. The general effect, however, is of a greenish larva with reddish markings, which imitates closely the colouring of the green twigs of *Tamaris*, just as the brown form does the older twigs on which the fullgrown larvæ usually rest. This imitation of the foodplant is equally strong in the other two species observed, *e.g.*, the larva of *Adactylus staticis* is brown, of just the colour of the stems of *Statice cordata*, which are brown, with a somewhat smooth shining surface and without much irregularity. In *A. staticis* the protuberances are reduced to the small double tail horn (on 9th abdominal). The surface has numerous little points that give a shining aspect to it, and, in effect, the stem and larva are extremely alike. The larva of *Agdistis heydenii* again imitates the general tone of the *Atriplex halimus* to an extraordinary degree, a whity-buff colour with the peculiar glaucous colouring of the plant, enhanced by the minute opaline or transparent balls at the bases of the hairs, so that, seated on a not too old stem or petiole, it is hardly visible. A large Noctuid larva imitates the same glaucous tone by colouring that seems very odd in a Noctuid larva. I suppose this to be *Mamestra chenopodiphaga*. The interest lies largely in the same effect being so successfully attained by these two larvæ in such different ways, the one with a tuberculated and bristly surface, the other with a quite smooth skin. The "quite smooth skin" is really very minutely tuberculated with pale spots on a greenish, and later on a brownish, ground. The halfgrown larvæ are greenish-white, like the foliage, the fullgrown larva has some brown tints, and no doubt affects the twigs rather than leaves. Chapman has also described in detail the Agdistid larvæ in the Walsingham collection, and given us the following resumé thereof :—

1. Adactylus* bennetii.—See *posteà* in our detailed account of the species.

2. Larva from Ham es Salahin† (taken on a *Statice*, apparently *S. limonium*).—Intermediate between larvæ of *bennetii* and *staticis*. The front horns rather smaller, and a vestige of the horn behind them can be traced. The horn on the 9th abdominal has a wide single base, and this carries two separate little horns.

3. Adactylus staticis.—Differs very little from larva of *A. bennetii*, the chief difference being that the caudal horn is divided, so that the two terminal hairs of *A. bennetii* are in *A. staticis* each on a separate small horn, side by side and quite distinct from each other, whilst the lateral hairs on the horn of *A. bennetii* are each on a minute horn, in front of the chief one on its own side, the bases of these small horns, however, being not quite distinct. The prothoracic horns are rather shorter than those of *A. bennetii*, and have a minute horn behind each.

The following species exhibit greater developments of the fleshy horn-like protuberances bearing the tubercles. Of these, however, some have the horns confined in some degree to the thoracic segments :—

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* These three larvæ are very close, and it may be noted that the few larvæ of *A. bennetii* in the Walsingham collection show variation in the prothoracic horns, *viz.*, (1) The two simple horns. (2) Traces of second horns behind these. (3) The four horns on a definite ring-like ridge. This latter is a deviation from normal *A. bennetii* greater than that shown in the prothoracic structure of *A. staticis*. [These variations are also to be observed in Essex larvæ.] (Chapman).

† The spelling on this label is very doubtful. It is the larva noted *anteà*, p. 128 (Chapman).

1. Larva from Chiclana (feeding on *Limoniastrum*).—This possesses two great mammillæ on margin of prothoracic plate, a third smaller colourless one below (in front of spiracle), each carrying a hair; in same row as these are other clubbed hairs similar to those on mammillæ (probably primary, as secondary hairs are elsewhere scarce or wanting); immediately above the spiracle is a small boss and hair, and another larger one at base of leg, this has a constricted neck, reminding one of the dorsal tubercles of *Ernestia lerensis*. The mesothoracic tubercle i is large, globular, with neck, and has two hairs (one front, one back); ii is much the same, but smaller, and with one hair; these (i and ii) are placed transversely across dorsum; below ii but quite in front is a still smaller boss (? iii), another tubercle (? iv) without boss, between this and one at base of leg (vii) which is smaller than, but resembles, that on prothorax. On metathorax the hairs are as in mesothorax, but on the flat surface. On the 9th abdominal are four hairs on reversed trapezoidal bosses, whilst on the 10th are two comparatively long hairs (perhaps 0·11mm.) on distinct bosses at margin of anal plate. On the intermediate segments i is a convex shield with hair, ii is a little further out and smaller, iii close above spiracle. There are two subspiraculars at same level, widely apart, one (v) as far in front as the other (iv) is behind spiracle; a lower one (vi) is placed before those (vii) at base of prolegs are reached. The secondary tubercles take the form of white (? in living larva) circular or oval plates, rather numerous about spiracle, and especially large and conspicuous on dorsum in front of i.

2. Ernestia lerensis.—In this larva, horns only occur on thoracic and 9th abdominal segments, on the intermediate segments the tubercles are developed in a remarkable way, really, no doubt, the same as the horns, except in size. The prothorax has on either side two prominences at front margin of plate and one a little further out, one larger one further back, and another outside this, just above spiracle; each of them carries one clubbed hair. On the mesothorax, i consists of two conjoined towers, one in front of the other, whilst ii, rather smaller, is further out; each tower carries an Indian club-shaped hair, its sides are rough, and studded with the same abundant secondary hairs that cover the whole surface in a scattered way; lower, and near the front of segment, is another small boss (iii), whilst a tubercle (iv) without boss is at front margin of segment lower down; vii, with boss, is a little way above leg. On the metathorax, i is as on mesothorax, but a little smaller, ii is further back instead of nearly outside i, iii is in middle of segment and without boss (instead of at front margin and mounted); iv and vii are as in mesothorax. On the 9th abdominal, the two horns are well apart, and, as it were, on a transverse ridge. On the intermediate segments, i and ii are wide apart, nearly at corners of square (*i.e.*, only slightly trapezoidal), not very large, but of peculiar construction, *e.g.*, they have a narrow neck, then swell out wide and flat, and on top of this a rough thickened structure, with a hollow on summit from which the hair arises. (They vary a little, but the upper surface and margins are always rough, with fine but irregular beading.) Tubercle iii has a small mammilla, it is close above, and a little in front of, spiracle; iv is well below the spiracle and somewhat behind ii; there is also one (vii) at base of proleg, but these (and probably others) have very little base, and carry such small hairs that they cannot be determined on some segments, and others are lost. The general surface has numerous fine transparent secondary hairs, clubbed (and often serrated) like the primary setæ, and only differing in size.

3. Agdistis frankeniæ (from Biskra).—[Appears at first sight very close to *Ernestia lerensis*, but the general surface is smoother*; closer examination, however, makes it really much closer to *Herbertia tamaricis*.] The prothorax has a posterior pair of very tall pillars, whilst in front there is, on each side, four eminences bordering the anterior margin, each with hair, and another pillar just above spiracle; between these last is a hair without base; another marginal one at base of leg. On each side of the mesothorax is a double pillar, a smaller pillar lower and forward, and two lateral flat tubercles, one at the middle of segment and the other at base of leg. On the metathorax there is a smaller double pillar on each side, of which the front element is the lower; a posterior shorter pillar further out, and laterally, three tubercles without raised bases, the first median, the next posterior, and the third at base of leg. On all the abdominal segments the dorsal tubercles are like those on the 2nd and 5th of *H. tamaricis*, the anterior a short pillar slightly bent backwards, the posterior a

* The larva examined is much covered with some powdery substance, which seems to be a sort of natural exudation of the larva, it is consequently difficult to be sure of in some points of structure (Chapman).

longer and more slender one much bent forwards (forming an arrangement like the double hooks through which ropes are run out from a ship); the others are small and very difficult to see, but iii is very close above spiracle; iv is well behind the spiracle and above v, which is only slightly forward of a position immediately below spiracle.

4. Agdistis heydenii (from Cannes).—Remarkable from the fact that the tubercles form short pillars and carry comparatively long hairs (0·5mm.) directed straight backwards from their bases; they are slightly curved, and end in a slight knob or club.* On the prothorax, the hairs are erect, on four dorsal tubercles placed somewhat trapezoidally, below the front one is another (with a baseless hair between them), below the spiracle on front margin another, and between the spiracle and posterior edge is yet another tubercle; these are all on tall swollen bases. On the mesothorax, the dorsal tubercle on either side is formed by the confluence of three, *viz.*, a tall pillar with backward directed hair, and on the front of the pillar, and again on the outside, a round protuberance, each carrying hairs; below this is a less prominent boss (iii) with a forward hair; and below this again a pair almost level (with a forward and backward hair); again a similar pair, and finally one at base of leg. The mesothoracic tubercles are the same, except that the outside boss of great tubercle is fairly separate and the anterior one nearly so. On the abdominal segments, the dorsal tubercles (i and ii) are well apart, trapezoidally placed, each is a rounded boss almost a ball, with a long hair nearly parallel with surface of larva and directed backwards; iii is rather behind and not very close to spiracle; iv is higher than v and well behind spiracle, v but little in front of it. The bent pillars of i and ii get smaller backwards, till, however, on the 8th abdominal, ii is on each side a great hump; on the 9th abdominal i is absent, ii forms a considerable pillar on each side, and iii is well-pronounced; the 10th abdominal segment has four smaller bosses along the posterior margin of anal plate (two on each side), really the centre of these is on the plate, and there is an ordinary-looking hair on margin behind it.

5. Herbertia tamaricis.—In many respects, this is the most specialised larva of those considered, the subspiracular tubercles in particular being of different pattern from those already described, *viz.*, iv (?) is high up and directly behind spiracle, v below, but a little behind, spiracle. The prothorax carries four trapezoidally-placed, humped, low and rounded tubercles; also a central one at posterior margin of segment (with twin hair-base but no hair); three small tubercular bosses in line with the front trapezoidals, one above and two below spiracle; another small one above spiracle (apparently on a segmental element between those of dorsal tubercles, but to which spiracle belongs). The mesothorax carries two large tall pillars (apparently the twin pillars of *E. lerensis*, but further conjoined, so that only their tops are distinct, and with a third tubercular boss on its outer posterior aspect, so that the pillar represents three tubercles); below these on either side is another flat tubercle, and lower two others at approximately similar levels; a small one at base of leg. The metathorax has a dorsal tubercle with two hairs but no prominent boss; below this is a small one, and two others lower, the posterior a little the higher of the two. On the abdominal segments i and ii are distinct, but very close together; iii is close above the spiracle. The 2nd and 5th abdominals have the curious prominences curved over to each other and carrying i and ii. On these and the other abdominal segments the minute hairs have the same backward direction that gives so marked a peculiarity to *A. heydenii*.

To complete our summary of these larvæ, we quote Hofmann's description of that of *A. adactyla* (*Die deutsch. Pteroph.*, p. 29), made from a living specimen at Potsdam:—

6. Agdistis adactyla.—12mm. long. On the back of the 1st segment (prothorax) are four cone-shaped elevations with a strong brown bristle at the apex; the 2nd and 3rd segments have each two elevations with two bristles each, the hind one of which is directed backwards. The elevations on the 2nd segment are far taller than those of the 3rd. On each segment from the 4th to the 10th stand four bifid laterally compressed tall warts (elevations), arranged in a quadrangle, the anterior point carries a short bristle directed forwards, and the posterior point a long curved bristle directed backwards. On the 11th and 12th segments the four warts have

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* No other larvæ have such long hairs except *A. satanas*, where, however, they have quite another character. As in *A. frankeniae*, the surface is covered with a great deal of a similar powdery secretion (Chapman).

gathered close together and are no longer bifid, but cone-shaped; the posterior pair is much taller and stronger than the anterior. The anal flap (13th segment) bears four simple, strong, brown bristles. The flange is very strongly expressed, and bears on each segment an elongate bipartite larger wart, one of its two bristles is directed forwards and the other backwards. The remaining lateral warts are very small and bear one bristle; on the belly no distinct warts are observable. Ground colour grey-brown; the markings consist of an indistinct, thin, black, sometimes obsolete, dorsal line, a spiracular line composed of detached oblique black streaks, and a black undulating basal line. The flange is lighter than the ground colour, almost whitish. Spiracles small, ringed with black, very difficult to see. Head small, retractile, rough and bristly, grey-brown. Above each pair of the thoracic feet, but below the flange, lies an elongate roll set with brown scales and white clubbed hairs; underneath each are two small warts set obliquely. The thoracic feet are grey-brown, the last joint is whitish with a black apex. Ventral and anal claspers like the belly itself, somewhat lighter coloured than the upperside. The ventral claspers exhibit on the inner sole a double row of hooklets, of which the outer are very long whilst the inner are very short. The larva is very inactive and slow, and when touched assumes a peculiar condition of rigidity, when the 2nd and 3rd segments are elevated in a characteristic manner (Stange, *Stett. Ent. Zeit.*, 1889, p. 318). It lives at the beginning of June on *Artemisia campestris*, much concealed.

The following species has remarkable developments of the setæ, the hairs reminding one much of those of *Agdistis heydenii*, but almost more of such Alucitid larvæ as that of *Porrittia galactodactyla*, the long hairs being directed backwards with a sweeping curve, and supplemented by what appear to be secondary hairs, all of which are of the usual bristle-like pattern and not of the clubbed form as in other Agdistids. This does not, however, refer to the secondary hairs proper, with which the skin generally and the tubercular pillars are crowded, and which also carry a certain quantity of secretion; these hairs are colourless and, though tapering, blunt-ended. It seems somewhat hopeless to describe the larva in detail:—

7. Agdistis satanas.*—The chief tubercular pillars are tall, carry a long hair, 0·8mm. to 0·9mm., black, curved and pointed; the surface of the pillar is covered with a wealth of secondary hairs, usually longer than those of the body-surface, and some of them almost true hairs like the tubercular ones (this applies chiefly to the dorsal tubercles). On the prothorax are two great cones (one on each side) in front, and behind each of these, and a little further out, a rather larger one; along the margin below the first are three smaller ones, and another one at base of leg; there is also a small one above spiracle. On the mesothorax, the dorsal tubercle, i, is very large and carries two hairs, one in front and one behind; outside this is a smaller cone (ii) with hair, then a single one again, then a pair level, again a pair, and one at base of leg (the latter almost a pair by reason of a very strong secondary hair some way behind it). The metathorax is almost exactly the same. On the 1st abdominal segment, i and ii have not such large bases, but i has the true tubercular bristles upright and then sweeping backwards, and a strong hair directed forwards like a brow-antler; ii is much the same, but the brow-antler is stronger, and there is a similar hair behind supplemented by a slighter one; iii is quite simple, a good way above spiracle; iv is some way behind spiracle and about on a level with it, and has a very strong hair and a good brow-antler pointing forwards; v is directly below spiracle, its primary hair is not so strong and there is nearly as strong a secondary hair behind it; below iv is a strong cone with strong hair, below this again is a tubercle and hair in middle of segment, and there is no other till those on the proleg are reached. The remaining abdominal segments are the same, the cones and hairs diminish a little backwards, but are still well-developed

* This larva was swept by Millière, and what it is, is merely a matter of conjecture. That such masters in knowledge of these larvæ as Lord Walsingham and Millière suggest it may be *satanas* carries much weight. It appears to me to be certainly a plume larva, and with great probability an Agdistid, but it differs so much from all the others as to give room for some doubt. Whatever it is, it is a most remarkable form (Chapman).

on the 9th abdominal; there is no accentuation on either the 8th or 9th. The prolegs have large swollen hairs. [The remarkably high position behind spiracle of iv, as in *H. tamaricis*, and less so in some others, makes it fairly certain that this is an Agdistid.]

As we have already noted, the Agdistid pupa is long and slender, but in its general features and mode of attachment is quite of the Alucitid type. We note that the second and third legs project as one column quite free beyond the wing attachment to the 3rd abdominal segment, the column containing at its base laterally a point (really the apex) of the wings, and extending to the end of the 6th abdominal segment. A trace of the labial palpi is seen centrally between maxillæ, and there is a space (possibly femoral) between the maxillæ and first leg.

Meyrick gives (*Trans. Ent. Soc. Lond.*, 1890, p. 486) the following diagnosis of the structural peculiarities of the Agdistid imago :—

Face with more or less developed horny prominence; ocelli distinct; tongue developed. Antennæ four-fifths, in ♂ filiform, shortly ciliated. Labial palpi moderate, ascending, second joint with rough projecting scales beneath, terminal joint short. Maxillary palpi obsolete. Tibiæ simple, outer spurs one-half inner. Forewings entire; vein 2 from near angle, 3 and 4 approximated or stalked, 5 widely remote from 4, from near middle of transverse vein, 7 from near 8, 8 and 9 stalked, 10 from near 8, or sometimes 8 separate, 9 and 10 stalked, or all three separate. Hindwings entire, on lower margin of cell beneath with a pecten of dense scales in disc, and inner margin roughened beneath with scales; vein 2 from middle of cell, 3 and 4 approximated at base, 5 absent, 6 remote from 7, 8 shortly approximated to 7, posteriorly divergent.

To this Hofmann adds (*Die deutschen Pteroph.*, p. 27):—"On the forewings an unicolorous and thinly-scaled discal field may be differentiated; this commences broadly on the outer margin and runs to a pointed end at about two-thirds the length of the wing, while the costa and inner margin are much more thickly scaled. The markings consist of small dark points or little streaks in special situations, namely, 3-4 in the costal fringes and one each in the apex of the discal field, in the middle of the lower margin, and in the upper, as well as in the lower, angle of the discoidal cell. Hindwings without markings. On the underside of the forewings the pale costa with the dark points is visible; the apex of the forewing and of the hindwing as far as III_1, and the folding part of the hindwing, thickly scaled with black and white, because these parts are exposed to the light when the wings are folded. Abdomen from the 3rd segment with two small black spots in the median line on the hind margin of each segment. Legs without markings."

Meyrick appears to have recognised, on imaginal characters, that there was room for considerable subdivision within the group, for he remarks (*Trans. Ent. Soc. Lond.*, 1890, p. 486) that the Agdistid "species are very similar superficially, but they include remarkable variations in structure . . . The occasional separation of veins 8 and 9 of the forewings is only paralleled in this group in the *Siculodidae* . . . The differences in the frontal prominence, which are considerable, are of value in specific distinction."* These differences he does not work out, it would be interesting to know if they coincided with the larval differences.

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* Meyrick, having got so far as this, asserts that "there is no necessity for generic subdivision," because he thinks the divergent forms "will eventually be connected by transitional forms," a very lame conclusion it appears to us.

Hofmann gives the following specific tabulation of the three German Agdistid species (*Die deutsch. Pteroph.*, pp. 28-29):

1. Forewings blackish slate-grey, dusted with whitish on the inner margin and sometimes also on the costa. The fringe on the outermost third of the costa white with small black spots, which, however, never reach the apex of the wing.

(*a*) The white fringes of the costa with four small black spots, which represent the ends of nervures of I, then II_1, II_2, and II_3*—*A. adactyla*, Hb.

(*b*) The white fringes of the costa with three black streak-like spots, representing the ends of nervures I, II_1, and II_2*—*A. satanas*, Mill.

2. Forewings bright brownish-grey finely dusted with brown at the base, on the costa and the inner margin. Fringes on the outermost third of the costa bright yellowish-grey, with four small black spots, divided at the apex of the wing by a dark brown line—*A. tamaricis*, Zell.

Genus: Adactylus, Curtis.

Synonymy.—Genus: **Adactylus,** Curt., "Brit. Ent.," fo. 471 (1833); Wood, "Ind. Ent.," 1st ed., p. 234 (1839); Curt., "Gen. Brit. Lep.," pl. xv., fig. 193 (1858). **Agdistis,** Stphs., "Illus.," iv., p. 370 (1834); Zell., "Linn. Ent.," vi., p. 324 (1852); H.-Sch., "Sys. Bearb.," v., p. 364 (1855); Staud., "Cat.," 2nd ed., p. 341 (1871); South, "Ent.," xvi., p. 27 (1883); Leech, "Brit. Pyral.," p. 50, pl. xvi., fig. 1 (1886); Tutt, "Young Nat.," x., p. 163 (1889); "Pter. Brit.," p. 14 (1895); Meyr., "Handbook," etc., p. 441 (1895); Staud., "Cat.," 3rd ed., p. 77 (1901); Barr., "Lep. Brit. Isles," pl. 431, figs. 1-1*b* (1903). **Agdistes,** Stphs., "Illus.," iv., app., p. 424 (1834); Westd., "Classfn.," etc., ii., p. 115 (1840); Moncrf., "Ent.," v., p. 321 (1871); Richdsn., "Lep. Faun. Portld.," p. 4 (1890); Barr., "Lep. Br. Isles," ix., p. 341 (1904). **Adactyla,** Zell., "Isis," 770 (1841); Sta., "Man.," ii., p. 440 (1859); Porritt, "Buckler's Larvæ," etc., ix., p. 335 (1901).

The genus *Adactylus* differs from *Agdistis* and the allied genera, particularly in the larval stage, the peculiar tubercular processes being restricted to the prothorax and 9th abdominal segment. The earliest generic diagnosis made from *bennetii* as type, was that of Curtis, in 1833, under the above name, but he stultified his description by citing *adactyla*, Hb. (which he renames *huebneri*) as the type. As, however, he evidently knew only Hubner's figure of *adactyla* (*huebneri*), and his description was entirely based on the structure of *bennetii*, we have no hesitation in asserting that the latter is the true type of the genus. His diagnosis reads as follows:—

Adactylus bennetii (The seaside plume). [Type of genus: *Alucita adactyla*, Hb. *Adactyla*, Curt. *Alucita*, Hb., Tr.]—Antennæ inserted on the crown of the head close to the eyes, rather short and slender, composed of numerous joints clothed with scales above, and very pubescent beneath in the male (fig. 1 ♂); less so in the ♀. Maxillæ slender spiral, and nearly as long as the antennæ (fig. 3). Labial palpi curved, densely clothed with scales and truncated, giving them a triangular form towards the apex, with the third joint just visible (fig. 4); triarticulate, basal joint long, broad, second short and broad, sublunulate, third minute, ovate and truncated obliquely. Head small, subglobose, with a conical tubercle on the forehead thickly clothed with short scales (fig. 7). Eyes small, lateral and orbicular. Thorax small, globose and trilobed. Abdomen very long, linear in the ♂, with the apex thickened and lobed; stouter in the ♀ and subfusiform, being narrowed at the base and somewhat conical at the apex. Wings plaited together and erected when at rest, lanceolate, inferior the smaller. Legs slender. Coxæ long. Thighs short. Tibiæ, anterior the shortest, clavate, with a short spine and brush of scales on the inside near the apex, the others spurred at the apex, posterior very long, with a minute pair of unequal spurs below the middle. Tarsi very long, five-jointed, basal joint very long, eighth not very short. Claws minute but distinct (fig. 8 + hindleg). *Bennetii*, Curt., *Guide Gen.*, 1039.—In author's cab. . . . *Adactylus* is distinguished from *Pterophorus* by its undivided wings, the form of the palpi, which are obtuse and

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* These little spots are to be seen more distinctly on the underside of the wing (Hofmann).

densely clothed with short scales, the very minute spurs to the hind tibiæ, and several other minor differences (*British Entomology*, fo. 471).

Curtis appears to have been entirely ignorant that Hübner had already (*Verz.*, p. 429) created the genus *Agdistis* for his *adactyla*. The next year, 1834, Stephens redescribed the genus under Hübner's name, with *bennetii* as type (*Brit. Ent. Haust.*, iv., p. 370).

The imagines of this genus, in common with all other Agdistids, are characterised by the absence of the cleft of the anterior wings present in the British Alucitids, although the point on the edge of the wing, where it normally occurs in Alucitids, is without a fringe, whilst the posterior wings are not divided into plumules. The ovum is a very specialised structure (judged from that of *A. bennetii*), for, although laid as a flat egg, the micropylar end is circular with crenate edge, the crenulations giving rise to longitudinal flutings that suggest strongly an urceolate egg turned over on its long side, the pronounced flutings, however, owing to the egg being on its side, give the egg somewhat the form of a brick (roughly not unlike an Ennomid egg). The larva has the characteristic Alucitid tubercular arrangement on the abdominal segments, i (on 1st subsegment), nearer mediodorsal line than ii (on the 2nd subsegment), iii (on 1st subsegment) supra-spiracular, iv and v (on 1st subsegment), both subspiracular and above the lateral flange, vi (single) and vii above prolegs, the subsegmental divisions being lost below the flange.

Adactylus bennetii, Curtis.

Synonymy.—Species: **Bennetii**, Curt., "Brit. Ent.," fo. 471 (1833); app. p. 424; Stphs., "Illus. Haust.," iv., p. 370 (1834); Wood, "Ind. Ent.," 1st ed., p. 234, pl. li., fig. 1625 (1839); Zell., "Linn. Ent.," vi., p. 324 (1852); Curt., "Gen. Brit. Lep.," pl. xv., fig. 193 (1858); Sta., "Man.," ii., p. 440 (1859); Staud., "Cat.," 2nd ed., p. 341 (1871); 3rd ed., p. 78 (1901); Moncreaff, "Ent.," v., 321 (1871); South, "Ent.," xvi., p. 27, pl. i., figs. 3-3*c* (1883); Leech, "Brit. Pyr.," p. 50, pl. xvi., fig. 1 (1886); Tutt, "Young Nat.," x., pp. 163, 197 (1889); "Pter. Brit.," p. 15 (1895); Meyr., "Trans. Ent. Soc. Lond.," 1890, p. 487 (1890); "Handbook," etc., p. 441 (1895); Richdsn., "Lep. Fauna Portland," p. 4 (1890); Snellen, "Tijds.," xl., p. 363 (1897); Porritt, "Buckler's Larvæ," ix., p. 335, pl. clxiii., fig. 1 (1901). **Bennettii**, Westd., "Classfn.," etc., ii., p. 115 (1840); H.-Sch., "Sys. Bearb.," v., p. 365, supp. fig. 1 (1855); Barr., "Lep. Brit. Isles," ix., p. 341, pl. 431, figs. 1-1*b* (1904). **Bennetti,** Zell., "Isis," 1841, p. 772 (1841).

Original description.—*Adactylus bennetii*, ♂, ♀. Length 6½-7½l., breadth 1in. Reddish-cinereous, sometimes with an ochreous tint; eyes black; superior wings with four dark spots upon each = one towards the base, another nearer the middle, and two beyond it approaching the posterior angle; abdomen of ♀ with five or six pairs of black dots down the back* (Curtis).

Imago.—25mm.-29mm. Anterior wings entire, much arched near the apex, which is pointed; colour shining grey, the costal and inner margins much sprinkled with white scales, a line drawn from the apex of the wing to the base of the median nervure, and another from the base to the outer margin (at about one-half between the apex and anal angle) would enclose a wedge-shaped space, much more sparsely scaled than the rest of the wing, and not sprinkled with whitish scales similar

* Curtis figures the species with a plant, and notes:—"The plant is *Carex limosa* (Green and Gold Carex); communicated by C. J. Paget, Esq., from a bog at Belten, Suffolk." One suspects that the plant was simply added for artistic purposes, and that neither plant nor locality had anything to do with the moth.

to those on the costal and inner margins; in the costal area are two or three short blackish streaks, and directly along the base of the fold are four black dots stretching longitudinally across the wing; fringes rather lighter and more shiny than the ground-tint of the wing. Posterior wings entire, the same colour as the forewings, the nervures rather darker, no markings, fringes paler, very shiny, and distinctly marked with a dark line passing through it parallel to the hind margin.

Variation.—There is considerable variation in the tint of the ground-colour of both fore- and hindwings and the quantity of black markings. The various forms that we have noticed are:

(1) Unicolorous whitish-grey, without black markings = ab. *grisea*, n. ab.
(2) Whitish-grey, with four black dots on the disc = ab. *grisea-typica*, n. ab.
(3) Whitish-grey, with the usual dots and short black costal streaks = ab. *grisea-lineata*, n. ab.
(4) Whitish-grey, with ochreous costal and inner margins = ab. *ochrea*, n. ab.
(5) As 4, but with four black dots on disc = *bennetii*, Curt.
(6) As 5, but with short black costal streaks = ab. *ochrea-lineata*, n. ab.

Only one local race of the species has been described, *viz.*, from Portland, where the species lives on a different foodplant, and has a different habitat from the saltmarsh form. This form we call:—

a. var. *portlandica*, n. var. *Bennetii* var., Richdsn., "Lep. Fauna of Portland," p. 40 (1890); "List Portld. Lep.," p. 171 (1896).—Rather lighter coloured and about one-eighth smaller than the specimens taken on the saltmarshes of the Isle of Wight. At Portland the insect occurs on cliffs by the sea, and the larvæ feed on *Statice binervosa*, and not on its usual foodplant *S. limonium*, an inhabitant of saltmarshes. Although the latter plant grows on the Chesil Beach, *A. bennetii* has not yet been taken there (Richardson).

In his "List of Portland Lepidoptera," p. 171, Richardson adds that "The insect is common in all stages on *Statice auriculaefolia* (*binervosa*), rather small and 'dark' compared with the saltmarsh form." In his original description he noted the form as "lighter coloured . . . than Isle of Wight specimens." The later note he says was a *laps. cal.* for "light coloured."

Egglaying.—In captivity eggs were laid June 6th-7th, 1899, on the underside of fresh and withered grass leaves, over which some ♀s had been enclosed; no foodplant was available (Bacot). On June 3rd, 1905, eggs were laid freely on the small central leaves of the foodplant, usually on the underside, a little way from the edge and near the bottom of the leaf (Ovenden). A ♀ was busy egglaying June 15th, 1905, when spring larvæ were still feeding, about halfgrown in last stadium (Chapman).

Ovum.—The egg when laid is green, with whitish opalescent tint, according to light. Its length is 0·74mm., its greatest width 0·40mm., its greatest height 0·30mm. Its form is remarkable, laid on a rather flat side, one end is nearly circular, about 0·30mm. across, approximately flat; the margin of this end is raised into a set of beads, paler than the rest of the egg, pearly white, about twenty-six in number; they are crenulations of the margin, and might be described as belonging to the top or sides of the egg, the beads, however, do not overlap the sides, *i.e.*, they do not project beyond the lines bounding the sides, though the sulci between them just mark the end of the sides, inside the beads; the top bulges a little, so that its middle is nearly level with the crenated margins that stand up round its edge. The circular (?) margin of this end is faintly angulated, so that a little way from it, ridges arising from the angles give the cylindrical (?) egg a somewhat quadrangular section, *viz.*, two short sides and a wider top and bottom; really, the lower angles bounding the attached face of the egg are poorly marked at this end of the egg, the upper ones are very distinct, and have not gone far before they are definite ribs, marking out a top surface. At the circular end of the egg, this surface is about 0·30mm. wide, about two-thirds or three-fourths of the way to the other it has widened to 0·40mm., and then it narrows off rapidly to a rounded end, where the lower pair of ribs also meet. This end of the egg is decidedly thinner than the other, 0·25mm. near the end, but the rounded end of the egg is so shaped that, if it were only more pronounced, it would be pointed and wedge-shaped. There is a certain amount of wavy sculpturing of the surface that is not, or is not distinct enough to be described as, cellular. The flat top surface usually shows a slight longitudinal median ridge, if there were a similar one below, which is not detected, the section of the egg would be hexagonal instead of quadrangular. As the egg matures, it exhibits some faint reddish spots and a red tinting of the flat end. As it gets nearly ready for hatching, the egg generally loses the red spots and becomes of a sickly amber tint, but with the red in the end area even more pronounced, and finally this end of the egg becomes quite black (head of larva). When the larva leaves the egg, it emerges by a very small hole in the flat end, or almost in the crenate border, and so inconspicuous that, till looked for, it is difficult to believe that such a hole exists. The empty egg retains its form perfectly, and the sculpturing is now much more easily seen; the beaded border stands out conspicuously, and the micropylar area is seen more easily. There is a small central circle, in diameter one-eighth or one-tenth of that of the flat end or even a little less; in this may be seen three dots that may represent the micropylar pores. Between this and the beaded border are radially arranged narrow cells, not, however, closely packed, and without a central rosette, but still in stellate manner (Chapman, June 20th, 1904).

Habits of larva.—The small green autumnal larvæ feed on the leaves of *Statice limonium*, and, after hybernation, may be found in April and May resting on the foodplant, from which, however, they fall on the slightest disturbance. At rest, they so much resemble the *Statice* in colour that it is only by searching the plants that show signs of being eaten that they are to be discovered. The young autumnal larvæ feed on until late in October; on October 12th, 1903, larvæ were still feeding, eating on either side of the leaf, but apparently the upper by preference, not quite the full thickness of the leaf, pieces about 1·5mm.-2·0mm. across, and variously waved and branching; even now, the colour of the larvæ seems to vary a great deal, some being almost pale green, others of a fuller green, whilst others are of a tint rather nearer brown than green. During the winter, the larvæ, in their haunts on the marshes of the Medway, must be fully exposed, for where the larvæ are to be found abundantly in early spring, there is not a square yard that is not covered with water at nearly every tide. Traces of feeding may be found as soon as the leaves begin to appear, but the feeders are difficult to find until from the commencement to middle of April, when they are very variable in size. It is possible that hundreds of larvæ must perish every winter, and probably this accounts for the rarity of the early summer (June) compared with the later (August) brood in most seasons. When the larvæ are first to be found in April they appear to be of variable size, and to be in at least three different stadia; they attack the leaves in various ways; often a piece is eaten clean off the apex, at others a slice is taken out of the side; frequently the space eaten in the latter case is just about the size of the body of the larva both in length and width, the larva frequently resting along the eaten portion where it is very inconspicuous, although, certainly, they are more frequently found near the centre of the leaf, and are especially at this time fond of basking in the sun. Ovenden observes that, although they perforate the leaves in confinement, they never appear to do so in nature when young, yet Gardner says that, on the Greatham Marshes, the larvæ are not uncommon, making small holes through the leaves in May and June, the holes betraying their presence on the *Statice limonium*. Chapman notes that larvæ found on May 7th, 1899, on the saltmarshes near Southend, were of different sizes, from nearly fullgrown green examples to small rusty-coloured ones, less than a quarter-of-an-inch long; of those taken, only one was on the upperside of a leaf, the rest all beneath, on the newly-grown leaves, generally low down on, or close to, the petiole, whilst Meek notes that, although they rest on the leaves when young, they later get down close to the roots of the plant and are just the colour of the leafstalk on which they then rest. Ovenden observes that, on May 13th, 1904, larvæ were still to be obtained in all sizes, from the winter (hybernating) skin up to the full-grown, not at all uncommonly, at rest on *Statice*, and fairly easy to find when once their habits were known. He says they now feed and rest exposed, but many get beneath a leaf; and whilst some larvæ make perforations in the leaves, others clear along the edge as they go, and when a nearly fullgrown larva gets hold of a young rolled-up leaf, he will clear it down to the petiole. The larvæ are to be found most freely on solitary plants, growing amongst the other herbage which appears to offer some protection; such *Statice* plants are usually much larger and more succulent. Where the leaves are found to be eaten, and no exposed larvæ are to be detected, then carefully turn back the leaves, when the larvæ will generally be found on the underside; if this fail, a careful search of the herbage and grass culms just near will often be rewarded with success, for the larva, although somewhat sluggish, is easily disturbed; it feeds both by night and day. The length of the larval life of the winter brood varies much. Ovenden had larvæ, collected at Strood, commence to pupate on May 9th, 1904, whilst other larvæ were still small, and Whittle found hybernated larvæ still feeding at Benfleet as late as June 8th of the same year. The larvæ of the summer brood hatch normally between mid-May and the end of June, and, quite contrary to the long larval life of the winter larvæ, have a very short existence in this stage, the pupæ being usually abundant from the middle of July until the middle of August. They are to be found in the greatest abundance from mid-June to mid-July, again in September and October, being much less abundant in April and May after hybernation, although usually still common. Larvæ have been recorded as taken on May 22nd, 1890, at Greatham Marshes (Bower); August 1st, 1890, at Portland (Richardson); May 20th, 1892, at Shoeburyness (Bower); May 15th, 1898, at Canvey (Whittle); common during the first fortnight of May, 1899, near Southend (Whittle); abundant at Strood, from April 15th continuously until May 19th, 1904, the earliest pupating May 9th, and others not doing so until the end of the month, many pupæ, however, being found on May 19th (Ovenden); throughout the spring until June 8th, 1904, at Benfleet (Whittle); larvæ again abundant at Strood, June 24th, 1904, and continued so for nearly a month (Ovenden).

Larva.—*First instar* (newly-hatched): The newly-hatched larva is about 1·3mm. long, and about 0·16mm. wide; head very little larger than body, black. The colour of the larva is a light yellowish-green, thickly covered with dark (black ?) skin-points, producing a general effect of dirty olive-grey. The most curious point about the larva is that it appears to have no tubercles. It is, however, just possible to make out i, ii, iii, iv and v, as definite circles rather larger than the skin-points, and the hairs are found to be very minute, clubbed like a little triangle, hardly broader than high, attached at one angle; tubercle vii bears, however, a well-developed hair, about 0·02mm. long, directed to the surface on which the larva rests. On the prothorax, this tubercle exists and a rather larger hair above it (the prespiracular). The 10th abdominal carries six hairs on either side, two down on the proleg, or nearly so, and four on the anal plate, of which two are rather long, nearly 0·05mm. Tubercles iv and v are well apart, as in the adult larva. The anal horn is a well-developed mammilla, a little wider and shorter, but otherwise much like that in the fullgrown larva, it carries two of the small triangular clubs well apart. There is a distinct subsegmentation into two nearly equal portions, each of which has about eight rows of skin-points, "about" because they are not so definitely in rows as to be so described with accuracy, but are approximately so. There are no prothoracic horns, but towards the outer end of the anterior margin of the prothoracic plate is, on each side, a triangular baton, much larger than any other, although one on the hind margin nearer the middle is almost as large. The head carries various hairs, and on each side (at least) two triangular batons; the eye-spots are large, five in an arch and one central. The prolegs have short cylindrical props with nine hooks, forming a complete circle, hardly broken on outer side. Anal claspers have 7 (or 8) larger hooks. The spiracles are large, or rather are short projecting tubes at the summit of a considerable mammilla, the first and last much the largest. The true legs carry a very large, scimitar-shaped, battledore palpus, that looks at first like the claw, which is, however, only half its length (Chapman, June 24th, 1904). *First instar* (full-grown): Head much larger, in proportion to body, than is that of adult larva; rounded, black, surface very rugose, thick and heavy-looking. Body of even thickness; skin much wrinkled; segmental incisions distinct but not deep. The skin covered with a coat of sparse, but coarse, dark-coloured spicules. Spiracles prominent, larger in proportion to size of larva than in adult; they are prominently stalked, or mounted on chitinous tubes. The prothorax bears two frontal processes, but these are short and blunt-ended, not conical as in the adult. The 9th and 10th abdominal segments are very large, the 9th nearly as long as the 8th, and the 10th somewhat longer; the 9th bears a short flattened horn, neither so tall nor circular in section as in the adult larva, although there is some variation in size. The setæ at anus, simple, fairly long and tapering; on the head they are short and club-ended, apparently just as in adult. The primary tubercles appear to be no better developed than in adult, and are very inconspicuous (Bacot, June 20th, 1899). ? *Third* or *Fourth instar :* 4·5mm. long, and about 0·7mm. thick in thoracic and first two or three abdominal segments, thence tapering very slightly to last segments. Colour, a green very close to that of the leaves of the *Statice*, with two red prominences on prothorax, projecting forwards over head, and one caudal on 9th abdominal projecting backwards—the head and 1st thoracic and the 9th and 10th abdominal are reddish, or strongly marked with pink, giving a very marked character to the larva, with the double front horn and the single one behind. The head is carried in the manner we are familiar with in drawings of the larva of *Apatura iris*, the vertex thrown forward, the mouth retracted, so that the horns on prothorax (on head in *A. iris*) are pointed directly forward and project in front of the head. These horns have each a tubercle at apex and one on outer flank. They are short hairs, Indian club-shaped, as are more or less all the others. The caudal horn (on 9th abdominal) has two tubercles at its extremity, or one might say at the lateral margins of the rounded end, and one other on each side near its base. The prothorax has, just below and behind the bases of the horns, which occupy the whole dome of the segment (much of the area often covered by the prothoracic plate), a large, dark, conical prominence, carrying on its summit the first spiracle, marked by several alternate white and black rings, some possibly the effect of reflection from a polished surface. Well below and in front of this is a black tubercle, with a true bristle, about three times as long as the clubbed hairs, and quite unlike them, but like those on anal plate. The head is yellow, with a network of red lines of smallish mesh, the lines themselves comparatively broadish. On the head are a good many slightly clubbed bristles. The ocelli are five in a semicircle (the three lowest rather perhaps in line) with a sixth centrally placed. The other spiracles are placed on dark, raised, smooth mammillæ, smaller, however, than that on first thoracic, that on 8th abdominal, however, nearly as large. The whole scale is microscopic, but either extremity looks something like a vertebrate head, with the horns for snout, or upper jaw of an open mouth, and the spiracles as eyes. The 10th abdominal (anal plate) has four marginal bristles nearly equal to that on prothorax, seated on slightly raised bases; it carries an ordinary tubercle above (just behind the horn of the 9th abdominal); there is a bristle nearly equal to these on the outer aspect of the base of the clasper. The whole surface of the larva has, besides the spiracles and tubercles (yet to be noted), a large covering of hair-points of two kinds. Certainly most of these do not carry any sort of hair, but some appear to terminate in a sharp point. The one kind are white or porcellanous, looking like raised polished buttons, of which there are perhaps 30, between dorsum and spiracular level, on one side of an abdominal segment. They can be seen with a hand lens as minute white dots tending to fall into transverse rows. The others are much more numerous and only about $\frac{1}{3}$ to $\frac{1}{4}$ the diameter of the white ones, and are black, though a few are rather paler, and some of the ground colour, but still prominent little buttons. These black points are convex polished projections, like the white ones, tend to fall into transverse and oblique rows, and are about their own diameters apart. There may be, perhaps, 250 on the area from spiracle to dorsum of an abdominal segment. Below the spiracles is a paler whitish band, this has a paler ground-colour, the black points are less coloured, and the large white ones are more numerous, 15-18 to a segment. Each segment is divided into two very distinct subsegments by a depression passing across dorsum from just behind spiracle. The posterior of these (rather the smaller) is again less markedly divided into a smaller posterior, and larger anterior, subsegment. The white points tend to run into a transverse line at the anterior border of the segment, but neither they, nor the smaller, seem to give any aid in making out subsegments, since they are ranged (so far as they are ranged) into 25 or 30 transverse rows ; though these rows are often for some distance separated by sulci, it is impossible to follow any individual row for more than a short distance. In calling the processes of the prothorax and of 9th abdominal horns, an erroneous impression may be given, since they are very wide at base and blunt. Those on prothorax might be described as being an anterior projection of the margin of prothorax over the head, not very dissimilar to that in larvæ of Lycænids, Anthrocerids, or Lymantriids, but with the front margin deeply indented medially. The two sides of each horn are at an angle to each other of about 60°. The tail-horn is more raised, *i.e.*, more vertical, at an angle of about 45° from the horizontal. The 9th abdominal segment is very narrow ventrally, but is dorsally, from anterior border to end of horn, about equal in length to the 8th ; the horn is half this dorsally, ventrally one-third of the 8th. The sides of the horn are at an angle of about 30° to each other, the upper and lower surfaces being so rounded that any angle may be quoted ; they may even be called parallel. One chief point is that their surfaces are not in any way differentiated from the rest of the surface, so that they are rather warts, humps, or processes, rather than horns, as for example, those of Sphingid larvæ, etc., are. The tubercles on an (say 4th) abdominal segment are—i, which differs from all the others in having as base a finely shagreened circular area, 0·09mm. across, the tubercle in the centre being, much as the others, a raised chitinous ring with a short colourless (slightly spiculated) club, about 0·03mm. in length ; this tubercle is near the middle line and on 1st (broad) subsegment; tubercle ii, on anterior portion of 2nd subsegment (or on middle of its front half, if these further divisions be recognised), a little further out than i, with no special base, but its chitinous mammilla about twice the diameter of the white points, baton as in i ; tubercle iii about in line (transversely) with i, just above and slightly forward of spiracle, structure as ii, but base slightly smaller. Below the spiracle are two tubercles, iv and v, on a slightly raised and rounded eminence (flange, subspiracular portion) occupying anterior half of segment ; one of these (the anterior, v) is about twice as far below, as iii is above, spiracle, and nearly twice as much in advance of it, the other (the posterior, iv) is not so far below the spiracle as the anterior, but is further behind it, than the other is in front ; vi ? is another quite similar tubercle that lies about the middle of segment (from back to front) and about half way from spiracle to prolegs. On base of proleg are three tubercular hairs set triangularly, rather larger than the others, and decidedly bristles and not batons or clubs ; the (1st) longest is posterior, the other two are—one well above the others and to front of 1st, the other a little below the 1st, and a little in front of 2nd ; on the 2nd abdominal (and those segments without prolegs) only the 1st and 2nd of these seem to be present ; there is also a minute tubercle inside proleg, which is present also on the segments without prolegs. The ventral prolegs consist of a base so short that the surface of the body touches the surface on which the larva rests (perhaps correlated with the glabrous leaf surface on which it lives, and contrasting with the pedicels of the prolegs of species onhairy or woolly leaves), and carries a circle of fifteen hooks disposed round the inner, anterior and posterior portions, but wanting on the outer (slightly anterior) fourth. The anal prolegs have much the same structure, the hookless portion of the circle being, however, more anterior. The central hooks are larger than the others. There are two long bristles, low down on the bases of the claspers, and four smaller ones higher up. On the 2nd and 3rd thoracic segments are four tubercles between dorsum and spiracular level, almost in a row down the middle of the segment, but the lowest a little forward. Of those on the marginal flange, one is at upper margin of flange (about spiracular level), and nearly below the 4th of upper set, a second some way behind this and triflingly lower, another well below it and a trifle in front ; lower still, at base of true legs, are two, tolerably near together and at about same level (Chapman, October 12th, 1903). *Penultimate instar:* Small larva, 0·26 in. long, is reddish-brown in tint, but really seems to have a green interior with a warm rosy pink skin, varying to pink only on two front horns and tail horn, dotted all over with white points, which are the larger of very numerous hard-looking tubercles covering the whole surface, the smaller of which are black or self-coloured (colour of skin ?). Caudal horn carries two hairs, each front horn carries one, the head is usually retracted to be beneath these. The Sphinx-like character of the anal horn is increased by finding that it carries two hairs at its extremities, but any real relationship is contradicted by its being on the 9th abdominal segment instead of on the 8th as in Sphinges. There is a faint suggestion of a yellow subdorsal line (Chapman, May 11th, 1904). *Final instar* (just moulted) : A larva of *A. bennetii* was observed on May 1st, 1904, at about noon, that had evidently just changed its skin. The old skin was stretched almost at full length by the side of a large hole eaten out of a leaf of the foodplant, and had lost its colour of bright green with purplish-red tinge at head and anal end, which responded so excellently to the coloured edges of the leaves of the foodplant, where it apparently likes to rest, and was of a semitransparent blackish-grey, the empty head-case, however, being quite glassy-looking and transparent. The larva was now 9·4mm. in length, of a more yellow-green tint, and the intersegmental incisions were quite yellow, the head and prothorax alone being of the previous fuller green tint ; the mouth-parts are now tinged with brown and the ocelli brown-black ; the double pointed prothoracic cowl is of a delicate red ; the horn on the 9th abdominal segment is also red to its base and bluntly pointed. The pro- and mesothorax show signs of three subsegments, but the abdominal segments 1-9 show two subsegments of which the anterior is wider and carries the spiracle, the anterior of the 9th abdominal carries the horn, but the posterior subsegment is very distinctly marked below the horn. The yellowness of the ground colour is due to the large size and abundance of the shagreen tubercles, although the segmental incisions and the anal segment are independently yellower in colour than the rest of the body. The cowl and anal horn are also heavily shagreened. The spiracles are as striking as ever, those on the prothorax and the 8th abdominal being especially well-developed. There is also a well-developed pale subspiracular flange starting on either side from one of the prothoracic points, and ending with the anal flap. There is the slightest trace of a mediodorsal line (? depression) from the mesothorax to the caudal horn, and the primary tubercular setæ, although exceedingly minute, are traceable, and there are two long setæ, one on either side of the anus stretching back posteriorly, apparently the only long hairs on the body. The true legs are pale green, as also are the prolegs (of the same tint as the venter). The latter are short and strong for a plume larva, and very different from the long slender prolegs characteristic of so many Alucitid larvæ. The venter is flattened, and the larva as a whole less cylindrical than the larvæ of the Platyptiliids. At this time, in confinement, the larva loves to bask on the upperside of a leaf, coiling itself in an U-form, or stretched at full length (Tutt, May 1st, 1904). *Final instar* (fullgrown): About 13mm. long, 1·6mm. wide at broadest part, *viz.*, across meso- and metathoracic segments, the body tapering rapidly from here to head, and very gradually to anus, which is usually blunt and rather square-ended. The larva is, on the whole, cylindrical and even in thickness, *i.e.*, the divisions of the segments, though clear and well-marked, are not deep, and the segments do not swell out in the centre as is often the case (*e.g.*, in Arctiid larvæ). The larva as a whole is bright green (apple-green) in tint, very closely resembling the leaves of its foodplant. It has a broad, but rather faint, paler lateral stripe, placed rather high up its sides, and a faintly-marked dark mediodorsal line. The skin is speckled and looks shagreened like that of an Amorphid larva. The short dorsal horn on the 9th abdominal (not 8th), and the pair of small dorsal projections on prothorax are tinged with red. The spiracles are small, placed on a brown elevated chitinous button, and are situated just above lateral band very high up the sides, almost at the subdorsal area. The legs are short and small, very pale brown at the horny joints, but so pale as not to contrast sharply with the green of the sides. The head is small, rounded, but deep from crown to mouth, and forms in outline a broad, flat-sided oval. At rest, it is rather retracted and hidden by prothorax, which is much larger than the head, and projects forward over it like a hood or cowl. At rest, the crown of the head is much anterior to the mouth, which is drawn close in to the first pair of legs, the face being subventral (reminding one of Poulton's drawing of the larva of *Aglia tau*). Antennæ rather noticeable; the division of lobes of the head distinct; the clypeus small, and not extending more than about half-way from mouth to crown; the surface of the head rather rough, with scattered hairs, a few of those nearer to the face are tapering, those higher up nearer the crown tend towards being club-shaped (? glandular), all rather short; the head is slightly darker towards the crown on its sides and angles; the ocelli very distinct, black in colour, all six in a small group (rather compact); there are a few small shagreen-like spots on head. The prothorax small, compared with the meso- and metathorax, much longer dorsally than ventrally, where it is merely a narrow strip, consequently it overhangs and produces the hooded appearance; on the anterior edge of prothorax there are two cone-shaped tubercular projections, one on either side of median line; these are reddish-tinged towards the top, and bear a short glandular hair at the summit. The 9th abdominal segment, which is now not very distinctly separated from the 8th, although the division can be easily seen if looked for, bears a short cone-shaped horn (fleshy-looking) at its posterior margin in central dorsal position. The horn slopes backwards over anus (it much resembles the horn of an adult larva of *Amorpha populi*), and bears two small glandular club-shaped hairs, one on either side just below the apex. In addition to these two hairs near the summit of the horn, there are two, one on either side, near the base of the horn, club-shaped and similar to those near the summit. The skin is studded all over its dorsal and lateral areas with small brown chitinous buttons, it is also speckled with less numerous and larger pale yellowish spots, these two characters together producing the effect of shagreen-spots, one of the chief features of its resemblance to the Sphingid larvæ. The prolegs are small and bear a ring of hooks; so far as can be seen, however, these are ill-developed on the outer portion of the ring; the anal claspers have an incomplete ring, not quite half a circle. The hairs are short, club-shaped, of a semi-transparent white (? of a glandular nature). Tubercles i and ii are in trapezoidal position, far apart, due, perhaps, to the great length of the segments, ii, however, not greatly further from the centre than i, but far enough to be discerned; iii is present, situated just above the spiracle ; the two subspiraculars are present, iv below and posterior to spiracle, v further below and anterior to spiracle. The setæ on the thoracic segments differ from those on the abdominal segments, i and ii being placed transversely and not as trapezoidals. A slight pit or scar is present on the meso- and metathorax in about the position of the spiracle on the abdominal segments; this is the more noticeable on account of the absence from the skin, at this point, of the ordinary chitinous button (Bacot, May 18th, 1899). The fullgrown larva, 14mm. long, is green, covered with very fine black points, suggestive of a darker dorsal line, which is, in reality, the dorsal vessel, or rather the absence of fat bodies over it. There is a pinkish tinge towards the terminal segments. The horn is directed backwards with two points (the hairs). The anal plate has three pairs of hairs, which are large and obvious as compared with others. The frontal horns (prothorax) projecting over head, each carry one very minute hair, nearly as long as those on the 9th abdominal. The spiracles are like small bronzy metallic shields, the actual spiracle being at the summit of the boss. In the living larva the supraspiracular tubercle (iii) can be detected, but the trapezoidals (i and ii) are indistinguishable from the small bosses that are pale and inconspicuous in this larva, but noted as white points in another larva, 0·26 in. long. On all the younger larvæ these white points are conspicuous. This one may be near pupation. The larva looks very smooth and rounded, very like *Sphinx ligustri*, due to there being no evident hairs, bristles, or tubercles. The hooks of prolegs are 8-10 on an inner rather forward semicircle. One of the most remarkable peculiarities of this larva is that tubercle i, especially on the posterior segments, has a remarkable arrangement of skin-processes all round it, precisely as if it were surrounded by ordinary wing-scales, but only the tips of these, with four to six sharp teeth, are visible. These lie like scales with the points facing posteriorly (Chapman, May, 1904). The larva is also described by Moncreaff (*Ent.*, v., p. 321), and also by South (*Ent.*, xvi., pp. 27-28). Buckler figured the larva of this species (*Larvæ*, etc., ix., pl. clxiii., fig. 1) on April 29th, 1871.

Pupation.—The fullfed larva crawls to the top of a leaf or rests on the leaf-stalk, spins across it numerous silken threads to which it attaches itself by the anal claspers, and, in this position, remains about two days, the skin gradually becoming brown, and assuming a shrivelled appearance; in this quiescent stage preceding pupation, the larva is much shortened in length, the head is slightly retracted, the meso- and metathorax are remarkably swollen and very "Sphinx"-like, the abdominal segments also being somewhat shortened, the head and venter inclining to a slightly orange tint, the dorsum still green. Moncreaff says the final change is gone through very suddenly; a few minutes suffice to throw off the old skin, which remains in a little heap on the leaf, and the pupa then hangs freely suspended by the anal hooks (including those on the 8th abdominal segment), being attached by its cremastral fringe of fine hooked bristles on the ventral area to the slight silken pad spun by the larva. The colour of the newly-formed pupa is green, but it changes to its normal darker coloration in from 24 to 48 hours. A pupa that was formed on May 9th, 1904, had, on May 12th, the abdominal segments of a purplish-brown tint, the thorax being dorsally of the same colour; the projecting beak also black as well as the wings and the appendages, the latter standing out quite free at their extremities and ending at the 5th-6th abdominal incision; the conspicuous frontal beak, the raised mesothorax, the distinct intersegmental abdominal incisions, and the striking anal spike, as well as the peculiar concave curve at the dorsum of the 2nd-4th abdominal segments, are among the most marked features of this remarkable pupa. Buckler's figure of the pupa (*Larvae*, etc., pl. clxiii., fig. 1*a*), made May 10th, 1871, is almost unrecognisable owing to the bad reproduction.

Pupa.—This is an almost typical Alucitid pupa differing only from the more usual Alucitids in being long, slender and of very uniform size from end to end as compared with most of them, and, as compared with some, exceedingly smooth, but this feature also occurs in ordinary Alucitids. It has the same method of attachment, the same number of free segments, a similar backward extension of the leg-cases—it only differs in degree. The length is about 15mm., the width (at the free abdominal segments) about 1·5mm., thicker thoracically, and tapering from the last four or five segments to a sharp point. Close to the vertex are, on either side, two bristles, rather far apart from each other to be both antennal basal hairs (as in most pupæ), but probably so. Further down on the cheek is another hair. On the clypeus is another. There is another just in the centre of the glazed eye area, close to the first leg, and another just on the inner margin of the eye area, at base of what looks like the mandible, but has no trace of suture. These hairs, like all the others in the pupa, are very minute (about 0·03mm. long). The labium is a rounded lappet from above, in outline very similar to the jaw-like projections from each side. The glazed eye is very large and well-marked; there is the semicircular glazed line, dividing the area into an inner and an outer portion of about equal width, the inner portion being bounded by a curve parallel to the glazed line, and formed by the maxillæ, mandibles (?), base and cheek; it is marked by radiating lines, and has the already noted hair. The inner portion has series of dots (eye-facets) inside the glazed line in tolerably regular rows, which fade out at about the fifth or sixth row, whence radiating lines or ridges proceed to the centre. The antennæ extend down either side and reach to very nearly the ends of the wings. Their markings of transverse wrinkles are very like, and not seemingly more special than, those on the legs. The maxillæ (proboscis) occupy the middle of the front below the head; for the first millimetre they are rather wide (each 0·43mm.), then narrow rather quickly to half the width, till about two-thirds of the way to the end of the wings they become extremely narrow, or even invisible, not by actual lessened bulk, but by being covered by the first legs; on the specimen being carefully observed, there is, however, a portion exposed to their very extremities; beyond the first legs they are similarly overlaid by the second legs, and disappear a little before half-way between the ends of the first legs (and wings) and the second. The first legs begin rather widely, against the antennæ, and narrow very slightly and gradually, finally tapering rapidly to a point level with the ends of the wings. The second legs begin between the first leg and antenna, close to the upper end of first legs. They widen out decidedly just beyond the end of the antennæ, to fill up as it were the extra space available, and end about 3·6mm. beyond the wings opposite the 6th or 7th abdominal segment (according to the degree to which the pupal segments are extended). Here they form a stiff process in conjunction with the ends of the maxillæ and the third legs, which appear from beneath the wings, and are so much behind the second, that they might escape notice; they extend fractionally beyond the second pair. This stiff process is quite free, and applied to the pupal surface when at rest, but when the pupa throws itself back, Alucitid fashion, it stands out prominently. The prothorax has the hairs too evanescent to be accurately determined. The mesothorax is large and prominent, it has the trapezoidal hairs, and laterally are two hairs one above the other; there is a curious hollow in the wing-base, just in line with the posterior margin of the mesothorax. The wings are marked by minute, transverse, compound wrinkles, along which the colouring is more intense; there are indications of the neuration. The wings are attached down to their pointed extremities, ending at the posterior margin of the 3rd abdominal segment. Dehiscence causes splitting of the mesothorax to a point short of its posterior border. The metathorax has a dorsal keel or carina; in the specimen examined there is a hair near the middle line in front, and another near the outer anterior angle, and, on each side, there is a third, but on one side it lies parallel with, and a little outside, the first; on the other side it is more than half-way to the outer one. The hindwing is a broad short strip, ending rather abruptly opposite the spiracle of the 2nd abdominal segment. The 1st abdominal segment is a square dorsal piece and has the four trapezoidals disposed widely apart, in nearly a square, but the posterior a little further out as if to occupy the whole segment as commandingly as possible; there is another tubercle, which hardly escapes being covered by the hindwing and just in line with i; the hairs of the trapezoidals are distinctly of the Indian club-shape common on the larva. The 2nd abdominal segment is longer than broad, tubercle i two-fifths of segment from front edge, ii slightly further out, about four-fifths, iii just above spiracle and amongst the longitudinal wrinkles bordering the wing; just behind the spiracle is a rugosity, that is more marked in the following segments, where it looks as if, when the segment was doughy, a finger (size of spiracle) had been used to give a backward drag. The 3rd abdominal is much like the 2nd as regards the trapezoidals (i and ii) and iii; the spiracle has just escaped the wrinkling against the wing, and further back there is a hair close to edge of wing, and, therefore, below and behind spiracle; the wing ends here in a very slender transversely wrinkled tag. The 4th abdominal has i, ii and iii as before, there is the finger-mark behind (and a little below) spiracle, whilst above this is a specially smooth patch of similar size; the rest of the dorsum at this level has, as has also the 3rd, 5th and 6th, to about the same degree and others less, fine transverse ridges widening here and there into minute pits or lacunæ (about size of spiracle); at some distance below the spiracle are two hairs at the same level, and one in front and one behind spiracle, so as to form with it an equilateral triangle; some distance below the posterior of these is a hair, and again, nearly as much further, another hair followed by the scar of proleg, in front of which are two more hairs (the upper one anterior), these two nearly (but hardly) fall into a group with the preceding one. The 5th and 6th segments are not quite so wide, but are nearly identical with the 4th. The 7th is a good deal narrower, i, ii, iii the same, and of iv and v, the anterior (v) is the lower (begins to be so a little on the 5th); the tubercle at proleg (vii) is represented by two hairs, the posterior the lower. The 8th abdominal is much the same as the 7th, the trapezoidals are quite square, but the lower (proleg) set of tubercles is wanting and replaced by a portion of the cremastral hooks. On the 9th abdominal there is a very definite prominence or horn, carrying two hairs, and outside this another hair (iii ?). The 10th abdominal is not very clearly marked off from the 9th, and has no hairs except the very abundant cremastral hairs. There is a slight hiatus between the maxillæ close to the base, and whether the labial palpi can be said to be visible here or not depends somewhat on the imagination, also as to whether anything and what occurs between the maxillæ and the first legs, where (in Sphinges and other pupæ) portions of the first femur are sometimes visible (Chapman, May 1904). At first bright apple-green in colour, gradually (in the course of two or three days) turning to a dull leaden-green hue, grey-green on the dorsal area, leaden-green on the leg- and wing-cases. The pupa is very long and slender, 14mm. in length, of even thickness on abdominal segments, save for the anal tapering, which commences at about the 8th abdominal segment, about 1·6mm. in diameter, but rather deeper and wider at the mesothorax, where, dorsally, this segment runs up into a pyramidal hump at its posterior end, the greatest width of the pupa being just at the junction of the forewings. It tapers rapidly and sharply from mesothorax to head, which ends in a sharp beak or nose-horn. The spiracles are yellow, raised and prominent, especially those on the 2nd abdominal, which show up very clearly just against the margin of the wings; the wing-cases of the primaries extend to the end of the 3rd abdominal segment, and of the secondaries to spiracle on the 2nd abdominal segment. The antenna-cases extend just on the 4th abdominal segment, one pair of leg-cases extends to the end of the 4th, while the other two pairs extend uncemented to the end of the 7th, abdominal segment, one pair (presumably the 3rd) being immediately beneath the other pair (presumably the 2nd). The anal armature consists of a row or fringe of fine semi-transparent bristles, with yellow-coloured hooked tips; these run down either side of the ventral area of anal segment; a pit or depression on ventral area at junction of the 8th and 9th abdominal segments has a group of similar hooked bristles rising from its bottom. The skin of the pupa is much wrinkled and roughened or shagreened, the rough points being pale or whitish. A few short hairs are present, so far as I can distinguish, in same position as the primary larval setæ, but the hairs themselves are simple and not clubbed, as are those of larva (Bacot, May 28th, 1899). South's description (*Entom.*, xvi., p. 27) of the pupa is unsatisfactory, but Barrett (*Lep. Brit. Isl.*, ix., p. 342) seems to have paraphrased South's description, without acknowledgment, so that the pupa becomes "green, dusted with white, and shaded with violet-brown; wing- and limb-cases deeper green," the paraphrase carrying a somewhat erroneous impression of the pupal colours.

Variation of pupa.—[Living pupæ May 18th, 1904.] The living pupæ vary much in colour from a pale greenish form to a deep brown that may be almost called black. The two commonest forms are rather darker than the palest, and not quite so dark as the darkest. These two forms match, apparently, the green of the growing plant and the sombre tints it has when dead—either dry or decayed. The green pupæ look as if they owed their colour to the thinness of the pupal shell, allowing the green tissues within to be seen, but, as the brown ones give equally an impression of the underlying tissues as well as the skin being brown, such a conclusion is doubtful. In both cases, white, or at least pale, points that represent apparently the pale skin-points of the larva, and dark shadings, especially in the appendages, are abundant, but are most clearly distinguishable in the pale green. To take one of these green ones in a little more detail, the back is olive-green, becoming paler towards the head and darker for the last few segments. Each segment is crossed by numerous fine ridges, 30 to 40 in number, having much the aspect, but on a much smaller scale, of subsegments, each ridge being rounded above, and pressed closely against its neighbour, and many of them only running a certain distance before they narrow and disappear, allowing their neighbours which they had separated to meet. It is on these ridges that the pale (hardly white) raised dots are disposed. The darker markings are very fine marblings tending to range themselves into longitudinal lines, and not definitely confined to the ridges. They are darker green than the ground colour, and it is their darker colour that overpowers the pale green ground colour and gives the olive-green effect. This darker green seems the result of a pigmentation that looks as if it would be black if there were only enough of it. The anal horn is pale brownish. Laterally and ventrally the surface, when not hidden by the appendages, agrees substantially with that of the dorsum. The actual venter, however, is green, free from either white dots or dark marbling, and is consequently pale having on the 4th, 5th and 6th abdominal segments a kidney-shaped darker mark on either side, that looks like scar of proleg, but can hardly be so, the fine transverse ridges passing across it without any structural changes. There is a certain amount of ruddy tinting of the incisions, especially laterally. The appendages (wings, legs, etc.) are definitely very dark green, and this appears to be due to pigment, as, towards the head, dots and islets of pale green appear where it is wanting; the beak is also dark, but the rest of the head and prothorax are freer from dark markings than any other part of the pupa. In the dark form the appendages are nearly black, but are, perhaps, more strictly dark green or brown-green, the head and prothorax more nearly resemble the pale form than any other portion of the pupa, with a good deal of green and white over the pro- and mesothorax. The rest of the pupa is a deep ruddy brown, as if the colour of the incisions of the pale form had here spread and overwhelmed everything. The white dots are still paler along the fine ridges, but the dark marblings are wanting at first view, yet exist as two anterior (close) and two posterior (further apart) dark spots dorsally, and two subdorsal wavy lines (one below the other) on each side, with other less definite markings. The posterior half of the dorsum of each segment (2nd-7th abdominal) is paler than the rest, and so shows up more definitely the two posterior dark spots which it encloses, and the upper of the subdorsal bands which bound it laterally.

Foodplants.—*Statice limonium* (Bower), *Statice binervosa* (*auriculaefolia*) (Richardson).

Time of appearance.—The species is doublebrooded, occurring in late May to mid-June, and again in late July-September. The first British specimens were taken at Tollsbury at the end of July, 1832 (Curtis). The following dates will give an idea of the variation of the time of appearance of each of the broods in different years:—The end of August and beginning of September, at Freshwater (Riding); June 17th, 1876, at Middlesboro' (Sang); end of July, 1878, at Sheerness (Walker); bred July 30th, 1882, from larvæ collected at Yarmouth, Isle of Wight (Bankes); imagines caught August 20th-31st, 1883, at Burnham (Bower); bred June 20th-28th, 1884, from larvæ obtained at Yarmouth; June 19th, 1884, imagines captured at Yarmouth, and August 18th-19th, 1884, also at Yarmouth (Bankes); June 16th, 1884, at Greatham (Sang); August 6th, 1884, at King's Lynn (Atmore); June 15th, 1885; June 16th, 1886; also bred from July 29th-August 5th, from larvæ taken on June 16th, 1886; also captured August 9th, 1887, at Yarmouth; and June 15th, 1887, in the Isle of Purbeck (Bankes); July 24th, 1887, at Shoeburyness (Sheldon); August 16th, 1888, and July 20th, 1889, and following days at Hartlepool (Robson); June 13th, 1889, at Yarmouth (Bankes); July 25th-August 14th, 1889, on the banks of the Yar near Freshwater (Tutt); imagines captured July 29th-August 28th and bred October 4th, 1889, at Portland (Richardson); imagines August 9th-30th, 1889, at Hunstanton (Porritt); June 9th, July 25th, 1890, at Benfleet (Whittle); August 1st, 1890, imagines at Portland (Richardson); August 12th, 1890, at Freshwater (Sheldon); June 16th, 1891, at Yarmouth (Bankes); August 1st-15th, 1891, at Freshwater (Hodges); imagines August 22nd, 23rd, 1891, at Shoeburyness; June 6th, and again July 30th, 1892, at Canvey; May 24th, and again August 1st, 1893, at Canvey; May 19th, and again August 17th, 1894, at Canvey; June 3rd, and again July 28th, 1894, at Southend (Whittle); July 31st, 1894, in the Isle of Purbeck (Bankes); imagines August 3rd, 1894, at Yarmouth, Isle of Wight (Watts); June 1st-22nd, 1895, at Canvey (Whittle); May 29th, 1896, in the Isle of Purbeck (Bankes); June 26th, 1896, at Canvey; June 24th, 30th, 1897, at Canvey (Whittle); August 28th, 1897, at Maldon (Raynor); June 12th, and again on

July 18th, 1898, at Canvey; June 22nd, July 2nd, 14th, 1898, at Shoeburyness (Whittle); one captured June 1st, 1899, at Benfleet (Edwards); July 4th, 1900, at Maldon (Raynor); June 2nd, 1901, at Benfleet (Whittle); July 18th, 1901, at Northey Island (Raynor); July 21st-24th, 1902, at Benfleet (Whittle); first imagines of the year observed May 30th, fully out from June 8th-15th, 1904, at Strood; imagines of second brood already out July 17th, and became very abundant, the last imago being taken August 17th, 1904 (Ovenden).

Habits.—In spite of Carrington's statement that "the imagines may be disturbed from among the foodplant throughout the day, especially during fine calm afternoons," we would suggest that it is next to impossible to disturb them in the daytime. Barrett also says that the moth sits among its foodplant during the day, having its forewings rolled round the hind into a cylinder, slightly raised and thrown forwards in such a manner that it resembles a letter "Y." He adds that it flies if disturbed, but only to another part of the bed of sea-lavender, again to swing by its long legs and assume the curious rolled-up form which renders it so difficult a creature to set out after death. Our experience is that they appear naturally on the wing at dusk, often simultaneously, in great numbers, the time of flight for the June brood being as nearly as possible 8.40 p.m., and lasting for about 30-40 minutes, after which the imagines are only to be obtained by searching (Ovenden), that of the second brood from about 7.30 p.m. to 8 p.m., in late July and August, fluttering up the stems of the plants growing in their habitat, and taking short flights among the herbage, and from flower to flower of their foodplant, the ♀ s, at this time, probably engaged in the work of oviposition. They fly thus actively for rather less than three-quarters of an hour, *i.e.*, until darkness has fully set in, and may then be found resting on the herbage, by means of a light, but comparatively few in number so that one suspects many are still actively on the wing. Those at rest are to be found standing on the grass and reed culms, or on flowers in the vicinity, with the wings rolled up tube-like in the Y-like form above described, as if to occupy the least possible space, and so exactly resembling a piece of dried grass as to be perceived with the greatest difficulty. Moncreaff states (*Ent.*, v., p. 321) that the imagines fly abundantly over *Statice limonium* in June and July in the saltmarshes around Portsmouth. Curtis noted their peculiar mode of rest when he first discovered the species at Tollsbury, and says that the moths assumed a most singular attitude, and resembled so much the dead pieces of grass that the eye did not readily distinguish them until they took flight. Sheldon observed them flying at dusk at Freshwater; Hodgson saw them commonly at the end of July flying at dusk over *S. limonium* at Sheerness. Whittle records examples at sugar at Shoeburyness, and Morley at electric light in August, 1895, at Ipswich.

Habitat.—Curtis claims (*British Entom.*, fo. 471) to have discovered this species in England, among the grass and seashore plants growing on the salterns at Tollsbury, on the coast of Essex, in July, 1832. The haunts of this species are the marshes by the sides of almost all tidal rivers around our eastern and southern coasts, where the *Statice limonium* grows. It haunts such localities along the estuary of the Thames, and along the banks of the small rivers that open out on the shores of Essex, Suffolk, Norfolk and Durham, of Kent, Hampshire and Dorset. It abounds on the marshes at the mouths of the

Thames and Medway; on Portsea Island, the banks of the Yar in the Isle of Wight, and similar localities. Whittle has observed it in abundance on saltings about Southend and the salt-marshes at Shoeburyness, Raynor on those at Maldon, and Porritt on the salt-marshes among *Statice limonium* at Hunstanton. In Durham and Yorkshire it occurs on the salt-marshes around the mouth of the river Tees, and it is recorded also from Caithness. Richardson, however, states (*Lep. Fauna of Portland*, p. 4) that, at Portland, the species occurs on the cliffs by the sea, the larvæ here affecting *Statice binervosa* (*auriculaefolia*) and not the ordinary saltmarsh species, *S. limonium*. It has only occurred in the marshes of Holland outside this country.

Localities.—Exceedingly local, but possibly still overlooked in many counties. Caithness: Bilbster near Wick (Dunbar). Dorset: Purbeck—Wych (Bankes), Portland (Richardson). Durham: Hartlepool (Robson), Greatham (Sang). Essex: Benfleet, Shoeburyness, Southend, Canvey (Whittle), Northey Island, Maldon (Raynor), Tollsbury salterns (Curtis), St. Osyth (Harwood), Burnham (Bower). Hants: Isle of Wight—Yarmouth (Bankes), Freshwater (Sheldon), the banks of the Yar near Freshwater (Tutt). Kent: Medway marshes —Strood, etc. (Tutt), Sheerness (Hodgson), Sheppey (Walker). Norfolk: Hunstanton, common (Porritt), King's Lynn (Atmore). Suffolk: Ipswich (Morley), Woodbride (Waller), Southwold (Cruttwell). Yorks: Middlesborough, near Redcar (Sang).

Distribution.—The species at present has only been recorded from Britain and Holland.

Holland: Zeeland near Zurikzee (Fokker).

Superfamily: ALUCITIDES.

Comparison of the Platyptiliidæ and Alucitidæ.

This superfamily, as already noted, includes the whole of the Palæarctic Alucitids in which the forewing of the imago is divided into two lobes by a fissure on the outer margin in the median area, and extending almost to the discal cell, and in which the hindwing is divided into three distinct plumules or feathers separated by two fissures, one dividing the radial and cubital areas, the other the cubital and anal areas, the latter fissure more deeply cleft than the former. The plumules, therefore, are only united towards the base of the wing. We have already noted (*anteà*, p. 113) that there are exotic Alucitid genera that have undivided wings, *e.g.*, *Ochyrotica* and *Steganodactyla*, others that have more than two lobes to the forewings, *e.g.*, *Heptaloba* (with four) and *Deuterocopus* (with three).

The Alucitid egg is flat, oval in outline, not markedly truncate at the micropylar end (as is the Agdistid egg). The Platyptiliine egg, however, is more cylindrical and truncate than the Alucitine, although there is much variation in the extent of this difference.

The Alucitid larvæ, in spite of a general similarity, exhibit two marked varieties of form, (1) the cylindrical (or Platyptiliine) and (2) the flattened (Alucitine). They vary, however, greatly in the arrangement and character of the tubercles, some larvæ being almost naked and exhibiting the primary tubercles as single-haired setæ, others having them modified into complicated warts. In the Platyptiliine section, there is a tendency to simplification in the tubercular structures, in the Alucitine a tendency to complication.

The Alucitid pupæ are particularly uniform in their general appearance, their mode of attachment, and capacity to perform a peculiar somersault movement by turning the anterior segments backwards over the attached posterior segments. They also carry over the larval tubercular structures in a more or less modified form into this stage.

As we have already pointed out, the oval, larval, pupal and imaginal characters suggest the division of this superfamily into two main family divisions—the *Platyptiliidae* and *Alucitidae*. These have already been diagnosed (*anteà*, p. 127). The Platyptiliid egg is larger, fuller, and more cylindrical, with the micropylar end somewhat flattened; the Alucitid egg is flatter, the two ends more alike, and the outline more markedly oval. The Platyptiliid larvæ are, when young, and sometimes throughout life, internal feeders, of a form that is fairly cylindrical, whilst those of the Alucitines are chiefly external feeders, and considerably flattened. The Platyptiliid larvæ of *Marasmarcha*, *Stenoptilia*, etc., although external feeders after hybernation, retain a very typical cylindrical outline, whilst the Alucitine larvæ of *Hellinsia*, and, to a certain extent, *Adaina* (an internal feeder throughout life), are a little flattened. The Platyptiliine (*sens. strict.*) larvæ, too, have enlarged unjointed secondary skin-points, those of the Alucitines being, except in a few cases, entirely without them.

The Platyptiliid pupa is, compared with the Alucitid, smooth, the latter being usually abundantly supplied with complicated wart-like structures carried on from the larval stage; the former, too, is longer and more cylindrical, the latter somewhat shorter and more flattened, whilst the fringes of fine hairs, found on the wings, legs and antennæ of the Alucitine pupa, *e.g.*, *Oidaematophorus* (*lithodactyla*), *Ovendenia* (*septodactyla*), *Porrittia* (*galactodactyla*), etc., are entirely wanting in most Platyptiliid pupæ, *e.g.*, *Eucnemidophorus* (*rhododactyla*), *Platyptilia* (*isodactylus*), etc. The fine regular transverse wrinkles, seen in the Agdistid pupa, are also present, and hardly more irregularly, in the Platyptiliine pupa, whilst in the Alucitine pupa, markedly in that of *Oidaematophorus* (*lithodactyla*), they are much larger and coarser.

In the Platyptiliid imagines there is a general tendency towards a triangular shape of the forewing, with somewhat pointed angular apex, considerable length of outer margin, and marked development of anal angle, the outer points of the fissure also showing distinct angulation. In the Alucitine forewing, the plumules are more linear, the apical and anal angles obsolete, and their edges strongly fringed for some distance along the costal and inner margins. The Platyptiliid hindwing is usually less deeply fissured than that of the Alucitines, and, whilst the outer margin of the plumules still retains some distinct sign of the hind-marginal outline of the wing in the former, that of the Alucitine plumules is obsolete and the plumules more lineated. The most characteristic imaginal feature, however, is the structure of the ♀ frenulum, this character being, indeed, quite critical as between the two families, that of the Platyptiliid imago with a single, and that of the Alucitine with a double, spina. In this respect the Agdistids show alliance with the Platyptiliids and not with the Alucitids.

Family: Platyptiliidæ.

The family name for this group is founded on *Platyptiliae*, Hb., the first coitus of Hübner's family *Obtusae* (*Verzeichniss*, p. 429), the other coitus of the group being *Amblyptiliae*. In this family there are apparently four distinct subfamilies, the *Platyptiliinae*, the *Amblyptiliinae*, the *Stenoptiliinae*, and the *Oxyptilinae*, although the second and third are very closely allied. Of these, on many characters, the Stenoptiliines appear to be the most generalised, the Oxyptiliines the most specialised. Chapman considers, however, for various reasons, that the Platyptiliines are the most generalised of the family. He bases his opinion on the following details: (1) The larval tubercles in structure and arrangement come nearest to those of the Agdistids. (2) The pupa is nearest to the Agdistids in smoothness, form, etc., also, though it has the dorso-lateral keels very highly marked, they are of the simplest structure and carry no special developments of the tubercles on them. (3) The imago has the most marked hind-margins, their ancestors, no doubt, had good hind-margins; these fail a good deal in the Stenoptiliids, more so in the Oxyptiliids, where they are sometimes very like the Alucitines.

Throughout the family, as already noted, the ovum tends to a rather cylindrical outline. The larvæ, too, both internal-feeding and external-feeding, have a more cylindrical form than those of the Alucitids. In the Platyptiliines the larval tubercles are of a very simple character, comparatively so also in the Amblyptiliines and Stenoptiliines but these develop into more or less complicated warts in the Oxyptilines, in which, in its highest forms, i and ii form a single dorsal wart, and iii, iv, v and vii are also complicated wart-structures. In the Platyptiliids, too, the larvæ are characterised by a very general clothing of enlarged secondary skin-points or skin-hairs. The simple arrangement of the tubercular hairs is of a very generalised character. One of the peculiarly Platyptiliid structures is that, on the prothoracic plate, the tubercular hairs show three setæ along either side of its anterior border, whilst behind each half of this row are three other setæ, not in a row, the internal one being well in front of the posterior border of the plate, the middle one, which is the strongest, being further back, but nearer the middle line than the middle hair of the front row; the third rather towards the extreme end of the plate than part of a posterior row, and being generally the weakest. In *Capperia* (*heterodactyla*) it looks as if each hair had subdivided and formed a little group of hairs without distribution; it is also to be observed that the larva of this species has no central hairs (?) on the prothorax, thus following the Platyptiliid type;* also that, in the larva of this species, we find the pale central line (characteristic of the Platyptiliids) that divides the prothoracic plate, all of which characters suggest the Oxyptiline connection with the Platyptiliid stirps. Its tubercles, however, are modified (as in the Alucitids) into real warts. On the other hand, the larva of *Capperia* has a secondary tubercle behind i and ii on the meso- and metathorax, a very unusual character in Platyptiliid, and very usual character in Alucitid, larvæ. In fact, with the exception of a suspicious mark in *Stenoptilia pterodactyla* (*fuscus*) in this position, which, however, carries no hair, it appears not to be present in any Platyptiliid larva examined. It may be associated with an external-feeding habit (Chapman).

The Platyptiliid pupæ are smooth, and more rounded and cylindrical than the Alucitine form. It shows a waist if viewed laterally, but has the marked ventral curve at the anal end; in fact, it shows a marked tendency in this direction towards the striking Agdistid pupal

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* It is remarkable that the larvà of *Alucita pentadactyla* is the only Alucitine species of those examined without these central hairs (Chapman).

characters. The smoothness is varied in the more or less external-feeding (in the larval stage) species by the presence of remarkable dorsal projections (Amblyptiliines), or armed processes (Oxyptilines), but still the pupæ are essentially smooth. The Oxyptiline pupæ have a particularly hairy appearance. It is to be noted that *Marasmarcha* (*lunaedactyla*), *Amblyptilia* (*cosmodactyla*, etc.), and *Capperia* (*heterodactyla*) possess the most exposed-feeding larvæ of the family. The processes just referred to as present in the more specialised pupal forms are remarkable developments of a dorso-lateral ridge, carrying hooked structures on which the trapezoidal tubercles are placed. *Marasmarcha*, belonging perhaps to the Oxyptiline section, has an almost identical pupa with *Amblyptilia*, whilst the Oxyptilines themselves have a similar structure on the anterior part of the dorsum only, on the posterior part the ridge is modified into a structure almost identical with the dorsal fan-ridge of certain Alucitid pupæ. The Stenoptiliine pupæ, with no armature except the simple generalised setæ carried forward to this from the larval stage, are paralleled by pupæ of equally simple structure in the Platyptiliines. The pupa of *Eucnemidophorus* shows the commencement of the latero-dorsal ridge which carries the trapezoidal tubercles, and which is so remarkably developed in *Amblyptilia* and *Marasmarcha*, so similar is it in these that one is left in doubt as to whether the latter is really Amblyptiliine or Oxyptiline, and ends in our supposing that it is an offshoot of the former, that has already developed certain imaginal characters (chiefly neurational) belonging to the latter. Chapman notes (*in litt.*) that *Marasmarcha* is an Amblyptiliid genus that has specialised its imago without carrying the larva on. Although of little service for detailed structural purposes, reference to Buckler's figures of some of the different forms of Platyptiliid pupæ (*Larvae*, etc., pl. clxiii., figs. 2*c*, 3*b*-3*c*, 4*b* and 9*e*), representing four distinct types, may prove interesting. Of these, that of *E. rhododactyla* (2*c*) appears to be the most like those of the Alucitids, the frontal beak being but little developed; that of *Gillmeria ochrodactyla* (3*b*-3*c*), on the other hand, is remarkably developed, being exceptionally elongated frontally with an outward and downward, somewhat ventral, curve. That of *Platyptilia isodactylus* (4*b*) tends in the direction of the last, but is much less markedly developed, whilst that of *Adkinia bipunctidactyla* is less pointed frontally than that of *P. isodactylus*.

The imaginal characters of this family are most marked. These have already been dealt with (*anteà*) and may be briefly noted as—(1) The angulated outline of forewing. (2) The less highly developed fissures of the hindwing. (3) The anal nervure alone entering the third plumule of hindwing. (4) The discoidal cell of the forewing closed by a vertical (or only slightly outwardly inclined) transverse nervure. (5) The ♀ frenulum with only a single spina. (6) The plumules of the hindwings differently shaped. (7) The frequent presence of scale-tufts on the third plumule of the hindwing.

The Palæarctic Platyptiliids, with very few exceptions, hybernate as larvæ in the second stadium. At this stage they are all internal-feeders, *i.e.*, miners, although many feed more or less exposed after hybernation. Typical among these are *Adkinia bipunctidactyla*, *Stenoptilia fuscus*, *Platyptilia gonodactyla*, etc. Some of them, however, must do little real resting once the foodplant has begun to grow, witness the size of some larvæ of *P. gonodactyla*, *P. isodactylus* and *Adkinia bipunctidactyla*, in the earliest shoots of their foodplants, although it must be confessed that they grow very rapidly in their final stadia and are also double-brooded. The size of the larva of *P. calodactyla* (*zetterstedtii*) in spring also suggests a possibility of very early spring- (if not winter-) feeding. Still the larvæ all appear to go into winter-quarters in their second instar. On the other hand, the larvæ of *Stenoptilia fuscus*, *Marasmarcha lunaedactyla*, etc., appear to remain quite tiny until comparatively late in the spring, and then to feed up pretty quickly. *Amblyptilia cosmodactyla* (*acanthodactyla*) and *A. punctidactyla* are striking exceptions to this rule, hybernating as imagines and laying their eggs apparently in May and June of the following year.

Subfamily: Platyptiliinæ.

Tribe: Platyptiliidi.

This tribe is readily recognised in the imaginal stage, by the squared outline of the apical area of the forewings, the two lobes of which are so far similarly-shaped that each has a distinct and well-developed anal angle. In the hindwings the plumules are differently shaped, the first fissure being markedly less than the second, whilst the third plumule usually carries a tuft of black scales on its hind-margin.

Whether we are accurate in treating these as the most generalised of the Platyptiliids or not may be open to question. In the larval stage, this tribe most distinctly has the least specialised tubercles, and the setæ are of the simplest form. It is possible that the earliest plume species had larvæ that were miners, and that Agdistines and Alucitines have specialised farthest away from them as external-feeders in different directions, whilst the Stenoptiliids, etc., retain the habit in the early larval stages and specialise in their tubercles towards the Alucitines in the later stadia; the Oxyptilids retain, within their limits, larvæ of internal-feeding habit when young and external when older, and others that are entirely external-feeders. Among the Platyptiliids (*sens. rest.*) we have those that have remained miners and have remained simple in their armature in consequence. Then, with regard to the secondary hairs, one also finds the Platyptiliids differing from the rest; in the other groups these (whether scattered on skin or supplementary in tubercular warts) are true hairs, whilst in the Platyptilias they are merely enlarged skin-points and not true hairs.

It is to be noted that the larvæ of *Fredericina* have no secondary skin-hairs, in that of *Platyptilia* (*isodactylus*) they are wanting on the pale areas, whilst in *Gillmeria* (*pallidactyla*) they are numerous. Another very important larval character is that, on the meso- and metathorax, tubercles i and ii have separate hairs, and are placed in transverse line across thorax, as in Agdistids, whilst in all the other Platyptiliines (*Eucnemidophorus*, *Amblyptilia*, etc.), i and ii are conjoined on thorax on either side of median line; again, iv and v present separate hairs on a single plate, not showing the conjoined bases of *Eucnemidophorus*, *Amblyptilia* and *Adkinia*, nor the further developed wart-like structure of *Stenoptilia*; further, the accessory post-spiraculars are both absent throughout the Platyptilias, nor are there any enlarged secondary hairs, whilst the assumed higher Platyptiliids present at least some traces of them, being least developed apparently in *Adkinia zophodactylus*.

Jordan states (*Ent. Mo. Mag.*, xviii., p. 74) that the Platyptiliid species (*sens. rest.*) have larvæ that are generally internal-feeders in composite plants; according to Walsingham, the larvæ of *P. carduidactylus* are gregarious in the heads of thistles (reminding one of the feeding-habit of the spring-feeding larvæ of *P. gonodactyla*, although those of the latter species live singly), whilst those of *P. orthocarpi* feed on the buds and flowers of *Orthocarpus*, one of the Scrophulariids.

It is interesting to observe that this group presents larvæ that still retain a certain remnant of the cocoon-forming habit, *e.g.*, *Fredericina* (*calodactyla*), *Platyptilia* (*isodactylus*, *gonodactyla*); it appears, however, to have been lost in *Gillmeria*. Here it is probably the remnant of a former ancestral habit. On the Alucitid side, in *Adaina* (*microdactyla*), on the other hand, the puparium is a comparatively recent acquirement, and may be more properly regarded as not really a cocoon at all, but the hybernaculum, used later for pupation.

The pupa of *Platyptilia* is apparently little specialised. It is short and thick, that of the Stenoptiliids being decidedly more long and slender, after the style of the Agdistids, smooth and with simple setæ, and is, as far as regards tubercles, the most primitive of all the Platyptiliine pupæ, indeed, so minute are the primitive setæ that they can only be discerned with a powerful lens; the Stenoptiliines are somewhat close, and so also is *Eucnemidophorus*, but the former lead on to *Marasmarcha* and *Amblyptilia*, and, although not presenting the remarkable developments exhibited by the latter, are, however, already considerably specialised.

We have already noted the peculiarity of the wing form; in addition we may note that the apex of the forewing is also sometimes drawn out so as to be slightly hooked. We have further drawn attention to the peculiarly Platyptiliid wing-form exhibited in the undivided-wing genera *Ochyrotica* and *Steganodactyla*, and, indeed, except for the fissures, there is little difference in the outline of these and the strict Platyptiliid species. Little is known of the course of the development of the scales on the third plumule of the hindwing. They really characterise the whole family, *Platyptiliidae*, and their absence in this group seems rather to be a suggestion of specialisation than otherwise; thus *Gillmeria* (*ochrodactyla*), *Buckleria* (*paludum*), *Stenoptilia* (*pterodactyla*), etc., appear to have lost them. Chapman suggests that, theoretically, in Platyptiliids (including Oxyptilids and Stenoptiliids) these black scales exist all along the margin, but are more developed at particular points more or less different in each species. It is oftentimes, of course, not the same patch developed in all species or the same little group. *B. paludum*, which has practically lost them still occasionally shows traces of them. Chapman has an example with traces of them on one side only, and another with traces only on the other side. Again, as between the Stenoptiliids and the Platyptiliids, it is to be noted that the latter have the neuration of the forewings, as represented by the nervure forming the upper boundary of the discoidal cell, more generalised than the former (see Hofmann, *Die deutsch. Pteroph.*, pl. ii., fig. 1, for Platyptiliid form). It is noticeable also that the Platyptiliids, that mine in the larval stage, have traces of the more usual wing-markings, a character largely lost in those assumed to be of more specialised wing-structure. It may be worthy of remark here that, in all these considerations, one has to calculate on cross-characters, *i.e.*, specialisations in certain directions and not in others, *e.g.*, the Alucitines (as represented by *Alucita pentadactyla*) have a highly specialised wing-form compared with any Platyptiliine, whilst there can be no doubt whatever that the "double spina" of the frenulum of the former is more generalised than the "single spina" of the frenulum of the latter.

Our tribe *Platyptiliidi*, as the genus *Platyptilus*, is thus diagnosed by Wallengren (*Kong. Svensk. Vaten. Akad. Handl.*, iii., p. 11) at length:—

Antennæ of both sexes with very short cilia. Forehead adorned with a more or less elongated tuft. Palpi longer than the head, rather rounded, slightly ascending, with the last joint more or less elongated, sometimes a little drooping. Legs longer, slender, the tibiæ sometimes thickened towards the apex. First pair of spines on the posterior tibiæ slightly unequal, second pair almost equal, shorter than the shortest spine of the first pair. Anterior wings not divided to the third part of their length, the segments broad, the posterior segment almost hatchet-shaped, the posterior angle of both segments well-marked. The segments of the inferior wings more slender, the third division with the anal angle sufficiently marked but nearer to the base. The anterior wings flat, covering the inferior when at rest. The veins of the anterior wings ten in number; first and second separate, coming from the base, the third from the posterior margin of the cell, all running into the posterior segment, the sixth coming out near the anterior angle of the cell, and running into the posterior angle of the anterior segment, the seventh two-branched, coming out from the anterior angle of the cell, and running into the apex of the anterior segment, the eighth and ninth coming out from the anterior side of the cell and running into the anterior margin of the wing, the tenth coming from the base and ending almost in the middle of the anterior margin. The cell well marked, with a very slender little transverse vein, almost straight, closed. Veins of the posterior wings three in number, the first coming from the base, two-branched, running into the anterior segment, the second three-branched, running into the second division, and the third simple, running into the third division. No cell.

Hofmann gives (*Die Deutsch. Pteroph.*, pp. 36 *et seq.*) a further excellent diagnosis of the group. He notes the neuration as being not different from that of *Eucnemidophorus*, and adds the following account of the general character of the markings to be found in the group: "The costa and inner margin of the forewing are rather darker than the central area; the former is usually sprinkled with fine white dots; behind the spots or the streak at the fissure, a paler area may usually be seen which extends faintly over the upper segment or lobe, but sometimes also passes on to the lower segment, thus forming a pale, though indistinct, transverse band just before the fissure; a fine bright transverse line often runs across both the segments; on the underside, the lighter area behind the costal triangle and the transverse line across the two segments are noticeable. The 1st segment of the hindwings often has a bright spot or transverse line, straight or diagonal, before the apex; the 1st and 3rd segments are often dusted with white, the 2nd segment, on the other hand, is always unicolorous. The fringes of the segments of the forewings have a dark, more or less thick, basal line, which penetrates sometimes more and sometimes less deeply into the mouth of the fissure, and also runs round the anal angle of the lower segment. On the inner margin of the forewings, below the fissure and beyond the centre, there is a small black tuft of scales in the fringe. At the place where the anal angle of the 3rd segment of the hindwing would be, there is a tooth-shaped, or stripe-like, collection of black scales in the hind-marginal fringe. The posterior part of the thorax and the 1st segment of the abdomen are mostly whitish, or whitish-yellow in colour. The front and middle tibiæ somewhat thickened at the ends with dark scaling, the pale hind tibiæ, as a rule, ringed with darker colour in the centre and at the ends."

The same author (*op. cit.*, p. 38) also gives a detailed account, with figures, of the ♂ genital organs. He says that, in the different Platyptiliid species, the various parts (pl. iii., figs. 1*a-c*) show little or no difference. The dorsal plate of the ninth segment consists of two symmetrical, nearly square, parts, which become somewhat narrower behind, and have rounded corners and are bent inwards slightly at the sides; they have their exterior margins bent downwards; a strong, mostly hairy, uncus (representing the tenth dorsal plate), bent decidedly downwards, arises in the median line between the two halves of the ninth dorsal plate. The genital claspers are extended, over-reaching the uncus, and strongly concave on their inner surface. The ninth ventral plate is small, square and emarginate behind, or oval and furnished with a short point behind.

When at rest, the wings are held horizontally, flat, and at right angles to the body, so as to form a straight line; the hindwings drawn up under the forewings; the insects cling by the front and middle legs, whilst the hind legs stand out behind and away from the body, or otherwise have the tarsi crossed over the tip of the abdomen. A similar habit prevails in *Eucnemidophorus*, *Amblyptilia*, etc.

Hofmann gives the following diagnostic table of the Platyptiliid species found in Germany (*Die deutsch. Pteroph.*, pp. 39 *et seq.*):—

I. The third plumule with a dark tuft of scales on the inner margin near the apex—*metzneri*, Zell.

II. The third plumule with a dark tooth- or streak-like tuft of scales in the centre of the inner marginal fringe (sometimes only very faint or even quite absent).

A. Palpi and frontal tuft about as long as the head, or somewhat shorter; frontal tuft more or less exceeded by the tips of the palpi.

1. With only one light band across both lobes (as the pale spot before the cleft is never developed into a complete transverse band).

a. With dark costal triangle*.

α. Expanse 12mm. Forewings grey-brown, with little yellowish mixture, strong white scaling, and not sharply defined darkening of the inner tip in contrast with the rest of the wing surface; the dark basal line of the outer marginal fringes of the fore-tip interrupted by a white spot; the black scales of the inner margin of the third feather form only a short streak or spot .. .. *gonodactyla*, Schiff.

β. Small, 9·5mm.-10mm., dark greyish-brown with little white scaling; the dark basal line of the outer marginal fringes of the fore-tip not interrupted. The scale-spot in the inner marginal fringes of the third feather very small .. .. .. *farfarella*, Zell.

γ. Large, 14mm.-15mm., ochreous-yellow; first feather below unmarked (rarely with an indication of a fine yellowish transverse line before the apex). The dark basal line of the outer marginal fringes of the fore-tip not interrupted. Costal triangle curtailed below. The accumulation of black scales in the inner marginal fringes of the third feather streak-like and rather long .. .. *nemoralis*, Zell.

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* The four species α-δ have similarly formed genitalia in the ♂ (Hofmann).

δ. Small, 10mm.-11mm., ochreous-yellow; first feather below invariably with a white transverse line before the tip (sometimes indistinct). Basal line of the outer marginal fringes of the fore-tip mostly interrupted in the centre. Costal triangle running to a point below. The shading* of the hind-tip sharply defined against the yellow ground colour; scale tuft in the inner marginal fringes of the third feather dot-like .. .. *zetterstedtii*, Zell.

b. Without dark costal triangle—*isodactylus*, Zell. (*similidactyla*, Dale, by error.‡)

2. With two bright transverse lines, one just before the cleft and a second across the centre of both lobes—*tessaradactylus*, Linn.

B. Palpi and frontal tuft much longer than the head; frontal tuft reaches to the tips of the palpi; upper lobe very acute. Fringes with darker basal line. Yellow species.

1. Ochreous-yellow, with mostly very distinctly expressed brown markings .. .. .. *ochrodactyla*, Hb.

2. Almost unicolorous, rusty yellow, without clearly expressed markings .. .. *bertrami*, Röss.

We give this tabulation simply because of its value in discriminating the species; as being of scientific value in showing the alliance of the groups it is poor enough, although the separation of *metzneri*, on the one hand, and *ochrodactyla* and *pallidactyla* (*bertrami*) on the other, appears to be sound.

The natural subdivisions, details of which will be given in our consideration of the separate genera, appear to us to be as follows:

A. Palpi or frontal tuft as long as; or shorter than, the head.

I. With the black scales markedly collected in a small patch near the apex of the third plumule—Mariana *metzneri*, Zell.

II. With the black scales markedly collected in a small patch near the centre of the third plumule.

α. With dark costal triangle, and two transverse lobal lines, or bands, more or less clearly defined, one before fissure, the other across lobes—Fredericina *tesseradactyla*, L., *calodactyla*, Schiff., *nemoralis*, Zell.

β. With dark costal triangle, and one clearly defined (external one) lobal transverse line—Platyptilia *farfarella*, Zell., *gonodactyla*, Schiff., *isodactylus*, Zell.

B. Palpi and frontal tuft longer than the head.

I. With the black scales on the third plumule absent.

α. With the dark costal triangle obsolete—Gillmeria *ochrodactyla*, Hb., *pallidactyla*, Haw.

Genus: Fredericina, Tutt.

Synonymy.—Genus: **Fredericina**, Tutt, "Ent. Record," xvii., p. 37 (1905). **Alucita**, Schiff., "Sys. Verz.," 1st ed., p. 146 (1776); 2nd ed., p. 128 (1801); Hb., "Eur. Schmett.," pl. ii., fig. 7 (1804), pl. vii., figs. 37-38 (1823); Zett., "Ins. Lapp.," p. 1012, var. *a-b* (1840). **Platyptilia**, Hb., "Verz.," p. 429 (1825); Zell., "Linn. Ent.," vi., p. 333 (1852); Staud. and Wocke, "Cat.," 2nd ed., p. 342 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 785 (1877); Frey, "Lep. Schweiz," p. 428 (1880); Tutt, "Young Nat.," x., p. 163 (1889); xi., p. 179 (1890); "Pter. Brit.," p. 48 (1895); Meyr., "Trans. Ent. Soc. Lond.," p. 486 (1890); Hofmann, "Deutsch. Pteroph.," p. 48 (1895); Meyr., "Handbook," p. 434 (1895); Staud. and Reb., "Cat.," 3rd ed., p. 72 (1901). **Pterophorus**, Dup., "Hist. Nat.," xi., p. 652, fig. 9 (1838); Zell., "Isis," p. 777

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* In several specimens of *gonodactyla* and *zetterstedtii* there is no shading of the hind-tip, in which case only the grey-brown or yellow coloration of the hind-tip is respectively distinctive (Hofmann).

‡ *Similidactyla*, Dale = *lithodactyla*, Tr., and has nothing to do with this genus. Hofmann is here possibly dealing with *isodactylus*, Zell., under the name of *similidactyla*, Dale. The species often has a fairly developed costal triangle (Tutt).

(in part) (1841); Dup., "Cat. Meth.," p. 381 (in part) (1845); Tgstrm., "Finl. Fjär.," p. 154 (1847); Frey, "Tin. und Pter.," p. 403 (1856); Sta., "Ent. Ann.," ii., p. 44 (1856); "Man.," ii., p. 441 (1859). **Platyptilus,** Zell., "Isis," p. 777 (1861); H.-Sch., "Sys. Bearb.," v., p. 368 (1855); Wallgrn., "Skand. Fjäder.," p. 11 (1859); Wocke, "Stett. Ent. Ztg.," xxiii., p. 254 (1862); Jord., "Ent. Mo. Mag.," p. 121 (1869); Nolck., "Lep. Fn. Estl.," p. 801 (1871). **Amblyptilia,** South, "Ent.," xv., p. 34 (1882).

The genus *Fredericina* was created in 1905 (*Ent. Rec.*, xvii., p. 37), when *calodactyla*, S.V. (=*zetterstedtii*, Zell.), was named as the type. This became necessary owing to the discovery of certain marked differences that were found to occur in the early stages when compared with *Platyptilia*. The egg is long, roughly cylindrical, somewhat inclined to the brick-shape of the Agdistid egg, the micropylar end being wide and flattened, its nadir more elongated and rounded, and with only faint traces of surface reticulation. The larva is peculiar in that it is without any trace of the enlarged skin-points or skin-spines (not true skin-hairs) which are to be found in *Platyptilia*, *Gillmeria*, etc. As these are quite *sui generis* among "plume" larvæ, it would appear that *Fredericina* is a generalised form and never had them. Skin-hairs (as described elsewhere among the plumes) are absent in the Platyptiliids, but they are well provided with these little unjointed spines, which, however, as already noted, are absent in *Fredericina*. The larval dorsal tubercles of the meso- and metathorax show, in *F. calodactyla*, the dorsal hairs (i and ii) of either side on a separate plate, but these so close together that, in some instances, it is not quite clear that they are really separate. In *Platyptilia* (*gonodactyla*) they are in every case both on the same plate. The larva of this genus forms a puparium in which to pupate as in *Platyptilia*. The pupa shows the double dorsal ridge weak; the nosehorn sharp (0.6mm. long in *F. calodactyla*), the anal end blunt, the cremaster with very few hairs; the posterior borders of abdominal segments smooth; the colour homogeneous and dark. Judged by external imaginal characters, *nemoralis* and *tesseradactyla* belong to *Fredericina*. This suspicion may be entirely upset, when more is known of the early stages. Speaking of the closely-allied pairs of Platyptiliid species, likely to be mistaken for each other, *e.g.*, *gonodactyla* and *farfarella*, *calodactyla* and *nemoralis*, Hofmann observes that they may be readily recognised as distinct species by the differences in the apophyses of the penis and of the ninth ventral plate.

Fredericina calodactyla, Schiff. and Denis.

Synonymy.—Species: **Calodactyla,** Schiff. and Denis, "Schmett. Wien.," 1st ed., p. 146 (1775); Ill., "Schmett. Wien.," 2nd ed., p. 128 (1801); Hb., "Schmett. Eur.," Aluc. pl. ii., fig. 7 (1804); "Verz.," p. 429 (1825). **Petradactyla,** Hb., "Schmett. Eur.," Aluc., pl. vii., figs. 37, 38 (*circ.* 1823); "Verz.," p. 429 (1825). **Calodactylus**, Dup., "Hist. Nat.," xi., p. 652 *in part*, pl. 313, fig. 9 (1838). **Tesseradactyla**, vars. *a-b*, Zett., "Ins. Lapp.," p. 1012 (1840). **Zetterstedtii,** Zell., "Isis," p. 777 *in part*, vars. *a* et *b*, pl. iv., figs. 3-4 (1841); Standfuss, "Stett. Ent. Zeit.," p. 156 (1848); Dup., "Cat. Meth.," p. 381 *in part* (1845); Tgstrm., "Finl. Fjär.," p. 154 (1847); Zell., "Linn. Ent.," vi., p. 333 (1852); H.-Sch., "Sys. Bearb.," v., p. 368 (1855); Frey, "Tin. Pter. Sch.," p. 403 (1856); "Lep. der Schweiz," p. 428 (1880); Stainton, "Ent. Ann.," ii., p. 44 (1856); "Man.," ii., p. 441 (1859); Wallgrn., "Skand. Fjäd.," p. 11 (1859); Jord., "Ent. Mo. Mag.," vi., p. 121 (1869); viii., p. 137 (1871); Nolck., "Lep. Fn. Estl.," p. 801 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 785 (1877); Staud., "Hor. Soc. Ent. Ross.," xv., p. 423 (1880); Snell., "De Vlind.," ii., pt. 2, p. 1020 (1882); South, "Ent.," xv., p. 33 (1882); xxii., pp. 29, 103 (1889); Leech, "Brit. Pyr.," etc., pl. xvi., fig. 7 (1886); Tutt, "Young Nat.," xi., p. 179 (1890); "Pter. Brit.,"

p. 48 (1895); Hofmn., "Deutsch. Pter.," p. 48 (1895); Meyr., "Handbook, etc.," p. 434 (1895); Staud. and Reb., "Cat.," 3rd ed., p. 72 (1901); Barrt., "Lep. Brit. Isles," ix., p. 355 (1904). **Megadactylus,** Mann, "Stett. Ent. Ztg.," p. 209 (1850). **Zetterstedtti**, Staud. and Wocke, "Cat.," 2nd ed., p. 342 (1871); Meyr., "Trans. Ent. Soc. Lond.," p. 486 (1890). **Zetterstedii**, Tutt., "Young Nat.," x., p. 163 (1889). **Nemoralis,** H.-Sch., "Sys. Bearb.," v., fig. 7 (1855); South, "Ent.," xiv., p. 304, pl.i., fig. 19 (1881). **Zetterstedti,** Leech, "Brit. Pyr.," p. 54, pl. xvi., fig. 7 (1886). **Taeniadactylus,** South, "Ent.," xv., p. 34 (1882); xxii., p. 30 (1889). [There appears to us to be little doubt, from the evidence offered by Schiffermüller's description of *calodactyla*, and Hübner's figure of the same, that both are to be referred to this species. Certain it is that, in both cases, they are Platyptilias, with which Hübner, in the *Verzeichniss*, p. 429, places them, and that both are the same species. In addition, Charpentier states that they agree (see *anteà*, p. 76), and that *gonodactyla*, Schiff., is only a worn *calodactyla*, Schiff. (*anteà*, p. 77), a mistake that might readily occur, but which shows also that both are Platyptilias. Zeller's own opinion (*Isis*, 1841, p. 879), that "hitherto he had thought that *calodactyla*, Hb., fig. 7, was meant for *zetterstedtii*, an opinion confirmed by its union in the *Verzeichniss* with *megadactyla*, Hb. (*gonodactyla*, Schiff.)," is important, but, as Hübner wrongly referred the larva of *Amblyptilia cosmodactyla*, Hb., to *calodactyla*, Hb. (*Raupen*, etc., ix., pl. *c*, figs. *a-d*), Zeller avers himself unable to solve the puzzle. We cannot understand Zeller's difficulty. Hübner's error in referring the larva and pupa to his *calodactyla* is evident. An Amblyptiliid larva and pupa cannot produce a Platyptiliid imago. Zeller thinks also (*Isis*, 1841, p. 879) that Hübner's *petradactyla* is nearly allied to *zetterstedtii*. Herrich-Schäffer (*Sys. Bearb.*, v., p. 368) expressly states that they are identical, and Hofmann agrees (*Die deutsch. Pteroph.*, p. 194) with this and treats it as the same species. This is our opinion.]

Original description*.—Dunkelbraun, und oraniengelb-gemischtes Geistchen (Schiffermüller). [Ground colour reddish-brown, costa darker; a distinct dark triangular costal blotch; the base of this blotch towards outer margin, its apex on the costa, at about one-third from base of wing; beyond the costal blotch a transverse yellow band extending to fissure; below fissure the yellow band is continued towards the inner margin as the base of a wedge-shaped mark, which runs along the inner margin of wing and points towards base of wing; this mark is edged superiorly with white, and this is continued as a fine white inner marginal line to the base; below it, about two-thirds from base, is a small, dark, longitudinal mark; across the two lobes and passing over the fissure is a pale line edged narrowly with black centrally, and much more broadly internally; three very short black longitudinal streaks arising therefrom pass into the yellow transverse band and point towards base, the most marked of these on costa; two small, black, longitudinal discal streaks; some white scales at end of fissure. Fringes greyish edged internally with darker. Hindwings unicolorous, reddish-grey, apex of 1st plumule rather dark, upper margin of all plumules edged with pale; fringes of plumules grey, mixed with darker scales on lower margin of 3rd plumule (Hübner, *Schmett. Eur.*, *Aluc.*, pl. ii., fig. 7).]

Imago.—19mm.-24mm. Anterior wings, apical point sharp and dark; ground colour greyish-ochreous; the costa darker; a large triangular costal blotch, base towards fissure apex on costa, of a deep red-brown colour; a short dark median longitudinal discal dash; inner margin whitish, cutting off darker longitudinal area between this and middle of wing; this darker longitudinal area with the appearance of being made of dark

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* Zeller's description of *zetterstedtii* reads as follows:—"Capillis in fasciculum brevem frontalem productis; alis anterioribus dilute ochraceis, marginibus brunnescentibus, triangulo costali ante fissuram cinnamomeo, striga laciniarum pallida; in digiti tertii dorso medio lineola atro-squamata. Var. *b*. Solito major" (*Isis*, 1841, p. 777).

lineations; two small black points on the inner margin, one about two-thirds from base, and one midway between this and anal angle (latter looks like a continuation of base of costal triangular blotch in crescent form); a pale crescent of ground colour, separating base of triangular blotch from a dark transverse band extending from costa across both lobes to inner margin (this band varies much in width and appearance), and sometimes contains quite a black line on the costa; a pale transverse line of ground colour crosses both lobes nearer hind margin than end of fissure; fringes white, except at anal angle where is a dark grey patch. Posterior wings reddish-grey, with a very mottled appearance; the costal edges of plumules pale shiny-grey; the apex of 1st plumule dark; the fringes long and pale grey, those of 1st plumule edged internally with dark, as in the lobes of the forewing; those of the hindmargin of the 3rd plumule mixed with black scales from base to nearly half-way to apex, where they become segregated into a conspicuous extended bunch (very inconspicuous in worn examples).

Variation.—The species varies considerably in colour, size, and markings. In some examples the prevailing colour appears to be reddish-brown, the costa, inner margin, triangular costal blotch, and transverse lobal bands being of this colour, the pale tint being confined to a longitudinal section of the middle of the wing, the pale lunule at the base of triangle (and its weaker continuation) and the narrow transverse lobal line; in others the pallid colour is predominant and the reddish-brown areas ill-developed; in others again the base of the triangular patch is extended to, and connected with, the lower half of the dark lobal band. In tint, too, the pale areas have in some specimens a much greyer, in others a more ochreous, hue. [The above notes were made from the examples in the Frey collection.] Our British examples vary considerably, and, on the whole, are slightly smaller and darker than those represented in the Frey collection; they are particularly wanting in the marked mottled appearance, and the dark markings are considerably more intense than in the continental specimens examined; in this respect, they are much nearer Hübner's figure although the ochreous band at fissure and pale wedge-shaped mark below the costal triangle are never yellow as in that; the deeper ground colour, more intense lobal bands, costal triangle, and inner marginal lineolæ, darker fringes, as well as the much darker hindwings, are very characteristic. One remarkable specimen in our collection, however, taken by South in Devonshire, is exceedingly pale, almost of a whitish colour. The species varies in size in England, for South notes a specimen captured in North Devon (and figured *Entom.*, xiv., pl. 1, fig. 19, under the name of *nemoralis*) that he says measured rather over 14 lines (rather over 29mm.) in expanse. Some from Devonshire and Kent average about 20mm.-23mm., the largest being only 23·2mm. Zeller, however, was the first to notice this large aberration (*Isis*, 1841, p. 977). The forms that have come under our notice appear to be as follows:—

1. Ground colour whitish (almost white); the costal triangle, and lineolæ on inner margin the only darker (brown) markings, the lobal bands and normally darker markings faintly marked in ochreous = ab. *pallida*, n. ab.

2. Ground colour ochreous, the costal triangle, costa, lineolæ on inner margin, and transverse lobal bands reddish-brown = var. (et. ab.) *zetterstedtii*, Zell.

3. Ground colour ochreous, suffused with brown scales, the costal triangle, costal margin, lineolæ of inner margin, and particularly the lobal bands of a deep

chocolate-brown, inclining to blackish; fringes black = var. (et ab.) *taeniadactylus*, South.

4. As in 3, but the costal triangle rather less distinct, and fringes white = ab. *petradactyla*, Hb.

5. Ground colour yellow (bright ochreous), and confined to the transverse lobal lines and inner marginal half of wing; the rest suffused with red brown; the costal triangle, lobal bands, and inner marginal lineolæ nearly black = *calodactyla*, Hb.

We note the Bossekop examples as being particularly bright in colour, but still they are very like the Silesian and central European type, although Wocke notes those taken at the foot of the Scaaddavara, as a little smaller (21mm.-22mm.) than those from the Riesengebirge, whilst Fuch's *doronicella* is, like *petradactyla*, a merely slight modification of South's *taeniadactylus*. Zetterstedt recognised it as a variable species, and gives (*Ins. Lapp.*, p. 1012) descriptions of the following Scandinavian forms:

(1) Alis anticis flavis, atomis brunneo-ochraceis adspersis, macula costali triangulari mox pone medium brunnea albo-terminata, margine interno fasciculis 2 cum ciliis immixtis fusco-brunneis. Long. al. exp. circiter $\frac{7}{8}$ poll.

(2) var. *a*. Alis anticis flavis, macula costali mox pone medium margineque apicali summo, brunneis; reliqua ut in diagnosi.

(3). var. *b*. Alis anticis flavis, macula costali mox pone medium, margineque apicali late brunneis, hoc striga pallida margini parallela notato; reliqua ut in diagnosi.

His var. *c*, "Similis var. *b*, sed paullo obscurior, cinerascens," is no doubt *gonodactyla*. Zeller notes that Mann's Pisa specimens do not in the least differ from the Sudeten examples. He also says that Herrich-Schäffer's fig. 7 (noted as *nemoralis*) is of too pure a yellow for true *nemoralis* ♂, the spaces between the costal triangle and the transverse line of the upper lobe being too narrow and the lobes of too yellow a ground-colour and without white dusting; and adds that, as the underside is not depicted, both Herrich-Schäffer's figures may serve as very successful representations of *zetterstedtii*, if we leave out of consideration the size of the first and the subjoined measurement of the second. The following are the already described forms:

α. var. (et ab.) *zetterstedtii*, Zell.—Capillis in fasciculum brevem frontalem productis; alis anterioribus dilute ochraceis, marginibus brunnescentibus, triangulo costali ante fissuram cinnamomeo, striga laciniarum pallida; in digiti tertii dorso medio lineola atro-squamata (Zeller, *Isis*, 1841, p. 777).

Zeller's description of the ordinary central European form under this name was not made in ignorance of the early Hübnerian names. He fully recognised that Hübner's fig. 7 *calodactyla* was a brightly coloured example of this species, his only doubt in applying the latter name to the species arising over the fact that Hübner figured elsewhere the larva of *cosmodactyla* (*acanthodactyla*) under the same name.

β. ab. (et var.) *petradactyla*, Hb., "Eur. Schmett.," Aluc. pl. vii., figs. 37-38 (1823).—Hübner's figure may be described as having the forewings ochreous, shaded with brown along the costal and inner margins; the costal triangle brownish-red, rather indistinct; the pale transverse band at base of triangle (just before fissure) and the median patch only pale ochreous; the lobal transverse line whitish, edged externally with darker, the whole lobal area dark; fringes white with black basal line. Hindwings unicolorous reddish-grey, fringes dark grey, no dark patch to third feather.

There can be no possible doubt whatever that this insect belongs here. This has been acknowledged by Zeller, Hofmann, and most other serious students of the superfamily. Zeller notes (*Linn. Ent.*, vi., pp. 333-4) of Hübner's *petradactyla* (figs. 37-38) that the differences between the figures and his *zetterstedtii* are probably entirely due to the poor condition of the specimens figured by Hübner, these differences (as shown by Hubner's figures) being—a broad brown dash in place of the costal triangle of the forewing, a bright elongate dash before the cloud of the lower lobe (indicated in *calodactyla*), the thick yellowish transverse lines in the lobes; the want of black scales on the margin of the third plumule of the hindwings, the shortness of the forewings. Zeller surmises further that Kuhlwein supplied Hübner with his *petradactyla* from the Riesengebirge. Herrich-Schäffer observes (*Sys. Bearb.*, v., p. 368) that Hübner's figures of *petradactyla* are small examples of this species from Silesia, and were, he adds, in Geyer's collection. The figures, he says, are sufficing but poor, the terminal portion of the fringes on the forewings not white enough, the inner margin not sufficiently sharply defined, the tooth on the outer margin of the third plumule of the hindwings absent.

γ. var. (et ab.) *taeniadactylus*, South, "Entom.," xv., p. 34 (1882); xxii., p. 30 (1889); Leech, "Brit. Pyr.," p. 54, pl. xvi., fig. 8 (1886); Tutt, "Brit. Pter.," p. 49 (1895).—Expanse 9½-10 lines. Forewing, ground colour pale ochreous-brown, dusted with darker brown scales; a narrow dark chocolate line edges the costa, and a dark chocolate-brown stripe runs along the inner margin; this latter is interrupted or broken by three blotches, rather paler than the ground colour, one at the base, one in the middle, and one between this and the angle of inner digit; there are three conspicuous dark chocolate-brown marks; the first, somewhat triangular in shape, has its base on the costa just beyond the middle, and its apex in close proximity to the digital juncture; the inner half of this triangle is much darker than the costal half, and its posterior edge is distinctly edged with whitish, especially so on the costa; beyond this the second and third marks represent a broadish fascia, interrupted by the fissure; its posterior edge is sharply defined by a whitish line running parallel with the hind margin; fringes black, streaked along the inner margins with white. Tip of outer digit acutely pointed. Hindwings dark grey-brown, with only slightly paler fringes, except third feather, which has an elongate patch of black scales in the middle, and between this and the base of feather, whitish cilia. Head and thorax colour of forewings. Abdominal juncture whitish. North Devon, three examples; other examples in Doubleday collection under name of *zetterstedtii*. The species may be at once separated from the last-named species by its narrow wings, the structural character of which would seem to indicate its belonging to the subgenus *Amblyptilia*. The ground colour and markings certainly favour *zetterstedtii*, but only superficially, for, on comparison, the dark brown digital fascia and black cilia sufficiently establish its claim to rank as a distinct species (South).

Leech says that this aberration occurs in June and July at Lynmouth; it flies at dusk; and differs from the type by the narrower wings, the darker brown digital fascia, and the black cilia. We do not observe the narrowness of the wings, but the darker brown digital fasciæ, the darker (not black) fringes, the suffusion of the ground colour, and other details, are very characteristic of the majority of our darker British specimens.

δ. var. (et ab.) *doronicella*, Fuchs, "Stett. Ent. Zeitg.," p. 329 (1902); Rebel, "Lep. Balk.," p. 310 (1903). *Zetterstedtii* var. *b.*, Zell., "Isis," p. 977 (1841). ? *Nemoralis*, South, "Entom.," xiv., pl. i., fig. 19 (1881).—Larger, 11mm.-12mm.; forewings with elongated apex, reddish-grey dusted with brown, with a dark brown costal triangle anteriorly weakly-margined before the fissure; lobes brown, clouded with darker shades; underside darker with a yellow line before the outer margin of the first segment of the hindwing. From letters received I first heard of this form, supposed then to be a var. of *nemoralis*, from which it was said to differ still more than var. *saracenia*, Wk., but, last autumn, two fine examples were sent to me as *zetterstedtii* var. The yellow line which occurs on the underside of the first segment of the hindwings near the outer margin—the best-known character by which *zetterstedtii* may be separated from *nemoralis*—proves it to belong to the former, though it differs from that in its distinctly larger size and different coloration. In size between *zetterstedtii* and *nemoralis*. Forewings with distinctly elongated apex, without the yellow tint of its ally, reddish-grey darkened with brown dusting. The lower part of the costal triangle, before the fissure, is marked distinctly only on its outer edge by a broad whitish transverse fascia; both lobes are brown-clouded; the cloud is interrupted by the transverse fascia and the pale line which runs before the outer margin, it is distinct on the upper lobe and is there posteriorly bordered by a blackish line; before this, in about the centre of the upper lobe, lies an indistinct brown triangle produced towards the base of the wing. The pale line of the lower lobe dies out towards the inner margin. Costal fringes before the pale line across the lobe scaled with darkisk black, outer marginal fringes blackish-brown at the base, the outer half white; the inner marginal fringe of the lower lobe white, twice spotted with brown, broadly brown at the anal angle. The hindwings brown, darker than in *zetterstedtii*, especially the third plumule, which has the scale tuft always larger and, therefore, more noticeable. Underside much darker than in *zetterstedtii*, grey-brown, the first segment of the hindwings with a sharper lighter diagonal line, the abdomen above blackish-brown. From Breslau. According to Herr Götschmann, from whom I received them, this is the form of *zetterstedtii* which flies among *Doronicum austriacum* (Fuchs).

One cannot certainly gather from Fuchs' account whether this be only an aberration or local form of the insect, possibly only the former. It is possibly to this that Zeller's var. *b*, described as "solito major," belongs, also South's large aberration captured in 1881 near Lynmouth. Still Fuchs' wing-measurement, 22mm.-24mm., with say 1mm. for width of thorax, makes this little larger than the specimens in the Frey collection from Silesia, etc., and which belongs to the form *zetterstedtii*, as compared with our smaller British examples from 19mm.-22mm., for the darker (if not all) of which we are inclined to keep South's name *taeniadactylus*, his type being evidently neither the palest nor quite one of the darkest of our British race. Still, Rebel notes that "a ♀ sent by Drenowski taken on the Vita, belongs to this quite recently described form, which differs very strikingly from the type in its larger size, deeper colour and stronger tooth of scales on the inner margin of the hindwings." Rebel adds that he has "also taken this form in the Wienerwald and in the Hochschwab district. Specimens have also been described from Breslau." We note that, although Fuchs' specimens have the rather darker general tint, and deeper coloured lobes of South's *taeniadactylus*, these features are coupled with a larger size, not so great as that of South's *nemoralis*, which is otherwise paler in tint. For the present we conclude that it is best to keep the name.

Comparison of Fredericina calodactyla and F. nemoralis.—Zeller says (*Linn. Ent.*, vi., pp. 333-5) that the life-histories show these to be separate species, although in the imagines it is difficult to find marked differences to separate them. The yellowish transverse line on the underside of the first plumule of the hindwings, always present in *F. calodactyla*, is said to be always absent in *F. nemoralis*, but as the line is so variable in *Platyptilia gonodactyla* one doubts where it is here sufficiently constant to differentiate the species. On the whole, *nemoralis* is a much larger insect than *calodactyla*, although occasional specimens of the latter approach it in size. Hofmann observes (*Die deutsch. Pteroph.*, p. 46) that, in *F. nemoralis*, the costal triangle is usually cut off straight below, and leaves the lowest part of the black streak at the fissure free; in *F. calodactyla* this is not so, or, at least, it is less clearly defined. The black scales on the 3rd plumule of the hindwings, also, always forms a much longer and thicker tuft than in *F. calodactyla*.

Comparison between Fredericina calodactyla and Platyptilia gonodactyla.—The former is more ochreous and has a redder tone, much less grey, distinctly more marbled and hence is a much brighter, as well as darker, looking insect. Stainton notes it (*Ent. Ann.*, ii., p. 44) as much darker in colour, the lobes of the anterior wings especially darker; the tip of the anterior lobe rather less produced; the pale streak keeping nearer to the hind margin on the second lobe. Leech observes it as being more slender in appearance, having the broken dash of dark brown colour along the inner margin of the forewing and the broad pale posterior edging of the costal triangle. Hofmann observes (*Die deutsch. Pteroph.*, p. 48) that *F. calodactyla* always differs, even in the darkest examples, from *P. gonodactyla* by its rich admixture of yellow and its brighter coloration; the markings are the same, the only noticeable difference being that the yellow colour (beyond the brown costal triangle) extends in a diffused manner further into the upper lobe, but even this character is not quite constant; the brown space in front of the white transverse line on the upper lobe, as regards its extent and its paler or darker tint, is just as variable as in *P. gonodactyla*.

Egglaying.—The eggs are laid beneath leaves of golden-rod, the upper surface tending to become depressed by desiccation, as in many plume (and other "flat") eggs. Those under observation began to hatch July 3rd, 1904 (Chapman).

Ovum.—The egg is pale yellowish-green in colour, ovoid in form, 0·52mm. long, 0·30mm. wide, and 0·26mm. high at the thicker, and 0·18mm. at the thinner, end. The sculpturing is of a hexagonal character, or at least polygonal, but is faint or evanescent, there being apparently the depressions of the cells, although the divisions between them are not well defined lines (Chapman. Described June 26th, 1904. The eggs probably at this date already laid a few days; hatched July 3rd). A long oval in outline, slightly inclining to brick-shape, the two ends of different form, the one flattened and the other tending to be pointed. Of the usual pale yellow-green colour, and semitransparent in appearance. Length between ·5mm. and ·6mm., width about ·3mm., thickness about ·250mm. to ·275mm. The pointing at the narrow end (? the nadir) is very much more apparent on edge view, the outline viewed in this position is really a very long ovoid. I can find no trace of structural pattern, the surface appearing varnished as usual. The sides of some of the eggs are somewhat depressed in places, but the eggs seem to vary a good deal in this respect, so perhaps the depressions are only a sign of age (Bacot, July 2nd, 1904).

Habits of larva.—Young larvæ left the eggs on July 3rd, 1904, and disappeared rapidly, apparently somewhere towards the lower part of the plant, but opportunity was wanting to carefully examine leaves, etc., for burrows (Chapman). The only (we believe) full-grown larva ever examined in Britain, was taken by accident in Raindean Wood, Folkestone, on May 23rd, 1904. Searching for larvæ of *Leioptilus tephradactyla* on leaves of golden-rod, we found a larva feeding low down in the main stem of a young plant of *Solidago virgaurea*, the burrow reaching into the root so that the outside leaves hardly held together when the affected part of the stem and root was pulled from the ground. The larva was sent to Dr. Chapman, with others of *Adkinia bipunctidactyla*, in stems and roots of *Scabiosa*, who at once guessed its species. "It was then, on May 25th, in the centre of half-a-dozen root-leaves, or leaves of a stem not yet begun to shoot up, these had apparently been pulled up together, but had broken from the root-stock at the level of the lowest leaf, so that a mere film below the larva remained to hold the leaves together, the larva had apparently eaten the central young leaves and bud, and as it changed to pupa not many hours after I found it, I imagine it used the space it had so cleared as a puparium, but I discovered no trace of silken cocoon or other means of attachment. The character of this pupa that is most marked in contrast with those of the other Platyptilias, is the delicacy and transparency of the pupal shell, and the netted pattern extending over so much of the pupa and over the transverse ridges (Chapman).

Larva.—*First instar* (newly-hatched): About 1mm.-1·5mm. in length according to extension. Head black; the remainder white or rather colourless and very difficult to make out owing to its transparency. The black head is ·27mm. across, and has various pale hairs in definite positions. The longest, 0·09mm. long, is in front, just above the antennæ, then several higher up and more laterally, a very small hair (0·02mm.) in the middle of either side (seen from the front), a similar hair on each side just above the clypeus, and another one at each angle close to lower end of clypeus. The clypeus itself has a small pair nearly central, a pair above and further out (about 0·04mm. long), and a pair just above the labrum. The jaws, 0·08mm. long and 0·05mm. wide (seen from front), are brown with 4 teeth and rounded edge internal to them. The prothorax has a faintly tinted thoracic plate, on which only 4 hairs can be made out on either side, apparently the 1st and 3rd of the front row and the 2nd and 3rd of the posterior row, of the two normal rows of three each. Of these the 1st of front row is 0·025mm. long, the 3rd 0·15mm., of the posterior no. 2 is 0·11mm. and no. 3 is 0·03mm. long. The spiracle is large and on a rounded, but somewhat conical, boss. There is a long hair, 0·16mm., in front of it, and this is apparently accompanied by one or two quite short ones. On the meso- and metathorax* there are the usual four pairs of hairs on either side, except that instead of the third pair, is a single hair, as is common in first instar. The two hairs of each pair are closer together than to the next pair, but are still a little way apart. It is not possible with their great translucency to say positively whether they have or have not a common chitinous base, but they appear to be separate. Their lengths are, 1st, 0·025mm.; 2nd, 0·18mm.; 3rd, 0·025mm.; 4th, 0·06mm.; 5th (the single one), 0·17mm. On the abdominal segments the hairs are normally disposed, those on i and ii well apart and trapezoidal, iii just above and in front of spiracle, iv below it, v well above and in front of iv, and apparently on a separate base.

* The tubercles on the meso- and metathorax of plume larvæ are primarily eight on either side, arranged usually in four pairs, at fairly equal distances apart, the first pair near the dorsum, the fourth close above the legs. Each individual hair (arising from tubercles) may be separate from the others, but it is usual for each pair to be together on a common plate, and in those species in which the tubercles become warts, they form four warts, and the pair of tubercles which each wart represents are often indistinguishable. There is also, usually, another tubercle (hair), behind the third pair, and in those larvæ with warts another also behind first pair. The two hairs of the first pair are usually arranged with the inner one most in front (trapezoidal), of the second pair the lower is generally to the front (reversed trapezoidal), the third pair are one above the other, and the fourth one in front of the other, to name these i, ii, iii, iv, etc., is to assume that they are homologous according to these numbers, with those on the abdomen. It may be so, but to my mind the evidence is much stronger that they are not so (Chapman).

There are also two (not so far as can be seen three, as in later instars) hairs at the base of each proleg, a posterior outer and longer, and a shorter inner rather in front; vi not seen; on segments without prolegs are two hairs in line transversely, vii and ? viii. The longer hairs (those on ii and iii) are nearly as long as the larva is wide, 0·23mm. and 0·16mm., that on i is about 0·06mm. and on v about 0·04mm. long, that on iv is, however, longer, 0·15mm. All the spiracles are well raised on tall rounded bases. The prolegs are on rather tall slender pedicels, and have three rather large hooks each. The hairs on the anal plate are difficult to locate exactly, but, besides shorter ones, there are four very long ones, 0·20mm. and 0·24mm. long. The claspers have four hooks, possibly five, as they are not very clearly seen, being easily retracted (Chapman, July 3rd, 1904). The newly-emerged larva has a somewhat flattened body tapering gradually to a rather pointed anus. The head is large and broad, carried horizontally, very polished in appearance, in colour dark brown. Both the anal plate and scutellum are in evidence, the latter paler than the head but still noticeably brown, the former very pale, almost of the same hue as the general body tint, that is a bright, but pale, semitransparent green. The segments are distinctly marked. The hairs are bright brown in a strong light, tapering, and, I think, quite simple; at any rate, I cannot discern any thorns; those on the head are short, but on the body they are much longer. The skin is shiny without spicular growth. Tubercles i and ii are set in pairs transversely, on meta- and mesothorax; their bases are well apart, but the space between the two pairs centrally gives them the appearance of being close together, iii and iv are close together but not touching; v is alone in usual position. On the abdominal segments i and ii are set in markedly trapezoidal position, iii carries a long single hair, iv and v, beneath spiracle, are, as usual, close together. There are, of course, no secondary hairs in this skin (Bacot, July 5th, 1905). *Final instar* (fullgrown): This larva is very like that of *Platyptilia gonodactyla* in general aspect; but differs especially in having no secondary hairs (*i.e.*, skin-points). The head is light brown. There is a deep brown prothoracic plate, divided in the middle line, with the usual six hairs on either side and a slightly darker puckered spot, where some plume larvæ have a black mark; the prothoracic spiracle is placed in a hardly raised conical plate, of about thrice the diameter of the spiracle itself; this plate looks nearly black; in front of the spiracle is a large plate with three hairs, the lower (front) one largest. On the meso- and metathorax, there are, on each side, three plates at regular intervals down the middle of segments, each of these tubercular plates with two hairs; and much lower a fourth plate with two hairs at base of legs. The first plate is nearly divided into two. Behind and between the second and third is another plate with one hair. Of the four plates the first has the hairs slightly trapezoidal, *i.e.*, the second a little further back. The second has them reversed, *i.e.*, the second rather forward, the third has them in line with the zone of the segment, *i.e.*, in a transverse line, the fourth has them one in front of the other. On the abdominal segments i and ii are placed trapezoidally, about one-third of the width of the segment apart, iii normal, iv and v on a single plate well below the spiracle, tolerably close together and the anterior (v) upper; vi has two hairs rather near together, but on separate plates, the anterior the higher, vii has three hairs, at base of prolegs, the posterior the largest; a minute hair below prolegs. The abdominal spiracles are nearly as large as the thoracic, that of the 8th abdominal much larger than the others. Anal plate dark with several long hairs. Length of hairs—longest about 0·3mm. on front and anal segments, on abdomen generally 0·1mm. to 0·15mm., with some shorter. Prolegs with seven to nine crochets, claspers with nine; the prolegs have very short chitinised pedicels. The skin-points are extremely fine, black; there are various small lacunæ free from them, but nowhere any trace of secondary hairs of any sort. The true legs are nearly black, with a fine sharp claw and well-chitinised base, and a good many bristles. The general colour of the larva is greenish-yellow, with a pink dorsal line, there is a pink band between ii and iii, with branches or extensions down to below spiracles. The tubercles are black, but all have a pale area round them, almost giving a pale subdorsal and lateral line. The pink and white below the spiracle merge into the green ground colour, which the pink and white above seem rather to overlay than replace. The plates on the last segments are nearly black; the 8th abdominal has two plates dorsally, each with only one hair (ii ?) and behind them a very narrow plate without hair, the 9th abdominal has a transverse plate, carrying two hairs on each side, and a subsidiary plate at each end (each with two hairs), that seem to be attached to the central one, making a continuous plate, right across the dorsum. The anal plate has seven hairs on each side. [The description of this larva may differ a little from that of a feeding example by its being so near pupation.] (Chapman, May 25th, 1904).

Foodplants.—*Solidago virgaurea* (Wocke), [*Senecio sylvaticus* (Rössler), *Senecio nemorensis* (Herrich-Schäffer)].

Puparium.—The only fullgrown larva ever examined in this country used for a puparium the hollow that it had made in the stem of *Solidago virgaurea*, in which it had been feeding, and which was loosely augmented by half-a-dozen radical leaves, but it appeared to use no silk whatever to hold the almost detached leaves together nor for suspension. This example pupated on May 26th, 1904, and the imago emerged in mid-June (Chapman). [Zeller says that "Fehr found larvæ in stems of *Senecio nemorensis* in June. These pupated from July 25th, the imagines appearing in about three weeks." (It must not be overlooked that this is the foodplant of the allied *F. nemoralis*.)]

Pupa.—The pupa, when first changed, is a vivid green with red longitudinal stripes on the abdominal dorsum. When mature the colour is rufous, with a faintly darker subdorsal line and darker beak. The double dorsal flanges, or ridges, are not strongly pronounced, and are not differentiated in colouring. On the mesothorax they seem rather wide apart, but this may be because they are not so high, *e.g.*, as in *Gillmeria pallidactyla* (*bertrami*). In some lights, the spiracles glisten. The sides of the first three abdominal segments are a little paler than the rest of the pupa, with a slight greenish tint. The most striking character of the pupa, as compared with those of *Platyptilia gonodactyla*, *P. isodactylus*, etc., is that the 9th and 10th abdominal segments are very short, so that, instead of the anal end of the pupa being conical, in continuation of the tapering of the previous segments, the end looks rather abrupt with the cremastral pen rather dorsally affixed, the difference, on close examination, is not great, but is enough to strike the eye. [I have only one pupa, and that one was much disturbed in its last larval instar and had no silk to which to attach itself, so that the difference may be due to the abnormal conditions, but there is no appearance of deformity.] To complete the account of these terminal segments, the length along the dorsal line of the 8th abdominal segment is 0·4mm., and of the 9th and 10th, to apex of cremastral pen, is 0·8mm., together 1·2mm. In *Gillmeria pallidactyla* (*bertrami*) the three segments are 1·7mm., of which the 8th takes about 0·45mm., and the 9th and 10th, 1·25mm. As the dorsal line is fairly straight, the result is that the ventral aspect of the 9th is terminal rather than ventral. The cremastral hooks are a set of ten forward, apparently arising from the two round ventral eminences of the 9th segment, and a posterior set rising round the margin of the cremastral spine, eight or ten near the apex (of which one or two are on the dorsum), and then, after a vacant space, some thirteen or fourteen along the margin quite up to the base; all are directed in the plane of the cremastral pen, *i.e.*, except the terminal one, laterally, rather than ventrally; they are brown straight bristles, with one complete close circular coil at the end, so close that the central opening of the circle is less than the thickness of the bristle; they are about 0·12mm. long. The anal scar is deep, between two large rounded and very wrinkled eminences. The eminences of the 9th abdominal segment have been referred to. The pupa is a male. The cremastral spine has a lofty ridge down each side of its dorsal aspect, on each are two minute hairs (0·02mm. or 0·03mm. in length) which probably represent tubercles ii of the 9th and 10th abdominal segments respectively. The length of the pupa is just 10·0mm.; seen laterally it is just 2mm. at the 2nd abdominal segment, in antero-posterior diameter; forwards it gets rather narrower, notwithstanding the dorsal crests (ridges or flanges) on the mesothorax. It tapers to about 1·3mm. at the 7th abdominal segment, the 8th is about 1mm. in diameter. The nose-horn is long and sharp, about 0·6mm. long and about 0·4mm. wide at base, and, with the whole head, is much wrinkled, chiefly transversely, and half-way along has a small knob on each side carrying a hair, with a smaller knob nearer the sharp apex. The mandibles are well marked and much wrinkled, they meet in the middle line for about 0·1mm., and so the labrum is only seen above them; between them and the two portions of the maxillæ is a small diamond-shaped piece of labium. The maxillæ disappear under the first legs after about 3mm., and remain so for 1·0mm. and reappear for a final 1·0mm. between the wing-tips, the first legs ending just after they reappear. The bundle of free appendages over the 4th abdominal segment does not quite reach its posterior border. Its tip consists of the second and third tarsi; the maxillæ nearly reach the tip, the sharply-produced wing apices are a little shorter, and the first legs barely reach into the bundle; the first but not the second legs reach up to the eyes. The antennæ extend to a little below where the maxillæ disappear, all these appendages are wrinkled, chiefly transversely, but the more basal portion of the antennæ are quite roughly and goutily lumpy. The wings show the venation as ridges, but without colouring; the hindwings end just past the spiracle of the 2nd (not the 3rd) abdominal, and have a quasi-suture marking them from the metathorax. There is a minute but distinct dorsal head-piece, which, on dehiscence, remains attached to the prothorax and also keeps the eye-cover attached to it. The transverse ridges of the thoracic pieces are less regular than on the abdomen, but are probably homologous with them though they look at first glance different. The dorsal flanges are wide apart on the front of the mesothorax and have a hair (representing tubercle i) internal to them, and one (ii ?) on the ridge; at the back of this segment they nearly coalesce, are ill-marked on metathorax, and more definite where they separate on the 1st, 2nd and 3rd abdominal segments. The sculpturing of an abdominal segment (say the 5th) is very similar to that of many other plumes. The whole surface is pitted with very minute fossæ, longest in the transverse direction; on the intersegmental subsegment and the intersegmental membrane proper these are arranged in transverse rows so closely together as to look very like the hexagonal cells on many eggs of lepidoptera, the space between the pits being merely fine raised lines like the network on an egg. What seems to be the intersegmental membrane proper is more delicate and has the network rather finer. The pits are about 0·008mm. in transverse, 0·004mm. in longitudinal, diameter. On the forward two-thirds of the segment, there is also a number (about 16 or 18) of transverse ridges (the pits not only lie between these, but form a continuous sculpture right over them, as if, as is probable, these ridges were not sculpturing but actual flutings of the whole thickness of the pupal shell). These fine ridges appear to run right across the segment, but, as an actual fact, they die out (intermediate ones appearing) after a length never more than a fifth or sixth of the circumference of the segment. There is no dorsal ridge on these segments, yet there is a slight angulation in the line of tubercle i. The tubercles carry a minute bristle (0·02mm.), i and iii between about the 6th and 7th ridges, and ii just in front of the last but one. The spiracle is an inconspicuous circle (or set of concentric circles) about 0·06mm. in diameter, which a little disarranges the ridges, the latter being about the same in number before and behind it. Behind the spiracle is a certain rearrangement of some of the ridges, which sweep a little backwards and then forwards, two finally passing forward and a little upward under the spiracle and thus crossing the others, and, possibly, representing one portion of the lateral flange, another portion of which, perhaps, exists in another doubtful ridge below this one; tubercles iv and v are on or just above this lower portion, v just in line of spiracle, iv lower and further back; tubercle vi carries a solitary hair, about two ridges from the posterior border; the three bristles of tubercle vii are as in the larva. The scar of proleg is marked by a slight tangle of the ridges, with a slightly raised dark mark (Chapman).

Time of appearance.—In Britain, this species appears to be on the wing from towards the end of June and continues throughout July. Mann notes it as early as the middle of May in the Pisa district, a record, however, that Zeller seems to doubt, although he notes the specimens as being accurately determined. In Germany, in the lowlands, it flies from early June into July, in the mountains from the end of July to the middle of August (Hofmann); early June in Hesse (Rössler); end of July and early August in Waldeck (Speyer); in July in Brandenburg (Kretschmer), and in the upper Harz (Hoffmann); June to August in Baden (Meess and Spuler); July 8th on the Sömmering in Styria (Roeslerstamm); in Switzerland, from the commencement of June into July at Zürich, the end of June at Samaden, commencement of August on the Bergli Alp (Frey); in Scandinavia it varies much, not althogether depending upon latitude, as it occurs from mid-June to early August at Tromsö; July to mid-August in the northern coast mountains of Lapland, from July 26th to August 8th at Bossekop, near Alten (Zetterstedt); middle of June to beginning of August in Finland (Tengström); from June 21st to August 1st in the Riga district (Teich). We have very few exact dates of capture of this species; the following are all we can muster:—July 16th, 1840, between Suul and Kongstue (Zetterstedt *teste* Zeller); July 10th, 1847, and throughout the month in the Riesen Gebirge (Standfuss); July 13th, 1860, at the foot of the Scaaddavara, Finmark (Wocke); June 1st, 1862, in the pinewood, south of Dotzheim (Rössler); July 28th, 1879, at Kerasdere, Amasia (Staudinger); June 11th, 1883, and August 2nd, 1884, at Tromsö (Schneider); July 22nd, 1897, in the Ustedal in Hol, and August 5th, 1897, at Aal (Strand); mid-July, 1900, at Pontresina (Chapman). In Britain, there are records from June 11th-July 1st, 1881, July 4th-18th, 1884, in North Devon (South); imago bred mid-June, 1904, from larva found in Raindean Wood that pupated May 26th, 1904 (Chapman); on the wing June 20th, 1904, at Folkestone (Purdey).

Habits.—This species was first found to belong to the British fauna in July, 1855, when several specimens were taken near Lynmouth by Boyd. Barrett says that the imagines inhabit woods in the south of England, flying along their broad grassy paths, or open spaces, but the species is extremely local, found among golden-rod but not among any species of ragwort. He further states that Zeller told him that, in Germany and the Alps of Central Europe, the species accompanied *Hellinsia osteodactyla*, a well-known *Solidago* feeder, "as if the two species belonged together." These are practically its habits in Raindean Wood near Folkestone, where it occurs with *Adkinia bipunctidactyla*, *Hellinsia osteodactyla* and *Leioptilus tephradactyla*, being disturbed by day from the long grass and other plants by the sides of the ridings where *Solidago virgaurea* grows, and flying more freely in the late afternoon and evening. South found specimens near Lynmouth by stirring herbage during the day. Standfuss gives (*Stett. Ent. Zeitg.*, 1848, p. 156) a most interesting account of the habits of this species in the Riesen Gebirge in July, 1847, observing that it appeared to fly in little companies, as he found, from time to time, some eight or ten specimens skipping about together over the low herbage, then for a time not one was to be seen, until another little company was discovered. *F. nemoralis*, he says, is certainly a distinct species; it was not found with *F. calodactyla* (*zetterstedtii*) on the hill-summits, but both were observed flying together lower down, and were then noticed to be distinctly different in their habits, as well as in size. The latter, he says, is a lively species for an Alucitid, flies freely by day in bright weather, and again later just at the very first shades of evening, and is always easily disturbed; the much rarer *F. nemoralis*, on the other hand, is exceedingly sluggish; it was scarcely ever to be found, even by the most diligent searching, throughout the day-time—from early morn until darkness had set in—and those seen allowed themselves to be readily picked off without attempt to escape, or fell to the ground; one, late in the evening, made a ponderous attempt to escape by flight. He further notes that the plant among which *F. nemoralis* hides is exclusively *Senecio nemorensis*, to the blossoms, leaves and stalks of which it clings, but *F. zetterstedtii* hides among many different plants.

Staudinger notes a doubtful example captured at light at Kerasdere in Amasia.

Habitat.—In England, it is a southern wood species, living by the side of the wide ridings in woods near Folkestone in Kent, Lynmouth in Devon, and Penzance in Cornwall, in the first two localities being abundant, but it is little known in this country, and is probably much overlooked. South notes that, in North Devon, it occurs in woody hollows near the sea, where, in its more western locality (from Lynmouth), there is an abundance of golden-rod, bilberry, heather, and other kinds of herbage, including a species of the *Compositae*, which he suspected might be connected with the moth, as it only seemed to occur where the plant grew; in the eastern locality (from Lynmouth) this plant was observed but golden-rod not. In the alps of central Europe the species is not uncommon, preferring apparently mountains of moderate elevation up to about 5000ft., although sometimes going much higher, since Jordan states (*Ent. Mo. Mag.*, xvi., p. 25) that it occurs in the fields beyond the church at Zermatt, also on the Riffelberg and on the way up to the Schwarz-See. It occurs freely in the mountains of Scandinavia, extending into Finmark and Lapland; it appears to be particularly abundant in the Riesengebirge in Silesia, in the Tyrol we found it on one of the little mountain paths that branch off into the woods of the Mendelstrasse, not far below the Mendel Pass (Tutt); in Finmark at the foot of the Scaaddavara, where there was plenty of *Solidago* but no *Senecio* (Wocke). Rössler notes the capture of a freshly-emerged example, June 1st, 1862, in the pinewood south of Dotzheim, where it flew just above the ground among *Senecio sylvaticus*, and adds that it tried to hide itself under the leaves of this plant. In Silesia, it occurs all over the Riesengebirge up to the summits of the mountains at 3500 ft., but is very rare in the plains, Wocke having once taken an odd specimen at Lissa in July; it also occurs in the foothills of Upper Lusatia (Sommer), and on the Oderwitzer Spitzberg, a basalt cone of 1574ft. elevation, near Herrenhuth (Möschler); common on the Probsthainer Spitzberger, in sunny places, flying about raspberry canes (Herrich-Schäffer), in Baden, it occurs in the mountains at Freiburg, always in the vicinity of *Senecio nemorensis* (Reutti). In Lower Austria, it is found in the Prater, in damp clayey spots near streams, in Liesing, Rodaun, and on the Eichkogl (Mann); yet Peyerimhoff took it at an elevation of 2500 metres on the Furka.

British localities.—Exceedingly local, and only discovered so far in the southern counties of England, in woods, comparatively near the sea. Cornwall: coast districts (Bond *teste* Jordan), Paul, Penzance (Baily). Devon: North Devon—Lynmouth (Boyd). Kent: Folkestone (Tutt), [Sydenham (Boyd), woods near Dover (Barrett)].

Distribution.—Central and Northern Europe, Piedmont and Central Italy, Taurus, southeast Siberia—Dahuria (Rebel). Asia: Taurus mountains (Rebel), ? Amasia—Kerasdere (Staudinger), Kentei mountains (Staudinger). Austro-Hungary: Hungary, throughout (Aigner), Styria (Roeslerstamm), Galicia (Nowicki), Bohemia (Nickerl), Lower Austria, distributed—Hernstein, on the Eichkogl (Rogenhofer), the Prater, Liesing, Rodaun (Mann), Tyrol–Rienzalpe, Cortina (Mann), below the Mendel Pass (Tutt), near Trafoi, Franzenshöhe (Heller), Transsylvania (Rebel). Bosnia: Dervent (Hilf *teste* Rebel). Bulgaria: western parts (Rebel). Finland (Tengström). France: Auvergne—Mont Dore, Cher—St. Florent, Indre — Nohant (Sand), Aube (Jourdheuille), Doubs, in the mountains—Pontarlier, Saut-du-Doubs (Bruand), Saône-et-Loire—Couches-les-Mines (Constant). Germany: Prussia—Neuhäuser, Dammhof, Königsberg, Norkitten (Speiser), Oberharz (Hoffmann), Hesse—the pinewood south of Dotzheim (Rössler), near Cassel (Knatz), Wiesbaden (Hofmann), Waldeck—Wildungen, Rhoden (Speyer), Thuringia—valleys (Knapp), Brandenburg—Frankfort-on-Oder, the Schwetiger Forst near Grundschäferei (Kretschmer), Silesia—distributed throughout the mountains up to 3500 ft., rare in the lowlands, Lissa (Wocke), Altvater, Leiterberg (Neustadt), near Reinerz (Standfuss), on the Oderwitz peak at 1574 ft., near Herrenhuth (Möschler), lower mountains of Upper Lusatia, distributed—near Lichtenau, Lauban (Sommer), Saxony—near Bautzen (Schütze), Freiberg (Fritsche), Bavaria—Allgau Alps (Hofmann), Baden—the mountains near Freiberg (Reutti), Feldberg, Todtmoos, Hinterzarten, St. Peter, Lahr, Hornisgrinde, Rippoldsau, Herrenwies, Heidelberg (Mees and Spuler), Schwarzwald (Frey), Alsace—in the mountains, Faisanderie, near Saverne (Peyerimhoff). ITALY: Pisa district (Mann). NETHERLANDS (Haar). ROUMANIA (Rebel). RUSSIA: Baltic Provinces—Aathales near Cremon (Nolcken), Tannenfeld (Berg). Livonia (Lienig *teste* Zeller), Riga district (Teich), Moscow district — Konobeewo (Albrecht). SCANDINAVIA: Sweden — Blekinge, Upland, Lapland, Norway — Finmark (Wallengren), at the foot oi the Scaaddavara (Wocke), Uleaborg, Kuusamo (Tengström), Saltdalen, Målselvdalen, Alten, Tromsö (Sparre-Schneider), Bossekop, Kaafjord, Sopnes, Nordreisen, Lyngör district—the Ustedale in Hol, Bakken, Aal (Strand), Slettafos (Jordan), between Suul and Kongstue (Zetterstedt *teste* Zeller), Stryn (Pettersen). SWITZERLAND: Western Alps, the Juras (La Harpe), Zürich, rare, Engadine—Samaden to Sils-Maria (Frey), Pontresina (Chapman), the Albula district—the Siala road, the Knieholzdreiecks near the Aela-Gletscherbach, Bergün, Glarus—Berglialp (Zeller), Zermatt (Frey coll.), the Riffelberg, between Zermatt and the Schwarz See (Jordan), Lenzburg, Oftringen (Wullschlegel), St. Gallen (Täschler), on the Furka at 2400m. (Peyerimhoff).

FREDERICINA TESSERADACTYLA, Linné.

SYNONYMY.—Species: **Tesseradactyla,** Linn., "Faun. Suec.," 2nd ed., p. 370 (1761); "Syst. Nat.," 12th ed., p. 900 (1767); Müll., "Faun. Ins. Frid.," p. 59 (1764); Göze, "Ent. Beit.," iv., pt. 3, p. 173 (1783); De Vill., "Linn. Ent. Faun. Suec.," ii., p. 532 (1789); Staud. and Wocke, "Cat.," 2nd ed., p. 342 (1871); Zell., "Stett. Ent. Zeitg.," xxxix., p. 162 (1878); Sorh., "Kleinschmett. Brand.," p. 3 (1886); Meyr., "Trans. Ent. Soc. Lond.," p. 486 (1890); Schneid., "Lep. Tromso.," p. 131 (1893); Barrt., "Ent. Mo. Mag.," xxxiii., pp. 25-26, 62 (1897); Kane, "Ent.," xxxi., p. 209 (1898); Walsm., "Ent. Mo. Mag.," xxxiv., p. 193 (1898); Fern., "Pter. Nth. America," p. 32, revd. ed. p. 33 (1898); Staud. and Reb., "Cat.," 3rd ed., p. 73 (1901); Dyar, "List Nth. Amer. Lep.," p. 444 (1902); "Proc. U. S. Nat. Mus.," xxvii., p. 923 (1904). **Tesseradactylus,** [? Fab., "Mant. Ins.," ii., p. 259 (1787); ? "Ent. Syst.," iii., p. 347 (1793);] Jord., "Ent. Mo. Mag.," vi., p. 121 (1869). **Fischeri,** Zell., "Isis," p. 781 (1841); Lienig, "Isis," p. 300 (1846); Zell., "Linn. Ent.," vi., p. 337 (1852); Dup., "Cat. Méth.," p. 383 (1845); Tgstrm., "Finl. Fjär.," p. 155 (1847); Stn., "Cat.," p. 28 (1849); H.-Sch., "Sys. Bearb,," p. 369, supp. fig. 12 (1855); Frey, "Tin. und Pter.," p. 405 (1856); Gart., "Wien. Ent. Monats.," p. 330 (1862); Wocke, "Stett. Ent. Zeit.," xxiii., p. 254 (1862); "Mitt. Schw. Gesell.," i., p. 335 (1865); Nolck., "Lep. Fn. Estl.," p. 801 (1871); Jord., "Ent. Mo. Mag.," xxiv., p. 42 (1887); Barr., "Lep. Brit. Isles," ix., p. 356, pl. 314, fig. 2 (1904). **Cosmodactyla,** Schläg., "Schmett. Tauschbl.," pp. 132, 216 (1848). **Tessaradactylus,** Wallgrn., "Skand. Fjäder.," pp. 8, 12 (1859). **Tessaradactyla,** Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 787 (1877); Hofmn., "Deutsch. Pter.," p. 51 (1895); "Illus. Zeits. Ent.," iii., pp. 152, 306 (1898).

Zeller says (*Isis*, 1841, p. 879) that Linné's *tesseradactyla* is so defectively described that its species can probably only be determined by the Swedish lepidopterists. In 1859, Wallengren determined the species as that which is here described; he says:—"As regards Linné's *A. tesseradactyla*, or, more correctly, *tessaradactyla*, it was a great satisfaction to us to find, through a consignment of moths, that Prof. Boheman shares our opinion on the species. Thus we found the result, at which we had previously arrived, confirmed by this celebrated entomologist, and regard it, therefore, as so much the more certain. Prof. Zetterstedt, in his *Insecta Lapponica*, has given the Linnean name to a species with "okragula" forewings, but that this cannot be correct is seen from Linné's words, '*alae superiores cinereo fuscoque nebulosae*.' Therefore, Zeller also has formed another name for

Zetterstedt's species, which was previously undescribed. That, at the same time, Linné's species should be sought among the more broad-winged, and not among those which have the hind lobe of the forewing deflected, is clear from the fact that with this, as with the preceding species, Linné says, '*alae . . . . fissura connivente*.' Hence one is obliged to take one's choice among the genus *Platyptilus*. Most authors have, therefore, thought to rediscover the Linnean species in *P. gonodactyla*, W. V. This has certainly also at times ash-grey forewings, but they are never '*cinereo-fuscoque nebulosae*,' as Linné states them to be in his species. Zeller has, therefore, rightly denied to this species the Linnean name, yet without giving it to any other. The genus named has, however, one species to which the Linnean description fits without violence, after the palpable mistake, '*alae inferiores . . . . tetradactylae*' has been corrected. Without any doubt we consider this species to be the *P. fischeri* described by Zeller, since only in this, can the forewings be said to be clouded with grey and brown. The whitish parts of the forewings are, especially in the more worn specimens, greyish, and the whole of the ash-grey ground colour is here and there strongly mixed with brown, so that, when one is not describing more accurately the colour-pattern of species, one will have to use just the expression chosen by Linné—and it is well enough known that the older authors before all things strove after brevity, hence at times distinctness was lost. *P. fischeri* is likewise, in southern and central Sweden, one of the more common, or at least oftener occurring, species in its family; and this could not well be entirely unknown to Linné, even as it could not have been mixed with any other species by him. *P. gonodactyla* is one of the rarest species in the country, and belongs more to mountain districts, whence also Linné's note, 'habitat in nemoribus,' is better fitted to *P. fischeri* than to the former species" (*Skand. Fjäder-Mott.*, p. 8).

Original description.—*Phalaena Alucita tesseradactyla*. Alis patentibus fissis cinereo-nebulosis, posticis fuscis. Habitat in nemoribus. Alæ superiores cinereo fuscoque nebulosæ, fissura conniventa. Inferiores fuscæ, nec maculatæ, tetradactylæ (Linné, *Fauna Suecicae*, ed. 2, p. 370).*

Imago.—Anterior wings, apical point sharp and dark; ground colour fuscous-grey or ashy, rather darker fuscous in the portion that makes up the costal triangle, the inner half of the base of which, just beyond the fissure, sometimes forms a small conspicuous darkish line or lunule; the ground colour is marked with white as follows—a fine longitudinal whitish shade from base of wing to base of triangle through middle of wing; a fine whitish inner marginal line extending the length of the wing (except for the characteristic dark spot or lineation on inner margin about two-thirds towards anal angle); a white lunular band at base of costal triangle expanding widely below fissure; a fine white transverse lobal line crossing both lobes from costa nearly to inner margin. Fringes white, edged internally with a fine dark marginal line; except at anal angle where the fringes are dark-grey. Posterior wings fuscous-grey (considerably mottled under lens); extreme apices of first and second plumules rather darker; fringes of same tint as ground colour of wings; the

* Zeller's description (*Linn. Ent.*, vol. vi., p. 337) of *fischeri* reads as follows: "Capillis frontalibus parum productis; alis ant. fuscescenti cinereis, strigula fusca triangulo costali adnata ante fissuram plagamque albidam striga laciniarum albida; digiti tertii dorso medio in ciliis atro-squamato (♂ ♀)."

third plumule with a few dark scales in almost same position as in that of *calodactyla**.

Variation.—This small ashy-grey species varies apparently but little in size and colour. In tint, some examples appear paler than others owing to the extension of the white areas in the centre of the wing and outside and below the costal triangle. In these whiter examples, the discal lunule stands out distinctly (as also it does in some of the paler *F. calodactyla*) along the base of the costal triangle at some little distance from the fissure, whilst, in the more grey examples, it becomes absorbed in the costal triangle and in one is absent altogether. In the Frey collection, examples from the Engadine and Zürich appear to be whiter than others from Silesia and Bossekop, but the material is too scanty to tempt one to any conclusions. One rather suspects that there is considerable variation, in this respect, within somewhat narrow limits in most localities. Wocke says that Finmark specimens from Altenelv are somewhat smaller than, but otherwise like, German examples. Barrett says that the Irish examples are whiter than continental specimens, with the dark markings grey rather than brown, the Swiss individuals having a decidedly warmer tinge of colour than those captured in Ireland. We append Barrett's description of the Irish specimens :—

a. var. *hibernica*, n. ab. *Tesseradactyla*, Barr., "Ent. Mo. Mag.," xxxiii., pp. 25, 62 (1897); Kane, "Ent.," xxxi., p. 209 (1898).—Forewings narrow at the base, but rather suddenly broadened behind and shortly angulated at the apex, so as to present a rather stumpy appearance; pale grey-brown dusted with white, and having two oblique, white, transverse stripes towards the hind margin, one of them crossing the base of the fissure, and the other crossing both lobes; immediately before the first of these is the usual dark costal triangle, of a dark grey-brown tint; preceding this, in the middle of the costal margin, is a small dark cloudy spot, a pair of similar spots lies on the dorsal margin before the middle and a pair of minute dark dots at the base of the fissure; cilia sharply white. Hindwings dark fuscous with a golden gloss; cilia smoky-brown, except at the tip of each lobe, where is, in each case, a dash of pale yellow; on the dorsal side halfway down the third lobe is a darker fuscous tuft in the cilia. Antennæ pale brown, barred with white; head and front of thorax pale umbreous, hinder part of thorax white; abdomen whitish-brown; legs whitish, the tibiæ of the hindmost pair having a brownish cloudy dash before each pair of spurs. It bears some resemblance to *Platyptilia gonodactyla*, but is less than one-half its size, being in fact decidedly smaller than the occasional dwarf second-brood specimens of that species. Hab.: Clonbrock (Barrett).

The American form is described by Fernald (*Pter. Nth. America*, p. 33) as follows :—

Expanse 16mm.-20mm. Head, palpi and frontal tuft greyish-brown. Antennæ whitish, dotted above with dark brown. Thorax grey in front, white behind. Forewings whitish, heavily dusted with brownish-grey. The somewhat indistinct brownish triangle on the outer third of the costa is followed by a whitish spot, and a subterminal white line crosses both lobes.

Comparison of Fredericina tesseradactyla with its allies.—Zeller notes (*Linn. Ent.*, vi., p. 337) that it is "closely related to *gonodactyla*, *zetterstedtii* and *nemoralis*, but is much smaller (forewings from $4\frac{1}{6}'''$-$4\frac{1}{2}'''$), with a very ill-developed tuft on the vertex; the ground colour dusky brownish-grey, without yellowish admixture, and always with sharply defined black-brown transverse streak before the cleft of the forewing." Hofmann writes (*Die Deutsch. Pteroph.*, p. 51): "The smallest Platyptiliid; easily separated from the other allied

* These scales are particularly easily removed in this species. Some otherwise perfect specimens are practically without, or with only the slightest traces of, them.

species by the very short frontal tuft, which can be distinctly observed in quite fresh specimens when viewed in profile, as well as by the white coloration with its brownish-grey shading, and the two pure white transverse bands, one just in front of the fissure, and the other across the middle of the lobes."

Ovum.—The egg is pale green and smooth in outline, forming a somewhat elongated ovoid (Gartner).

Habits of larva.—Gartner first discovered the larvæ in July, living in the dried pith of the flowerstalks of *Gnaphalium dioicum;* they were then exceedingly minute, and repeated observation convinced him that they made little growth during the autumn, and he was much astonished that, in spite of their small size, they had grown very considerably by the earliest days of spring. Search in the old flower-shoots showed that the larvæ had vacated these before winter was over, and the fresh shoots showed no signs of being inhabited. The withered central leaves of the newly-grown central shoots, however, gave evidence of the larval attack; these leaves were easily detached and showed the larva at work within. He says that as the larva confines itself to this portion, it is obliged frequently to seek a fresh plant, but, when the plants are more developed and the larvæ have grown older, they draw together the central leaves with silk threads, and penetrate more deeply into the substance of the plant, whilst the black-brown excrement is collected on an outer leaf and betrays the larval abode. "The larva bores in the stem of its foodplant and lives until the winter in the pith of the smaller stems" (Sorhagen), or in the flowering shoot, hybernating young, in the withered flower-stalks, entering, in the very early spring, the shoot of the young plant, which it eats down to the root; the small, still folded, terminal leaves of this shoot remain a long time in position in a withered or dried-up state, even when the larva has already left its first dwelling; it then goes into the still little-developed flower-bud which is yet on a short stalk and folded up into a thick knob, and on which there is outwardly not much or mostly nothing at all to reveal the presence of a larva, unless here and there a few grains of excrement, or a somewhat miserable appearance of the bud, betray the presence of a larva (Hofmann).

Larva.—*First instar:* Head, thoracic and anal shields black; body yellowish-white with single hairs. *Hybernating stage* (September): As before, but with dorsal and lateral rows of rust-brown. *After hybernation* (March): Stouter, but not much increased in length. Head, thoracic and anal shields dark brown; dorsal stripe crimson rust-colour, consisting of triangular spots; the subdorsal and lateral lines similar, but finer or more delicate. The ground colour of the body yellowish above and rust-red beneath. *Final instar:* In shape cylindrical, slightly narrower at each end. The head is small and black, the thoracic shield yellowish-white, with a small, black dorsal area divided by a pale line. The colour of the body is dark ferruginous-brown. On the dorsum of each segment stand whitish spots, each with two pairs of black dots (tubercles), of which the hinder pair are placed farther from each other than those in front; similar dots (tubercles) occur on the sides, from which arise long pale hairs. The anal shield and legs are dark brown. The larvæ frequently vary in the depth of their colour (Gartner).

Foodplants. — *Gnaphalium dioicum* (Gartner),* *G. arenarium* (? *luteoalbum*) (Sorhagen), *Gnaphalium alpium* (Wocke).

Puparium.—In the excavation made by the larva in the central stem of the foodplant, the fullfed larva pupates; the hollow is closed up by means of silk spinning, and, fixing itself in an upright position, the larva changes to pupa. On May 16th, 1861, the natural puparia were found, a bent-down flower-bud, kept in position by silken threads, beneath which a deep excavation in the centre of the plant was hidden, in which was an Alucitid pupa standing in an upright position. By following up this clue several pupæ were obtained, but it was too late for larvæ. The pupal stage lasts about three weeks, the pupa being partly protruded from its puparium on the emergence of the imago (Gartner). The larva pupates in the hollow of the stem which it has previously utilised as a larval habitation; in this, the pupa stands upright (Hofmann). The pupa can move the abdomen somewhat, but does not throw the anterior parts backwards (Zeller).

Pupa.—The slender pupa tapers towards the posterior end; the head dark brownish-grey, which colour is continued to beyond the thorax; the eye-covers dark with the frontal prominence between them. The dorsum of the abdomen bone-yellow, the row of spots along the back and the lateral curved markings darker; above the cremaster there is a long, thickly-ciliated point, directed somewhat upwards. The wing-cases pale greenish, the protruding portion of the leg-cases, which stand out free for the length of $3\frac{1}{2}$ segments, are brownish, in front of the hairy cremaster towards the belly are two points. The older the pupa the more it is marbled with brownish-grey (Gartner). About $4\frac{1}{2}'''$ long, slender, the head bent downwards, the upper part of the dorsum suddenly swollen; the abdomen closely and very finely striated transversely, quite smooth, greyish-white; the whitish cases of the forewings have a brown-grey dash extending towards the outer margin and acutely angled towards the base. Under the inner margin of this case, the case of the hind-wing protrudes as a very narrow, short, segment-like strip. The cases of the legs and antennæ, united into a point, reach to the 5th abdominal segment. The dorsal line is indicated only at its commencement by very pale spots. On each side of the dorsum of the abdomen runs a pale brownish longitudinal stripe, becoming stronger on each segment, but fading out on the last two segments. Below this, a row of pale brownish spots runs on each side, one of them lying at the commencement of each segment. Still lower, a row of faint spots follows these, but the last two segments are unspotted. The point of the tail is curved upwards, sharply pointed, and above there are two finely pointed warts near each other. Head, thoracic shield and leg-cases are brown-grey (Zeller).

Time of appearance.—In Britain, the species appears to have been taken only in June, having been discovered in the first week of June, 1895, at Clonbrock, and again taken directly afterwards on June 11th, 1895, at Ardrahan (Kane). It also occurs in central Germany in June, but Mann records it from Tuscany in the middle of April, and

* This plant is abundant in Scotland, Wales, Ireland and many parts of England, descending occasionally nearly to the coast level, its general habitat being mountain-heaths; common in northern Europe, Asia and America to the Arctic regions, and in the great mountain ranges of central and southern Europe and Russian Asia (Bentham).

Herrich-Schäffer says that Mann also found it well out in April in the Vienna district among spindle (!). [Millière seems to be in doubt about the insect which he says occurs around Cannes in April-June and September; we suspect he is referring to some other species.] In Germany, it occurs in June at Tantow in Pomerania (Büttner); in May and early June in Hesse (Rössler); mid-May and early June, and again in early August (erroneously suggesting a second brood), at Wildungen (Speyer); in June in Silesia (Wocke); also at the commencement of July on the Silesian mountains, and from about June 9th to mid-July in the Albula district, on the Knieholzdreieck and behind Chiaclavuot (Zeller); the last third of May near Regensburg (Schmid); in June and July near Munich (Hartmann); also in June and July in Baden (Meess and Spuler); but at the end of May in Würtemburg (Steudel and Hofmann); the end of May and commencement of June in Moravia, near Brünn (Gartner); and in May and June in the Mödling district (Mann). In the Baltic Provinces it has been taken in May at Kurtenhof (Teich). In Switzerland from the end of May through June and July, according to elevation, *e.g.*, end of July and early August at Samaden, at 6000 feet elevation, June in the Upper Rhone Valley, and end of May at Würenlos (Frey); similarly it occurs in May and June in south and central Sweden (Wallengren), but from mid-June to mid-August at the higher latitudes of northern Europe, *e.g.*, Uleåborg in Finland (Tengström), etc. The only exact dates of appearance we have been able to collect are the following: May 23rd, 1861, and following days, near Brünn (Gartner); June 5th, 1866, above the Faisanderie, in Hesse (Rössler); June 9th-mid-July, 1871, 1873, 1875, in the Ober-Albula district (Zeller); July 10th, 1890, July 7th, 1891, at Tromsö (Schneider); July 23rd, 1897, at Sund-dal, common, on August 2nd, 1897, near Aal, in the Votndal, July 20th-August 7th, 1902, at Erfjord (Strand); June 17th, 19th, 1871, in Scott's Valley, California (Walsingham); July 29th, 1903, on Bear Lake Mountain; August 11th, 1903, on Kokanee Mountain, near Kaslo, in British Columbia (Dyar).

Habits.—Little is known of the habits of this species. Kane observes that it was first taken at Clonbrock, flying in the sunshine to the flowers of a species of *Gnaphalium* on a dry bank alongside a bog, and later adds that it is easily disturbed from among its foodplant on a sunny day in Galway. Barrett adds that it flies in the late afternoon and evening among *Gnaphalium* by roadside and dry banks at the edges of bogs. Gartner says that this little plume lives gregariously in the Schriebwald, near Brünn, and swarms in the month of June in the early evening round the blossoms of *Gnaphalium dioicum*, and is sometimes to be seen sitting on these plants *in copulâ*. The same habits were observed in other wooded places in which the *Gnaphalium* occurred, and this led to the later discovery of the pupa and larva of the insect. In confinement, the moths, at rest during the daytime, become lively at dusk, without, however, showing much desire to breed, for only a single pairing was obtained. Some six years before Gartner discovered the life-history of these insects, Herrich-Schäffer noted that the imagines flew gregariously towards the end of May in large numbers in a few places about Ratisbon, especially above and beyond the Tegernheimer Keller, on wooded pastures where much *Hieracium pilosella* grows, although he added "the larva most possibly feeds on *Gnaphalium*." Borgmann observes that, in June, the imagines fly slowly among grass towards evening, in numbers, over a dry woodland meadow in the Kaufunger Stiftswald, near Cassel, where much *Gnaphalium dioicum* grows.

Habitat.—In Britain, the species has as yet only been discovered in the counties of Clare and Galway, where it prefers the stony pasturages, although its chief haunt at Ardrahan is in a clearing in a plantation where *Antennaria* (*Gnaphalium*) *dioica* grows plentifully (Kane), also at the edge of a plantation at Dromoland Castle (O'Brien). On the continent, its habitats are varied, extending from low stony wastes on the plains to high up the mountains to the snow-line, *e.g.*, the Riffelberg. Strand says that it is common in Arctic Norway—Tromsö, etc.—wherever *Antennaria dioica* grows, and Wocke notes that it occurs on dry loamy slopes at Altenelv, in Finmark, among *G. alpium*. Zeller says (*Isis*, 1841, p. 781): "This species is common in Bohemia on the Saxony boundary on dry knolls and on ridges between fields. In Silesia, I found, in mid-June, numerous examples on Probsthainer Spitzberg in open places between young forest and fir-trees; two specimens at Reinerz at the beginning of July on a hill, where the pine-trees had decayed away and the spot was covered with *Aira flexuosa;* two examples at Glogau in a hilly, woody neighbourhood, on a heath between birch underwood. The species, at least in these three places, is not common and is seen very rarely, as they are inconspicuous and fly only at sunset." He afterwards noted (*Linn. Ent.*, vi., p. 337) that, in Silesia, it occurs abundantly in the mountains, particularly on the drier foothills arising from the plains; later he observes (*Stett. Ent. Zeit.*, 1878, p. 162) that, in the Ober-Albula district, the insect is not rare in any places where *Gnaphalium dioicum* grows, flying in dry thickets and in open spaces in the vicinity of its foodplant. Gartner says that it prefers wooded places in Moravia where *Gnaphalium dioicum* grows. In dry woodland meadows near Cassel (Borgmann), on the foothills near Wildungen and Korbach (Speyer), in open spaces on the outskirts of deciduous woods on hillsides, and also in the wide grassy roads on the outskirts of such woods, as well as along the edges of the wood-ridings themselves in Silesia (Möschler). Millière says that the species occurs on chalky ground around Cannes, but as he states that the insect he is describing is double-brooded we doubt whether he is referring to this species.

British localities.—Only known at present from the west coast of Ireland. Clare: Dromoland Castle (O'Brien), through the Burrens of Clare to Corcumroe and Ballyvaughan (Kane). Galway: Ardrahan, Clonbrock (Kane).

Distribution.—Probably throughout the whole northern part of the Palæarctic region, also the western (mountain) part of the Nearctic and across the continent to Massachusetts. Europe north and central (except Batavia), southwest France, central Italy, Dalmatia and Hyrcania (Rebel). America: Colorado—Loveland (Smith *teste* Walsingham), California—Scott's Valley (Walsingham), British Columbia—Bear Lake Mountains, Kokanee Mountains near Kaslo (Dyar), Massachusetts (Fernald). Austro-Hungary: Bohemia (Fischer v. Röslerstamm), Moravia—Brünn (Gartner), Lower Austria—Herstein, in the foothills (Rogenhofer), Mauer, Mödling, Gahns (Mann), Vienna district (Mann *teste* Fischer v. Röslerstamm), Tyrol—near Bozen, Trient, the Dolomite region (Mann), Taufers, Franzenshöhe (Heller), Dalmatia, Croatia—Josefsthal (Mann), Budapest dist.—Nagyag (Aigner). Finland: up to Uleåborg (Tengström), Tyskland (Wallengren). Belgium (Lambillion). [France: Var—Cannes dist. (Millière), Auvergne—Mont Doré (Sand)]. Germany: widely distributed in north and south Germany (Hofmann). Prussia—near Dammhof (Speiser *teste* Sauter), Pomerania—near Tantow (Büttner), Hesse—Wiesbaden near the Chausseehaus (Vigelius), above the Faisanderie (Rössler), near Cassel (Borgmann), Waldeck—near

Wildungen, Korbach on the lower mountain slopes (Speyer), Thuringia, generally distributed (Knapp), Brandenburg — Garz-on-Oder, near Tantow, distributed (Sorhagen), Silesia—generally distributed (Wocke), Seefelder near Reinerz (Standfuss), Probsthainer Spitzberg, near Reinerz, Glogau (Zeller), Upper Lusatia (Möschler), Saxony—Saxon Upper Lusatia (Schütze), Bavaria—distributed, near Regensburg (Schmid), Munich district—near Schleissheim in the Schwarzhölzchen, Tegernsee (Hartmann), Württemberg—Katharinenlinde, Eisenbach, Wasseralfingen (Steudel and Hofmann), Baden—near Constance (Reutti), Hinterzarten (Meess and Spuler). Italy: Tuscany—near Ardenza (Mann). Russia: Baltic provinces, generally distributed and common — Magnusholm, Neuhof, Lips, Riga, Pichtendahl (Nolcken), Kokenhusen (Lienig), Ringen (Rosenberger), Kurtenhof (Berg). Scandinavia: Finmark to 70° N. lat. (Schoyen), Tromsö, Malselvdalen, Alten (Sparre-Schneider), Altenelv (Wocke), Bossekop (Chapman), Kaafjord, Sopnes, Lyngör district, common—Aal, the Votndal, Sunddal in Hol, Stavanger district—Erfjord (Strand), Throndjem, Little Elvdal (Jordan), common in south and central Sweden—Blekinge (Wallengren), Småland, Oestergöthland (Boheman). Switzerland: In the valleys and also in the mountains to about 6000ft.—Würenlos in the Limmatthal, Upper Rhone district (Frey), Ober-Albula—distributed from Bergün to Weissenstein, Upper Engadine—Samaden and Sils-Maria at about 6000ft. (Zeller), the Juras (Rothenbach), Riffelberg (Jordan).

Platyptilia, Hübner.

Synonymy.—Genus: **Platyptilia,** Hb., "Verz.," p. 429 (1825); Stphs., "Illus. Haust.," iv., p. 375 (1834); Zell., "Linn. Ent.," vi., p. 328 (1852); Staud. and Wocke, "Cat.," 2nd ed., p. 342 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 784 (1877); Frey, "Lep. Schweiz," p. 428 (1880); South, "Ent.," xiv., p. 304 (1881); Stange, "Stett. Ent. Zeit.," p. 118 (1881); p. 514 (1882); South, "Ent.," xv., pp. 31, 33, 145, pl. iii., figs. 1*a*-1*c* (1882); xxii., pp. 29, 31, 103 (1889); Tutt, "Ent.," xviii., pp. 169, 195 (1885); xx., p. 211 (1887); xxi., p. 259 (1888); "Ent. Mo. Mag.," xxv., pp. 104-107 (1888); Sorhgn., "Kleinsch. Brandbg.," p. 2 (1886); Leech, "Brit. Pyr.," p. 52 (1886); Tutt, "Young Nat.," x., p. 163 (1889); xi., pp. 18, 79 (1890); "Pter. Brit.," p. 35 (1895); Meyr., "Trans. Ent. Soc. Lond.," p. 486 (1890); "Handbook," etc., p. 434 (1895); Hofmn., "Deutsch. Pteroph.," p. 42 (1895); "Illus. Zeits. Ent.," iii., pp. 131, 152, 306 (1898); Barrt., "Ent. Mo. Mag.," xxxiii., pp. 25-26 (1897); Kane, "Ent.," xxxi., p. 209 (1898); Walsm., "Ent. Mo. Mag.," xxxiv., p. 193 (1898); Fern., "Pter. Nth. Amer.," p. 32, revd. ed., p. 33 (1898); Staud. and Reb., "Cat.," 3rd ed., p. 72 (1901); Dyar, "List Nth. Amer. Lep.," p. 444 (1902). **Alucita,** [Linné, "Faun. Suec.," 2nd ed., p. 370 (1761); "Syst. Nat.," 12th ed., p. 900 (1767); Müller, "Faun. I. F.," p. 59 (1764);] Schiff. and Denis, "Sys. Verz.," 1st ed., pp. 146, 320 (1776); Sulz., "Ges. Ins.," p. 163 (1776); Göze, "Ent. Beit.," iv., pt. 3, p. 173 (1783); de Vill., "Linn. Ent. Faun. Suec.," ii., p. 532 (1789); Illig., "Sys. Verz.," 2nd ed., p. 128 (1801); Hb., "Eur. Schmett.," Aluc. pl. ii., fig. 6 (1804); Haw., "Lep. Brit.," p. 478 (1811); Tr., "Die Schmett.," ix., p. 230 (1833); Zett., "Ins. Lapp.," p. 1012 (1840). **Pterophorus,** Fab., "Mant. Ins.," ii., p. 259 (1787); Fab., "Ent. Sys.," iii., p. 347 (1793); Sam., "Ent. Usef. Comp.," p. 409 (1819); Curt., "Brit. Ent.," fo. 161 (1827); Dup., "Hist. Nat.," xi., p. 647 (1838); Wood, "Ind. Ent.," 1st ed., p. 236 (1839); Zell., "Isis," p. 777 (1841); Dup., "Cat. Méth.," p. 381 (1845); Tgstrm., "Finl. Fjär.," p. 154 (1847); Frey, "Tin. Pter. Schweiz," p. 402 (1856); Sta., "Man.," ii., p. 440 (1859); Peers, "Ent.," ii., p. 38 (1864); Barrt. and Buckler, "Ent. Mo. Mag.," viii., p. 153 (1871); Machin, "Ent.," xiii., p. 283 (1880); Porritt, "Buckler's Larvæ," ix., p. 343 (1901). **Platyptilus,** Zell., "Isis," pp. 770, 777, etc. (1841); H.-Sch., "Sys. Bearb.," v., p. 368 (1855); Wallgrn., "Skand. Fjärderm.," p. 11 (1859); Jord., "Ent. Mo. Mag.," vi., p. 121 (1869); viii., p. 137 (1871); xxiv., p. 42 (1887); Nolck., "Lep. Fn. Estl.," p. 800 (1871); Gregs., "Ent.," vi., p. 426 (1873); Barrt., "Lep. Brit. Isles," ix., p. 350 (1904). **Platyptila,** Barrt., "Ent. Mo. Mag.," xviii., p. 177 (1882).

The heterotypical genus *Platyptilia* is diagnosed (*Verzeichniss*, p. 429) by Hübner as follows:—

The forewings posteriorly broad and obtuse; the hindwings not uniform—*Platyptilia calodactyla* et *megadactyla*, Schiff., *Verz.*, Alu. A. 4, 8; Hübn., *Alu.*, 7, 6. *P. petradactyla*, Hübn., *Alu.*, 37, 38. *P. ochrodactyla*, Hübn., *Alu.*, 12, 13. *P. rhododactyla*, Schiff., *Verz.*, Alu. A. 5, Hübn., *Alu.*, 8.

It will be seen that this genus in its inception contained the whole tribe *Platyptiliidi*, and, in addition, the genus *Eucnemidophorus*. We have already dealt with *calodactyla*, Schiff., Hb., and *petradactyla*, Hb., under *Fredericina* (*anteà*, pp. 161-2), and of the remainder of the original species in this heterotypical genus, we have *ochrodactyla*, Hb., the type of *Gillmeria*, *rhododactyla*, Schiff., the type of *Eucnemidophorus*, and *megadactyla*, Hb. (=*gonodactyla*, Schiff.), which we named as the type of *Platyptilia* (*Ent. Record*, xvii., p. 37). Whether *isodactylus*, Zell., is really congeneric with *gonodactyla*, Schiff., and *farfarella*, Zell., we are not prepared to say, but at present we know too little of their early stages to separate them under distinct genera. The egg is more or less cylindrical according to the Platyptiliid type, they are laid externally, but the larva at once becomes a miner and remains so all its life. The typical pupation habit of *P. isodactylus* in the second brood, is similar to that of *Fredericina*, *i.e.*, pupation takes place internally in the stem of the foodplant, whilst, in the first brood, the larva leaves its burrow and pupates in a cocoon outside. The larva of *P. gonodactyla* usually emerges from its feeding-mines and makes a puparium among the pappus of the *Tussilago* seedheads (in the first brood), or in a cocoon on the undersurface of a leaf (in the second brood). Occasionally it appears to pupate quite exposed, as is the case with *Gillmeria*. The two British species, *gonodactyla* and *isodactylus*, are double-brooded.

The following is our diagnosis of the restricted genus :—

Imago.—Frontal tuft short; palpi with the terminal joint rather short, porrected; the frontal tuft and palpi about as long as the head; the black scales on the third plumule of hindwings markedly collected in a small patch near the centre; the costal triangle of forewings usually well-defined; one lobal transverse line or band.

Pupa.—The nose-spine shorter, 0·25mm. (than in *Gillmeria*, 0·8mm.), less well-developed, and not so prominent; the dorsal line with a curved ventral sweep; the posterior border of abdominal segments with spinous ridge (marked in *isodactylus*, evanescent in *gonodactyla*); the cremastral hooks in forward part of cremaster obsolete, the hairs almost evanescent; the wing-markings rather different (difficult to define) from those in *Gillmeria;* the dorsal ridges distinct (but rather less prominent than in *Gillmeria*).

Larva.—Form, outline and colouring much as in *Gillmeria* and *Fredericina*; skin-hairs (or skin-points) present (in *Fredericina* absent); confined to definite areas, other parts bare (in *Gillmeria* completely covered); the skin-hairs dark (those of *Gillmeria* alternately dark and colourless); hooks of prolegs (8-10) fewer than in *Gillmeria ;* the basal or attached end of hooks, oblique, produced and narrow; the column rather shorter than in *Gillmeria :* the head, dorsal plates and legs black; mesothoracic and metathoracic setæ paired (four pairs on each side of segment), each pair on the same plate (rather less markedly in *isodactylus* than *gonodactyla*) : these pairs at a good distance from each other; the setæ of i and ii rather more trapezoidal than in *Gillmeria*, still almost transverse; plates on 8th and 9th abdominal segments present (absent in *Gillmeria*).

Platyptilia isodactylus, Zeller.

Synonymy.—Species: **Isodactylus,** Zell., "Linn. Ent.," vi., p. 328 (1852); Stphs., "List," p. 174 (1854); Sta., "Man.," ii., p. 440 (1859); Dbldy., "Syn. List," 2nd ed., p. 36 (1859); Jord., "Ent. Mo. Mag.," vi., p. 121 (1869); Barr. and Buckl., "Ent. Mo. Mag.," viii., p. 153 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 786 (1877); Leech, "Brit. Pyr.," p. 52 (1886); Tutt, "Young Nat.," x., p. 163 (1889); xi., p. 79 (1890); "Pter. Brit.," p. 35 (1895); Porrt., "Buckl. Larv.," ix., p. 343, pl. clxiii., fig. 4 (1901); Barr., "Lep. Brit. Isles," ix., p. 330, pl. 413, figs. 4-4*c* (1904). **Monodactyla,*** Haw, "Lep. Brit.," p. 476 (1811); Snell., "De Vlind. Ned.," ii., 2, p. 1018 (1882). **Monodactylus,** Stephs., "Cat.," ii., p. 229 (1829);

* We at first suspected that this should be considered a purely literary name, *i.e.*, not described from actual specimens, but copied from existent descriptions, when,

"Illus.," iv., p. 373 (1834). **Phæodactylus**, Stephs., "Cat.," ii., p. 230 (1829). **Similidactylus,**† Stphs., "Ill.," iv., p. 375 (1834); Wood, "Ind. Ent.," 1st ed., p. 236, pl. li., no. 1643*n* (1839). **Similidactyla,** Staud., "Cat.," 2nd ed., p. 342 (1871); Stange, "Stett. Ent. Zeit.," p. 118 (1881); p. 514 (1882); Sorh., "Kleimschmett. Brandbg.," p. 2 (1886); Meyr., "Trans. Ent. Soc. Lond.," p. 486 (1890); Hofm., "Deutsch. Pter.," p. 49 (1895). **Isodactyla,** South, "Ent.," xxii., p. 31 (1889); Meyr., "Handbook," etc., p. 434 (1895); Staud. and Wocke, "Cat.," 3rd ed., p. 72 (1901). [**Nemoralis,** Meyr., "Trans. Ent. Soc. Lond.," p. 486 (1890).]

Original description.—(Capillis in fasciculum brevem frontalem productis ?); alis anterioribus fusco-ochraceis, antice obscurioribus, triangulo costali ante fissuram obscuriore obsoletissimo; in digiti tertio dorso medio squamis paucis atris (♂ musei Stainton). The single, old and worn ♂ from Stainton's collection, which I have before me, has, as Stainton correctly observes, only a remote relationship with *ochrodactylus*, from the apex of the anterior wings being much less prolonged. It is much more nearly allied to *gonodactylus*, of which it has quite the same form of wing. Although the costal triangle seems to have been rubbed, yet it appears to have been originally paler and less distinctly margined. This then is the first point in which it differs from *gonodactylus*. The second lies in the

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of course, the name would stand or fall with the original. It appears, however, that Haworth really referred a specimen of *isodactylus* to *monodactyla*, Linn., quoting de Villers note thereon. Bankes has the specimen reputed to have been in Haworth's possession. The parts of Haworth's account that most probably refer to this insect are the "Habitat" and "Captor" (*infrà*), but, as Haworth queries the references he quotes, it is quite possible that the diagnosis (which Bankes says agrees with Haworth's example in his possession) was also made from the specimen, in which case the name would really belong here. The matter is of little importance, but we give our readers the details: "*A. monodactyla* (The hoary Plume).—Alis anticis canis retusis, fissura inconspicua, posticis tripartitis fuscis. [*Phalaena Alucita monodactyla*, Linn., "Faun. Suec.," 1452?; Villers, "Ent.," 2, 530, 1083?]. Habitat apud nos rarissime. Imago ripis. Communicavit ejus captor R. Scales. Expansio alarum 9½ lin. Obs. Alucitarum omnium alæ digitatæ quodam modo videntur; inferiores semper tripartitæ et ultra divisæ sunt. Superiores scissurarum numerus variat, ex his rimis nomina trivalia sumpsit Linnæus. *Monodactyla* illa est cujus alæ superiores indivisæ sunt; scilicet parum scissæ, rima unica ultra dimidiam alæ partem non extensa parumque visibilis. Didactylæ alæ superiores bifidæ, etc. Pedes omnium specierum longi, tenues, spinis acutis armati. Alarum situs fere semper cruciformis (de Villers, *loc. cit.*)." (Haworth, *Lep. Brit.*, p. 476). The species is placed by Haworth between *bipunctidactyla* and *tetradactyla*. Stephens' description is purely literary, and the name stands or falls with Haworth's. It reads: "*Pterophorus monodactylus*.—Alis anticis canis retusis, fissura inconspicua, posticis, tripartitis fuscis (Exp. alar. 9½ lin.). [*Ph. Al. monodactylus*, Linné?; *Pt. monodactylus*, Steph., *Catal.*, ii., 229, no. 7609.] Anterior wings retuse, hoary, with a very obscure short cleft; posterior fuscous, and divided into three. Rare, found near Croydon and at Darenth Wood, in June" (Stphs., *Illus.*, iv., p. 373). "Croydon and Darenth Wood" are not at present known as localities for *isodactylus*. Zeller referred the species here, possibly on the strength of information received concerning the Haworthian specimen, for, at the time that he made the reference, he was describing *isodactylus* from a single worn specimen in Stainton's collection. Doubleday marks ("Syn. List," 2nd ed., p. 36) *monodactyla*, Haw., with a query. Wood, in 1839, figures (*Ind. Ent.*, pl. 51, fig. 1643*n*) well this species as *Pterophorus similidactylus*, and gives as a synonym—*P. phaeodactylus*, Steph., *Illus.*, iv., p. 575, and notes it as occurring in Dorsetshire, Devonshire, the New Forest, etc. Stephens, in 1854, in his *List*, p, 174, gives Wood's figure, 1643, as undoubtedly *isodactylus*, Zell., but queries both Haworth's and his own *monodactyla* in reference thereto, *i.e.*, Stephens did not himself know at that time whether his *monodactylus* was *isodactylus*, Zell. (*similidactylus*, Wood), although Wood's figure is an excellent one. It appears doubtful, therefore, whether, in 1854, Stephens really knew the species.

† *Similidactylus*, Stphs. nec *similidactyla*, Dale, the latter = *lithodactyla*, Tr.

colouring of the lobes of the anterior wings, which, instead of being partially much darker, are rather paler than the remaining surface of the wings and have only an almost imperceptible trace of the whitish transverse line. Again, the cilia of the inner margin are dirty yellowish-grey, and there is no trace of the two deep black tufts of scales on them; whilst the streak-like collection of scales in the cilia of the third feather of the hindwing of *gonodactylus* is here reduced to the half, which, as in that species, lies rather nearer to the tip than to the base of the feather. The following marking would also furnish a good specific character if it should prove constant—the pale spot or dot in the brown line, which in *gonodactylus* runs along the cilia near the hindmargin of the anterior lobe, is entirely wanting in *isodactylus*. *Capnodactylus* has certainly anterior wings of a similar form, and also an interrupted brown line in the cilia of the anterior lobe, but, besides other differences, the second feather of the hindwing is much broader and blunter, and, in the third feather, the strong black bundle of scales lies very far towards the apex. The thorax much damaged. The legs less pure white, otherwise marked as in *gonodactylus*. The forewings of a brownish-clay colour, very dull, becoming whitish at the base along the inner margin; the costa darker, without white markings. The brown costal triangle in the same position as in *gonodactylus*, but paler, less sharply margined, and less extended along the costa towards the first lobe; on the inner edge it fades into the ground-colour. At the cleft is a darker spot with a smaller one above it. The two lobes with a paler, more yellowish, ground-colour than the rest of the wing, darkening slightly only on the terminal third, the darkening deeper and wider in the lower portion, whilst in front of the darkened area is the slightest trace of a transverse line. The hind marginal fringes whitish, traversed nearly at the base by an interrupted dark brown line, between which and the hind margin the colour is brownish-yellow, as in *gonodactylus*; at the anal angle of the hinder lobe the fringes are also similarly blackish; the inner marginal fringes are darker without black scale-tufts (as noted above). The plumules of the hindwings are grey-brown; the fringes much darker, particularly those of the third plumule. On the underside, the apex of the first lobe of the forewing is noticeably pale yellowish, and the transverse line is more distinct; the first plumule of the hindwing on the outer two-thirds has many scattered whitish scales, without forming, however, a transverse line. This doubtful species has been found in several localities in England. I am greatly surprised that it should have been already split up into two species* (=*similidactylus*, Dale, Stphs., *Illus.*, iv., p. 375, and *monodactyla*, Haw., Stphs., *Illus.*, iv., p. 373) (Zeller, *Linnaea Entomologica*, vi., pp. 328-9).

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* It seems to us the more remarkable that Zeller, having been informed (he only had one worn example for description) that this species had apparently been already twice described (1) as *similidactyla*, Dale, and (2) as *monodactyla*, Haw., should redescribe it, for, had the name *similidactyla*, Dale, been really given to this species it would of course have stood. As matters of fact (1) Stephens and Wood wrongly referred it to *similidactyla*, Dale, which = *lithodactyla*, Tr.; (2) Haworth's *monodactyla* seems to have been partly original and partly a literary description quoted from de Villers, and he appears to have erroneously referred a specimen of *isodactylus* in his collection to *monodactyla*, Linn. Bankes says that a specimen, presumably the one described by Haworth, and bearing his label, agrees with the latter's short description, and his remark as to "Habitat," to some extent, supports the idea of an independent description.

Imago.—20mm.-24mm. Head, thorax, and abdomen same tint as the ground-colour of the wings. The anterior wings with the apex comparatively blunt, the ground-colour clayey, pale greyish-ochreous, or ochreous-brown, more grey in the central area and along the inner margin, with a more or less indistinctly defined triangular blotch placed on the costa just before the fissure; a dark conspicuous discal lunule; the outer margin darker than the ground-colour, the darker band edged internally by a paler line parallel to the outer margin, and crossing both lobes; fringes pale greyish. Posterior wings divided into three plumules; greyish-brown, mottled with darker scales, especially along margins; fringes paler; the third plumule with some black scales, but not forming so distinct a tuft as they do in *gonodactyla*.

Sexual dimorphism.—The females average rather larger, and are decidedly darker (*i.e.*, more fuscous) than the males (Bankes).

Variation.—Hofmann notes that this insect is "distinguished from all the allied species by its peculiar clayey coloration, and by the costal mark over the fissure being either entirely absent, or represented by a dark straight dash extending towards the base of the wing." In size, there appears to be a considerable difference in the specimens of the two broods, those of the second brood being, on the whole, distinctly smaller than those of the first brood. Barrett considered that this was largely due to a difference in the temperature at which the larvæ fed up, noting that, in August, 1880, the second brood was very abundant at Pembroke, and that the individuals were much smaller than those of the spring brood. This difference might be best remembered by calling the autumnal brood:—

Var. gen. 2 *aestiva*, n. var. *Isodactylus* var., Barrt., "Lep. Brit. Isles, xi.," p. 351, pl. 413, fig. 4*b* (1904).—Variable in size, but the autumnal specimens distinctly smaller than those on the wing in June, and far paler in colour, often dull drab or whitish-drab (Barrett).

Barrett says that the autumnal specimens are often little more than one-half the size of those captured in spring; but Bankes observes that, "judging from a few caught, and a large number of bred specimens of both broods, the approximate average wing-expanse of the first brood appears to be—♂, 22·5mm.; ♀, 24mm.; and of the second brood to be—♂, 20mm.; ♀, 21mm. The largest ♂ and ♀ examined, both belonging to the first brood, but hardly larger than some others reared with them, expand, respectively, 25mm. and 26mm., while the smallest representatives of each sex, but little smaller than a few others of the second generation to which they belong, measure only 17mm. in the ♂, and 16mm. in the ♀. The wing-expanse of one dwarf ♂ of the *first* brood is just 18mm." Of the colour variation Bankes writes (*in litt.*): As a rule the examples of the second generation are, in both sexes, much smaller and paler than those of the first, although, very occasionally, individuals belonging to the latter may be bred identical in size and colour with normal representatives of the former, and, in exceptional cases, second-brood specimens are so large and dark that, were their history unknown, one would have unhesitatingly referred them to the earlier brood. The following is an attempt to classify the various forms:—

1. Forewing pale whitish-grey, hardly, or but slightly, clouded with darker =ab. *pallidus*, n. ab.
2. Forewing whitish-grey, somewhat clouded with darker=ab. *canus*, n. ab.
3. Forewing brownish-ochreous, clouded with fuscous=*isodactylus*, Z. The type specimen was a ♂ (*teste* Zeller).

4. Forewing ochreous-brown, whitish-dusted, clouded with fuscous = ab. *brunnea*, n. ab.
5. Forewing brownish-fuscous, sparingly dusted with whitish, partially ochreous-mixed posteriorly = ab. *fuscus*, n. ab.

This last-named form appears to be that figured by Wood (*Index Entomologicus*, pl. li., fig. 1643) as *similidactylus*. Bankes says that the only examples that he has seen of this extremely dark form are a few ♀ s of the first brood. Two specimens from the Puerto de Pajares, 4000 ft. elevation, belong to the ab. *canus* and ab. *fuscus* respectively.

Egglaying.—Pairing took place on the evening of June 6th, 1904, and several eggs were noticed on the plant the next day. The eggs of these June moths are laid on the undersides of the leaves of *Senecio aquaticus* singly, very rarely two are placed together. The youngest and the very oldest leaves seem to be avoided. The egg-stage lasts ten days, the first larva appearing on June 17th (Chapman). Eggs of the August moths are laid on the lower leaves of the plant. (It should be noted that I had no first-year plants on which they could oviposit, and as my old plants were largely reduced to stumps, owing to the ravages of the summer-feeding larvæ, there was little choice in the matter but for the moths to lay where they did.) Eggs laid between August 8th and 12th commenced to hatch on August 21st (Bacot).

Ovum.—The eggs are very smooth, shining and polished, so that any sculpturing or structure is not detected, either because it is exceedingly faintly marked or really absent. The eggs are pearly white; seen from above they are a fairly regular oval, 0·54mm. in length, and 0·33mm. in transverse diameter. Seen laterally, they are flat below and a little rounded on top, but only slightly, just enough to make it incorrect to say that the upper and lower sides are both flat; the ends are regularly rounded, one larger than the other, so that just inside the larger end the height is 0·27mm., and inside the smaller only 0·21mm. (Chapman, June 10th, 1904).

Habits of larva.—(1) *Summer feeding larvae* (second brood): Larvæ of this brood appeared from June 17th-20th, 1904, from eggs laid between June 7th-10th. The newly-hatched larvæ placed on leaves of the foodplant, and those that hatched from eggs laid thereon, with one exception, took to wandering, and one or two were seen to drop by threads, but no trace of the young larvæ attacking the leaves could be found. Three days later, however, the young leaves seem inclined to droop, and, looking at the axil of one leaf, a considerable drop of exuded sap is to be observed and some frass. At one other leaf, at least, a little frass appears in the axil. At one spot, about the middle of the stem, a small drop of fluid is seen, as large, perhaps, as a large pinhead; examining this, a young larva is seen about one-third buried in the stem, the next third in the fluid, and the anal end exposed with several pellets of frass. On June 27th, at thirteen different leaf axils are minute expulsions of frass, and there are two wounds in the bare stem, at one of which a larva was seen entering; there is no trace of larval work in leaves, or leafstalks, or midribs. On July 1st, portions removed from the plant with several larvæ in it a few days since, afford three small larvæ; these were placed a couple of days ago on two other plants, and have now burrowed into these, choosing for entrance the lower side of a small bud, *i.e.*, between the bud and the leaf; they are now working into the stem, but taking some tit-bits from the interior of the bud on the way (Chapman). On July 11th, the plant of *Senecio* *aquaticus*, passed on to me by Dr. Chapman, some few days since, was noted as having remained wonderfully fresh, and, until a few days ago, when it quite suddenly began to look very sickly, showed remarkably few signs of the ravages of the larvæ within. Examination showed that the larvæ are from ·3 in. to ·5 in. in length, and are making rapid progress. At least twelve have been already moved to other plants, and there appear to be still some left burrowing in the lower part of the stem. One of these left the burrow on the evening of the 11th, and, climbing to the top of the plant, was observed feeding on a flower-bud, but the habit was not again noticed as occurring in the case of any other larva. Larvæ will certainly move from one plant to another if their leaves are allowed to touch (Bacot). The larvæ of the second brood feed throughout July and early August, the young larvæ mining at first one of the smaller shoots of *Senecio aquaticus* near the buds; afterwards the larva crawls further down entering one of the larger branches at the axil of a leaf, frequently devouring the tender side shoot; it then bores down the interior, feeding on the pith till nearly fullgrown, when it again deserts its burrow, and proceeds to the thick main stem of the plant, which it enters, and there feeds up, hollowing out a space in which to assume the pupal state. In every case, a round hole is left for the extrusion of excrement, and, in the final burrow, this is placed exactly against the head of the pupa (Barrett). The larvæ feed in the stems of *Senecio nemorensis* near Rotterdam (Snellen). Fullfed larvæ and pupæ of this brood were found on a marsh on the banks of the river Yare, near Norwich, from August 15th-24th, 1870, and August 10th-20th, 1871 (Barrett). (2) *Winter feeding larvae* (1st brood): Larvæ commenced to appear from the August-laid eggs on August 21st, when two were placed on young leaves of young plants of *Senecio aquaticus*, and at once directed their course towards the front of the midrib, and thence downwards towards the central point of the plant. In one case, the leaf and centre of the plant were well clothed with tomentum, and the young larva kept to the surface of the leaf, burrowing beneath this. What at first sight appeared to be taking a slight breakfast by the way, was, on further observation, concluded to be merely loosening the tomentum to make a way, apparently by a biting action, at any rate by biting or pressure of the front of the head. On August 22nd, another larva hatched and was placed on another plant. These plants at the end of their first season, have, as in most biennials, made a ground rosette, but are leaving an upward stem for next season, these being, apparently, the present state of such plants as in the spring are like those in which larvæ were sent last spring by Bankes. The object being to discover, if possible, at what stage they pass the winter, a plant was investigated on December 3rd. One petiole had been burrowed for about an inch, but was abandoned, though the leaf was alive and well; the next younger petiole had been burrowed for only a few millimetres, had been entered half-an-inch from centre of plant, the ravages in it most inconspicuous. This burrow contained a larva 4mm. long, with black head and thoracic plate, and nearly black anal plate. [One preserved on June 30th is almost identical.] The larva was very white and colourless—there were, however, some contents in alimentary canal—but the burrow was very clear and suggested a resting-place rather than a feeding burrow. On January

25th, 1905, some dead plants were examined, and two, small, cocoon-like cavities were found in the bases of the leaves, *i.e.*, the petiole close to the centre, but the larvæ had gone; there was a little silk, and the cavities were apparently between two leaves, though their actual hollows were excavated out of one of them (Chapman). Larvæ found on May 19th, 1904, in the Wareham district, after hybernation, varied much in size, some being quite fullfed. Two of the tenanted plants of *S. aquaticus* contained two larvæ, feeding in the same stem; owing to the luxuriance of the vegetation the larvæ seemed specially hard to find (Bankes). The larvæ found (by Bankes) were forwarded to Chapman on May 21st, who reports: The larvæ have the appearance of being fat white grubs, of the same outline and build as *gonodactyla*, *ochrodactyla*, etc., but rather stouter and longer, 10mm. $\times$ 2·6mm. or 12mm. $\times$ 2·3mm., according as to whether one is stretched or retracted. The larva is a typical internal feeder by aspect, white (really faint greenish-yellow), with black head, prothoracic plate, spiracles, and tubercles to anal plate. On closer examination, the whiter patches round the tubercles, making subdorsal (including i and ii) and supraspiracular (including iii) bands, and a subspiracular (including iv and v) flange, are readily distinguished. Numerous minute black secondary hairs are also seen, darkest and most evident, dorsally and sublaterally. The larvæ excavate the central bud of the *Senecio*, clearing it out completely, and making their wide cavity down quite (or just) into the root, if by root we understand all below the level at which root-fibres are given off. Comparing the material before me with Buckler's and Barrett's account of the larva and its habits, one notes that they describe the second brood, this is the first, and, moreover, these (on May 20th) are fullfed. The plants are at most a few inches high, and those in which the larvæ are, are less than an inch, growth being checked by the larval attack. The roots are, however, thick and strong, doubtless being the stored-up material which carries the plant through the winter and starts it in spring. There is no evidence of how the larva passes the winter, but it probably does so on (or in ?) the shoot it now inhabits. The larvæ being fullgrown, and nearly all eating the white pith or heart of the young shoot, they quite lack the greenish tint Buckler describes. The skin is absolutely without colour, thin and pellucid in places, thicker and whiter in others. These white patches surround the tubercles, and nearly run together into similar white stripes as those that occur in *Gillmeria pallidactyla* (*bertrami*), etc., and are the white areas described by Buckler. The more delicate portions are coloured according to the material beneath. In my specimens, the fluid (blood) is practically colourless, the fat-bodies are abundant and white, and the contents of the alimentary canal are white forwards and dirty dingy posteriorly. The total result is, however, that we have a white larva, in which the differentiation of the skin into white and colourless areas is not at all conspicuous. Buckler's larvæ were not all fullfed, and, moreover, they fed on green food, *i.e.*, the leaves, buds and stems, well above the ground, mine are feeding in the stem at, or below, ground level (Chapman). Bankes writes (*in litt.*): "The larvæ of both broods feed throughout inside, and on the pith of, the stems of *Senecio aquaticus* (although, when those of the earlier ones are feeding, these stems are often very short), entering the first stem at its terminal bud and burrowing downwards; later on, they readily come out as often as convenience or necessity arises, and at once either re-enter the same stem lower down, or else bore into a fresh stem and feed downwards, the frass being ejected through the entrance hole. A single stem, if of any length, not infrequently contains more than one larva. The infected plants generally look rather sickly, but the presence of the larvæ therein may most readily be detected by the pellets of moist pale frass seen clustered beside the entrance hole. The larvæ of the second brood are far easier to find than those of the first, because, in July and August, the *Senecio* stems are so very much taller than in May, and, being then comparatively clear of the surrounding herbage, are more readily seen and examined, and bring the larval traces considerably nearer the eye. The larvæ of both broods feed up very irregularly, and, probably, in early June and early August of each year, larvæ, pupæ, and imagines could be collected together on the same date and in the same spot. This I have done on three separate occasions, *viz.*, May 31st, 1890; August 2nd, 1890; and August 1st, 1891, although all my expeditions have been timed to secure the insect *before* it reached the perfect state. On August 1st, 1891, and July 28th, 1892, many larvæ were found, in nature, dead in their burrows inside the stems, evidently from disease. In 1891, the previous weather was exceedingly wet, whilst in 1892 it was exceptionally fine and hot! My notes make mention of some larvæ being ichneumoned, but the parasites were not preserved." Stange observes (*Stett. Ent. Zeitg.*, 1882, p. 514) that the larvæ of the first generation may be found in Friedland in May, mining at first down the midrib of a radical leaf of *Senecio* (? *aquaticus*), and usually with head directed towards the leaf-base; later, it enters the central shoot and the upper part of the root which it eats out in a downward direction; the excrement is heaped up on the central shoot. The larva of the second generation lives in the stem and betrays its presence by the excrement which protrudes from the entrance hole.

Larva.—*First instar*† (newly-hatched): A minute yellow scrap, barely 1mm. in length, with large black head, nearly twice the width of the body of the larva; a large black prothoracic plate; a faintly tinted dark anal plate. The hairs are nearly half the width of the body in length; that on tubercle i directed forwards, on ii backwards, on iii forwards; iv and v present one very long hair directed nearly backwards (arising from iv), and a shorter one above and in front of it directed rather forwards (arising from v); these are quite distinct from each other and on separate bases. There appears to be no hair between these and those at the base of prolegs (vii). On the meso- and metathorax, i, ii and iii are as on the abdomen, except that i is nearly as far back as ii on metathorax, and quite so on the mesothorax, and in both cases they are close together; there is an accessory tubercle above and behind iii (? the usual second pair on thorax); below these a long hair (? solitary). The spiracles are very large and project very markedly. The general surface is very smooth, and no hairs or hair-points can be seen, but there is some trace of subsegmentation. The hairs are nearly black with slightly expanded

† When young the larva is white, and is peculiarly long and slender, thus forming, both in colour and shape, a remarkable contrast with the green hue and short, stout proportions assumed as it approaches maturity (Bankes).

ends (June 17th, 1904). *Second instar**: The head has increased from a width of 0·25mm. to one of nearly 0·5mm. (in the third instar it is 0·75mm., and in the fullgrown larva 1·2mm.); there are skin-points everywhere, colourless and transparent, but very prominent. The arrangement of hairs and tubercles seems to be already that of the adult larva, *viz.*, 6 hairs on each side of the prothoracic plate, 3 set as a triangle in front of spiracle, and 2, level, at base of legs; on the 2nd and 3rd thoracic segments there are 4 pairs of hairs—the first pair, a small inner and longer outer, placed slightly trapezoidally; the second pair, a small inner and large outer, slightly reversed trapezoidal (if these 4 hairs were described as actually in line the error would be trifling, and if said to be equidistant it would be little more appreciable, the distance between the hairs of each pair being more than half that between the pairs); the third pair is not quite so close, the upper hair is small the lower large, the upper one is behind the lower, the line joining them being about 45° from the horizontal, the upper one is so small that it may easily have been present in the first instar and escaped observation; the fourth pair is the pair on a level at base of legs. The abdominal tubercles, i, ii and iii are in usual position—i the smallest, ii the largest, i and ii are very far apart and very trapezoidal, iii being almost as near ii as i is. Tubercle v is small, below spiracle; iv large, lower and behind; vi is solitary, large, towards hind margin of segment; vii has one hair very large, the two in front of it small. There are 6 hooks to prolegs and 5 to anal claspers. The hairs are all smooth and pointed. *Third instar:* The same description would apply to the third instar, except that there are 9 hooks to the prolegs, and 7 to the anal claspers, and that the skin-points are prolonged into fine needle points. There are still no other secondary hairs. *Final instar:* In the last skin, the skin-points are quite rounded, but a certain number have developed into quasi-secondary hairs. These are most abundant on the anterior segments; on the mesothorax, they are fairly regularly distributed on the darker portions of the middle zone of the segment, but are not difficult to count, *viz.*, about 37 on either side, from dorsal line to leg-base. On the abdominal segments, they are wanting in the spiracular region, from just above iii to below v; there are about 13 round i and ii, and 6 between iv+v and vi, on the 1st abdominal, and none below vi. On the following segments they occur right down to the ventral line. On the 5th abdominal there are about 25 above iii, and about 30 below iv. On the 7th abdominal there are 14 on dorsum (above iii) and 8 below iv. On the 8th abdominal there may, or may not, be 3 or

* The larva in the first instar has apparently no skin-points. I may have missed the second instar, and what I take to be the second, may really be the third. I think, however, that this is not so. The chief ground for supposing this to be the case, is the considerable increase in the size of the head between the first and supposed second instar. A very similar amount of increase, however, occurs in *Adaina microdactyla*, where I have a larva at moult showing both heads in the same specimen, and what is nearer home, a precisely similar increase in the size of the head occurs at the first moult. The difficulty of following one larva in these internal feeders is practically too great to be achieved, especially when one has to be economical of material, but that of comparing a number of different specimens may usually be depended on, the criteria of different instars being, not the size of the larva itself, but of its head, or the lengths of the hairs, or other hard parts that are invariable throughout an instar (Chapman).

4 below iv, none dorsally, or on the 9th or 10th abdominals. On another specimen they are much more numerous, the 8th abdominal having 2 or 3 dorsally and 10 lower, and on the mesothorax, instead of 37 are 180 or so, on either side. The prolegs have 10 or 12 hooks, varying even on the two sides of one specimen. The spiracles are tall and thimble-shaped. The prothoracic plate (and head) is black with the usual 6 hairs and dark mark; 3 prespiracular hairs on one plate and 2 at base of legs, also on one plate. On the meso- and metathorax the first and last pairs of tubercular hairs are on just separate plates, the two intermediate ones on conjoined plates; above and behind the third pair is a small hair. On the abdomen, tubercles iv and v are on one plate, the others as well separated as in the second instar; on the 1st abdominal vii carries a single hair, and there is another near the middle line (viii ?). On the 9th abdominal are, consecutively, 3 plates, each with 2 hairs arranged trapezoidally, and then 2 hairs singly. The large black anal plate has 9 or 10 hairs on either side. The plates carrying the hairs are of a beautiful tessellated pattern. In one specimen (from Spain) the hairs on iv are curiously malformed, being bent and twisted, enlarged and flattened out, etc. One, for example, near the base, is flattened and bent as if it had been pinched, then further on it is flattened out into a plate with serrated edge, and a median one of the serrations is continued as a fine termination of the hair. The others have peculiarities of the same character. I find in one or two of the English specimens some trace of a similar peculiarity of this same hair. The quasi-skin hairs are really skin-points, *i.e.*, they are not jointed at the base, and, except for size, have the same simple structure as the skin-points. They only appear in *Platyptilia isodactylus* in the last instar (not at all in *Fredericina calodactyla* [*zetterstedtii*]) (Chapman). *Fullgrown:* Three-eighths of an inch in length, rather thick and plump, tapering much just at each end, the head small, the legs short and placed much under the body, the skin smooth, shining and pellucid; it is of a watery, greenish tint, showing a dark, greenish, dorsal vessel; the subdorsal stripe is also darker green than the ground-colour, and this is bordered above by an opaque whitish stripe, which lies beneath the skin, and shows partially through its glossy surface; another such faint whitish stripe shows through along the side, and below that is another, somewhat inflated, on which are the spiracles; the head is black, and so also is a narrow plate across the middle of the back of the second segment, which is divided in the centre by a thin line of the pale ground-colour; the anterior legs are black; the tubercular dots above are small and black, those along the spiracular region are rather larger, and those on the front part of the 13th segment are very much larger still; a black plate is on the anal flap; it is noteworthy that each tubercular dot has, in this species, but a single hair (Buckler). Buckler figured (*Larvae*, etc., pl. clxiii., figs. 4-4*a*) two larvæ of this species in different stages of growth, and very differently coloured, *viz.*, fig. 4 green, fig. 4*a* brownish, together with an enlarged view (fig. 4*c*) of one of the abdominal segments showing the tubercles, on August 16th, 1871, and May 18th, 1872.

Seasonal variation of larva.—Buckler states (*Larvae*, etc., ix., p. 346) that, on May 18th, 1872, he figured larvæ from Norfolk, mining the stems of *Senecio aquaticus*. These larvæ, he says, were finer than those he described in August, 1871, being perhaps the least trifle larger, the proportions, structure, and details all exactly similar, the general colour of the skin only being a little different, these being more yellowish and less greenish. One individual was flesh-coloured as far as the 7th segment, the remainder being of a pale, faintly ochreous, greenish-yellow.

Foodplants.—*Senecio aquaticus* (Barrett), [*Senecio nemorensis* (Snellen).]

Puparium.—The mode of pupation of the larvæ fullfed in May and those fullfed in August differs greatly. Those of the early brood come out of their larval burrows and form outside puparia, spinning up in leaves,* etc., those of the late brood make a hollow in the stem of the foodplant and pupate therein. Describing the pupation-habit of the latter, Barrett says that, "when nearly fullfed, the larva burrows into the thick main stem of the plant, hollows out a space of considerable size in which to pupate, the head of the pupa being in every case placed against the round hole that is left by the larva for the extrusion of excrement. The pupa lies perfectly free in the burrow, the anal segment not being attached to the usual button of silk." Describing the pupation-habit of the early, or spring, larvæ, Chapman says: "When made in a folded leaf, the edges of which cannot be got together (or rather the face, as the leaf is too large to be occupied to the edges, and is also rather stiff), the cocoon is made in the fold, and there is a good deal of loose silk inside, especially basally, forming a sort of loose pocket for the abdominal end of the pupa, the exposed silken surface is very various in shape and area, as may be necessary to complete the enclosure, but there seems to be generally a piece, some 2mm. or 3mm. wide, by 8mm. or 10mm. long, at the head end, at which it may stretch out another 6mm. or so, as a light network for emergence, and, through this, the front of the pupa may be seen. The rest of the silken surface is strong, thick and opaque, and looks, as it is, quite equal to holding the thick fleshy leaf in a fold. Along the margin, where the silk joins the leaf, some scraps of leaf are bitten out, and these are the little brown (now, of course, faded and dead) points, with which the silk of the cocoon is studded. This arrangement seems to be to allow the leaf to open freely. The typical situation (not always adopted) seems to be on the midrib of the leaf close to the petiole, and the cocoon is probably made before the leaf is fully expanded, so that little drawing together has to be done, but, as the expansion of the leaf proceeds, some holding together has to be accomplished. This nibbled margin meets the difficulty in two ways, *viz.*, by giving a rough surface to which the silk adheres much more firmly than to the smooth face of the leaf, and, by weakening the leaf, allows a reverse bend to occur here, and so relieves the tension (May 21st-30th, 1904)." Bankes writes that "the pupæ of the first brood may be found, in nature, either in the final burrow made by the larva inside the main stem of *Senecio aquaticus*, or else in a thin silken, blister-like cocoon, spun on the upper surface of a leaf of the foodplant, or of some other neighbouring plant, such as *Ranunculus*, the leaf being a little drawn

* The pupation habits of the spring larvæ were first noted by Buckler, who writes (*Larvae*, etc., ix., p. 346): "Larvæ of the early brood were, on May 10th, 1872, mining in the stems of *Senecio aquaticus*, but one of them, apparently fullfed, has slightly drawn the top of a leaf together, and in the corner thus formed has spun a web."

together on each side of the cocoon. My experience with this brood leads me to believe that, when the *Senecio* stems are of suitable length, the larvæ, as a rule, pupate therein, but when, owing to any cause, the plants are very stunted, the larvæ almost, if not quite, invariably pupate on the upperside of an upstanding leaf, thereby minimising the risk from floods, and securing suitable accommodation, which, owing to their own ravages in the stems, probably cannot be found within them. After prolonged drought I have found the shoots of *Senecio*, stem and all, not more than an inch or two in height by the end of May, when the larvæ have mostly pupated, but the radical leaves of the foodplant, containing the pupæ, were then an inch or two higher, and about on a level with the top of the surrounding herbage. The pupæ of the second brood are found, as a rule, inside the last burrow in the main stem of the foodplant." In confinement, pupation of first-brood larvæ took place in a loose, white, silken web outside the plant, the pupa not lying in any particular position. The pupation of the larvæ of the second brood takes place usually within the stem (Stange). Commenting on this difference, Chapman writes (*in litt.*): "The seasonal dimorphism in the matter of the pupating habit is most remarkable; Barrett describes the larva as forming the puparium in the stem in which the larva finished feeding, this would be impossible with early spring larvæ, not merely because there would be danger of their being possibly under water, or otherwise badly accommodated, but simply because there is no stem for them to pupate in, the largest available stem being (comparatively) small, succulent, and rapidly growing. The larva therefore leaves the stem (bud, root ?) in which it has fed up, and makes a definite cocoon elsewhere. Mr. Bankes sends four such cocoons on leaves of the *Senecio*, and larvæ in captivity have made similar cocoons on leaves, and have nibbled and torn paper to make it suit their requirements. They fold over a leaf till it nearly meets (and serve paper in the same way), and across the small remaining gap is spun a strong opaque diaphragm of silk for part of the fold, and, at the top, the silk spreads out more thinly into a short funnel-like portion, through which the anterior end of the pupa can be seen as through a very slight screen, and through which the moth is to emerge. The silk is whity-brown in colour, and seems to have some particles entangled in it in some cases." Bacot writes (August 12th, 1904): "I am rather puzzled as to where pupation is taking place; I found one pupa spun-up on the upperside of a leaf, but can find no more pupæ externally on the plant. Two others I found on the earth as though they had fallen, and I suspect the larvæ have pupated within the plant, and that they wriggle out of their puparia occasionally as in the two individuals just noted."

Pupa.—The pupa is, in some specimens I have, pale terra-cotta, with practically no dark markings; some of the summer pupæ are well-marked, but none anywhere approaching black, which is, I imagine, rather a rare form, as it does not occur amongst a number of (spring ?) pupæ sent me by Mr. Bankes. Of these, some are very dark and some very light-coloured. All these Platyptiliine pupæ are very much alike, but that of *P. isodactylus* is at once distinguished from all the others by the ridge, carrying spines, which encircles the abdominal segments, just above the line separating the front part of the segment from the intersegmental subsegment; it is present on the 3rd, 4th, 5th, 6th, 7th, and 8th abdominal segments. Its actual position is on the last but two of the transverse ridges marking the level part of the segment. Of these, I count 17 on each segment, but they are not continuous, and, by overlapping, fading out, etc., they might easily be counted, by rigid ruling one way or other, as low as 12, or as many as 20. A description of the 5th abdominal segment gives us all the tubercular hairs, as in the larva—i about middle of rough part of segment, behind the sixth ridge (eleventh on counting everything possible), ii just behind ridge of spines, iii well above spiracle and in line with i, though there is, on all segments, half-way between i and ii, a mark, as though three or four ridges had been rubbed down with a finger (supposing them to be plastic, as of clay or sand), which interferes with following the ridges on readily. In front of, and above, the spiracle, is a minute tubercular point, much further away than one would expect to see the accessory spiracular tubercle, judging from its larval position. Tubercle v is below the posterior margin of spiracle, and iv is below and behind v, three ridges above spinous ridge; vi is one ridge in front of spines, and vii is represented by the three usual hairs—the first in line with v, the second (largest) two (or three) ridges behind, the third, one ridge in front of the second. No inner (viii) hair is observed. On the 6th abdominal segment, vii retains only one hair on one side and two on the other, there is also a minute hair-point near the anterior border of segment, quite ventral to vii; and there is also trace of a hair-point at anterior margin, between ii and iii. The spinous ridge is very similar on the 4th, 5th and 6th abdominal segments. The largest spines, four ventrally on either side, are sharp, and triangular, and pointed backwards; one ventral to v, two, one on either side of, and close to, vi, and one just posterior to vii; the first and last of these are longest. Immediately ventral to the last is a hollow, with thick raised anterior ridge, that, though almost too posterior, is almost certainly scar of proleg, as there is no other, and it does not occur on the 7th abdominal segment. There is a very similar mark, still in line of spinous ridge, below the spiracles, but it is less of a hollow or pocket, and the raised margin (ridge) is behind it. Dorsal of this, the ridge is merely a line, except just below ii, where there is a low spine; above ii the ridge is well marked, with thinner portion in front of it. The 17 (12, or 20, as may be) ridges, are about twice their own widths (and heights) apart, and, whilst their summits are fairly transverse lines, their margins are very irregular; regarding them as hills, their flanks have many small subsidiary ridges running down into the plain. The finer sculpturing consists of numerous minute pits (3 or 4 in width of a valley), circular, and well separate from each other; to be like those of *Fredericina calodactyla* (*zetterstedtii*), they would have to enlarge to twice their size, and diminish the plain on which they are, by the consequent encroachment, but they are, perhaps, not so regularly placed as in that species. There is, however, quite a different sculpturing in places, and, all along the anterior margin (except just dorsally and in front of the spiracle), and along the posterior margin ventral to v, and the whole width of the segment ventrally, nearly out to vii, there are no pits, but extremely sharp skin-points, directed backwards, about nine in width of a ridge and valley; on the 7th abdominal, these skin-points invade most of the segment. The spiracles are well-marked circles about 0·08mm. in diameter, that on the 7th abdominal nearly 0·1mm. In one specimen, the anal scar is large, nearly 0·2mm. across, with central incision, marked by marginal ridges and wrinkles; it is in an area of more than twice the width, bounded by ridges running down into the cremastral spine and running forward and including a circular area smaller than the anal scar; this area is elevated on either side, and carries on each side one hair, similar to the cremastral ones, but smaller, and but imperfectly hooked; posterior to this is another very small one; the central line between the two elevations is smooth and depressed, the rest of the area between the ridges is transversely marked by ridges, which, however, curve to accommodate the circular area. The cremastral spine is a somewhat obtuse cone, with very sharp point; it carries fewer than 30 hooked hairs, about 0·2mm. long, thickened some distance before their ends, and with a fish-hook point. The small number of hooks, and the obsolete character of the forward group, must be correlated with the cocooning habit. Both summer and winter pupæ, however, are armed in precisely the same way. The 8th abdominal segment is very narrow ventrally, and, in the ♀, has a rounded central notch. The nose-horn is much less developed than in the other Platyptiliine species, except perhaps *P. gonodactyla*. Instead of being a salient spike, it is hollow in front (or below) and curved down and forward, and the apex incurved. In putting the head-parts on a slide, the nose-horn submits readily to being flattened; in *Gillmeria pallidactyla* (*bertrami*) it will only go down sideways, and twists the other portions. The face-parts are wrinkled, the jaws do not quite meet beneath the labrum, with its very small lappets on each side of the central notch; a diamond-shaped piece of the labium is visible, the maxillæ rapidly narrow, and at 2·0mm. come to a point, in some specimens finally disappearing beneath the legs, in others, maintaining a microscopic line at the surface to their termination 2·5mm. further on. The 1st leg broadly abuts against the antenna, the 2nd is still further out. The 1st pair of legs terminate 5mm. from head, at level of end of wing-margin (but short of apical point); the antennæ terminate 1mm. short of this. Beyond the line of hind-margin of wing, the appendages lie together in a bundle, fixed together, but free from the body. The bundle consists of the 2nd and 3rd legs (the 3rd posterior), side by side, extending to 1·3mm. beyond line, supported on either side by the prolonged wing-apex for about 0·7mm.; this pointed process of wing is about 0·2mm. wide at its base. The ends of the 1st legs just appear in front, and from beneath them the ends of the maxillæ proceed to the same distance as the wing apex. The dorsal head-piece is very minute, but carries the eye-cover on dehiscence, the prothorax is half as broad as long, 0·7mm. × 0·4mm. The mesothorax is notched at its outer front angle by a hollow, in which is an elaborate cover for the spiracle (the spiracle proper being some way under this and rather attached to prothorax when the parts are separated); this cover is 0·2mm. long and 0·07mm. wide, fairly rectangular in plan, but arched across, and a little from end to end, and is crossed by rows of fine spiculæ, those in each row connected by raised waved lines. The mesothorax also carries the dorsal flanges, which are well marked; each is 0·12mm. wide, and about 0·25mm. from the dorsal line; they converge so as almost to touch the middle line at the posterior border of the segment, and dwindle so as to be inappreciable on the metathorax, but are still traceable down to tubercle i on the 3rd abdominal segment; the hindwing disappears just beyond the spiracle of the 2nd abdominal segment. The forewing shows marks of veins, and also exhibits "Poulton's line," giving a wide inner- and hind-margin, slightly passing as an angle between the two lobes, and cutting off the long wing apex, so that the portion inside the line hardly intrudes into it at all; the slit between the lobes has paler chitin, with quite a large pale patch at the point of fission (Chapman). The pupa is figured by Buckler (*Larvae*, etc., pl. clxiii., fig. 4*b*), and is of a very dark grey colour, differing considerably from his description of the same (*infrà*).

Colour variation and markings of pupa.—The pupa is smooth*, nearly ·375 in. in length; the wings and leg-cases meeting in a point low down the abdomen, and in close contact with it; in colour, it is pale whitish-ochreous, the abdomen a little deeper tinted, it is generally striped and marked with brown, particularly on the head and back of the thorax; the dorsal marking is a series of brown acute triangles (Buckler). The spring pupæ are, as a rule, much darker than would agree with Buckler's description of the internal summer pupa; probably, I have not examples of the palest of the spring forms, but my palest are darker than Buckler's, whilst two are absolutely black, but with a fine "bloom" giving a bluish effect, one of the black ones must have the word "absolutely" modified, to admit of a faint trace of a paler subdorsal line being represented by brown spots faintly indicated on each segment at the ridge which encircles each segment. Barrett can hardly be correct in finding no cremastral attachment; it is represented in the summer form, in all the specimens examined, exactly as it exists in the spring one; the pupa is easily drawn out of the cocoon, but brings a thread or two of silk with it. Some pale pupæ would be best described as black, with pale ochreous markings, but one can be found that may almost be called pale whitish-ochreous, with dark markings. It may be called so in order to agree with Buckler's description, and also because, by analogy of other plume pupæ, the pale is the ground colour, and the dark is the marking. The spiracles (2nd-7th abdominal) are very distinct as shining brown points; the legs, maxillæ, most of the antennæ, and much of the wings, are black; the bases of the antennæ, and some markings on the head and marblings on the mesothorax, and wing-spines (bases), are ochreous. The metathorax is also very dark; the abdomen is paler, ochreous, with a faint greenish tinge; this has various black (not brown) markings; of these, a lateral line (below iv and v) of some width, and a narrower one below it, are fairly straight and linear; in calling these markings black, they are really very thin black, through which the pale tint of the interior shows sufficiently to prevent the black being solid and dense. A dorsal line takes the form of triangles, as noted by Buckler; on the 1st, 2nd and 3rd abdominal segments, they consist of very fine lines sloping outwards and backwards; two of these form a central triangle with an acute angle forwards, enclosing a small black triangle; the lines outside the triangle are rather reticulate; from the 4th abdominal segment onwards, the whole triangle is black, and somewhat blurred into an irregular dorsal band. Above tubercle iii is a line, also irregular, as

* Barrett adds (*Ent. Mo. Mag.*, viii., p. 154) that the pupa is destitute of hairs like those of the allied species (*gonodactyla*, *ochrodactyla*, etc.). This is erroneous all these pupæ possess the primary setæ in the pupal stage (Tutt).

if it were tending to form similar triangles. Ventrally, each segment has a central blackish shade, and, outside this, a wide shade sloping outwards and downwards. The bloom is visible wherever the surface is dark enough to show it up. The pen-like anal spike is fringed by a fine fan of rich brown-coloured hairs, with hooked extremities, perhaps 14 to 18 on each side; underneath the 8th abdominal segment is only a pair of small hairs of this character. Each abdominal segment is divided into two portions by a ridge encircling it. In front of this is the segment proper, about ·6 of the whole segment; behind it, is the intersegmental membrane; a small portion of this is not invaded in extreme flexion, and is also probably segment proper, but the line separating this from the real intersegmental membrane is not easily made out. This ridge is nearly evanescent ventrally; laterally it carries several short but sharp spines, probably of use in fixing the pupa during emergence; the longest and largest of these is just ventral to the spiracle, and there are two others ventral to this one, on either side, the first of these is double; there are also two (on either side) dorsal to the larger one. Of the pupæ examined, the ♂ s are dark, the ♀ s the paler. This is true of pupæ, whose larvæ had spun up in leaves of *Senecio*, but, of some cocooned in paper, all are paler than any pupating in *Senecio*, though still much overlaid by black markings. In a distinctly pale one, the wings are ochreous, without black marking; the legs, antennæ, etc., are darker ochreous with darker shading, especially towards the head; the head and thorax, dorsally, have much dark marking, except the mesothoracic crests, which are pale; the dorsal triangles on abdominal segments, the subdorsal blotchy band, the spiracular band of marbled lines, rather almost network, a sublateral dark line, and another below it, and the ventral triangulated line and dots are all very distinctly separate on an ochreous or olive-ochreous ground colour (Chapman). The pupæ of the second brood appear to be strikingly lighter than those of the first generation, much resembling those of *Gillmeria pallidactyla* (*bertrami*) (Stange).

Time of appearance.—This species is apparently wholly double-brooded, occurring first in June and again in August, each brood lasting over three weeks. Also double-brooded in Friedland, occurring in June and August (Stange). Chapman observes that, at Puerto de Pajares, in Spain, between July 12th-16th, 1904, the imagines were fairly abundant; eggs were laid and the larvæ fed up rapidly in confinement so long as food lasted, but finally the larvæ died when nearly fullgrown, on August 10th, and on the point of pupating; no doubt these would have produced moths in the ordinary course about the end of August, in time to lay eggs to produce hybernating larvæ. The species has, therefore, at Pajares, exactly the same life-history as in Britain, but is two or three weeks later in the season, probably passing its summer stages more rapidly (*in litt.*). Actual recorded dates are as follows—August 20th, 1879, and June 18th, 1880, in Friedland (Stange); the first week in June, in numbers, at the foot of the Eagle's Nest mountains (Kane); June 18th, 1836, at Dorchester (Dale); sparingly August 10th, 1864, and preceding days, at Cromaglaun Glen (Birchall); July, 1868, at Carmarthen (Hearder); June 21st, 1871, and August 20th, 1871, and following days, on the banks of the Yare, near Norwich (Barrett); imagines bred August 20th-September 2nd, 1871, others again bred June 6th-16th, 1872, all from larvæ found on the banks of the Yare, in Norfolk, the preceding July and May respectively (Buckler); imagines captured August 30th, 1889, May 31st, and August 2nd, 1890, May 24th-26th, 1892, near Wareham, Dorset; imagines bred May 29th-June 30th, 1890, from larvæ and pupæ collected May 15th-31st, 1890; also August 9th-September 15th, 1890, from larvæ and pupæ collected August 2nd, 1890; also June 10th-28th, 1891, from larvæ and pupæ collected May 25th, 1891; also August 2nd-September 8th, 1891, from larvæ and pupæ collected August 1st, 1891; also May 27th-June 11th, 1892, from pupæ collected May 24th-26th, 1892, and August 1st-30th, from larvæ and pupæ collected July 28th, 1892, all near Wareham; imagines bred August-September, 1890, from larvæ collected August 2nd, 1890, in the Isle of Purbeck (Bankes); imagines captured September 3rd, 1893, on the Belfast Hills (Watts); imagines taken August 14th-16th, 1900, and also September 18th, 1902, near Dartmouth (Bankes); imagines bred June 2nd-4th, 1904, from larvæ collected May 19th, 1904, at Wareham (Chapman); imagines inbred from the last recorded lot emerged August 2nd-12th, 1904 (Bacot).

Habits.—The moth is very local, yet plentiful in its restricted haunts; it hides during the day among coarse herbage, and especially among ragwort in marshy places, and is very sluggish when disturbed, shuffling into the nearest hiding-place, but, before dusk, it begins to be very lively, flying about such places quite freely; later, at night, ascending to fly abroad over the country, and sometimes even hang upon a roadside gaslamp. The females are particularly sluggish (Barrett). The moths, during the day, rest among *Senecio aquaticus* or other marsh plants, from which they may be more or less easily disturbed. They are on the wing during the evening, until about dusk, in favourable weather, flitting to and fro amongst the marsh herbage in characteristic Alucitid manner, and with the usual jerky flight. I have taken the imago on the wing as early as 4.40 p.m., in an exceptionally shady spot, on September 18th, whereas in June or early August it would, of course, not come on flight until a considerably later hour. The ♀s are decidedly more lethargic than the ♂s (Bankes). Griffith notes that he took a fine series in South Uist, flying in the evening over a large marsh where half-an-hour earlier *Bactra furfurana* was abundant. Chapman observes that, at Puerto de Pajares, in Spain, the imagines were common and easily disturbed from among *Senecio aquaticus*, both in the mornings and evenings. [Evans observes (*Ann. Scot. Nat. Hist.*, 1897, p. 100) having taken a doubtful specimen of this species off a lamp at Merchiston in October, 1894.] Chapman sleeved two ♂s and two ♀s on a plant of *Senecio aquaticus* on June 6th, 1904, and, at 9 p.m., one pair was observed *in copulâ*, the ♀ hanging by the front two pairs of legs to the plant, the ♂ inverted and suspended only by his attachment to the ♀; half-an-hour later they had separated (*in litt.*).

Habitat.—This species lives on marshy or swampy ground where *Senecio aquaticus* and *S. nemorensis* grow. Jordan notes (*Ent. Mo. Mag.*, iv., pp. 38-39) it as occurring in "an alder swamp, near Teignmouth, that was fed by a little stream running from Haldon, about a mile distant. It was about an acre in extent, and under the alder-trees grew sorrel and saxifrage, whilst near there were small thickets of *Eupatorium cannabinum*, *Epilobium hirsutum*, *Equisetum telmatera*, with the marsh-thistle towering up among them, and it was in these fastnesses that the plumes took shelter. There were also *Senecio aquaticus, Caltha palustris, Cardamine pratensis, Lychnis flos-cuculi*, and *Sparganium ramosum*, scattered through the bog, besides rushes and sedges, and a few occasional stragglers from the heath above, such as *Anagallis tenella, Wahlenbergia*, and *Pedicularis*, amongst the grass and *Sphagnum*, which formed a rather treacherous footing." Birchall observes (*loc. cit.*) that near Killarney, on the bog that lies between the Tower Lodge and the precipitous base of Cromaglaun Mountain, the imagines are abundant, being, however, apparently confined to the dry and somewhat elevated margin of the bog, the first example taken there being disturbed from a clump of *Calluna vulgaris*. In the Norwich district (*op. cit.*, viii., p. 153), Barrett found the species in a marsh by the river Yare, where *Senecio aquaticus* grew among coarse grass, flying over reeds and the tall herbage there. In the early summer of 1880, Barrett further notes (*op. cit.*, xvii., p. 91) that he found the species by no means scarce, flying before dusk among *Senecio aquaticus*, in the stem of which its larva feeds, and among which it conceals itself in the day-time, on a piece of peculiarly wet marsh thickly overgrown with *Iris pseudacorus, Senecio aquaticus, Mentha palustris, Ranunculus flammula*, &c., at Pembroke, whilst, in August of the same year, the imagines were so abundant on the same ground that he could have taken hundreds. Bankes records (*Ent. Mo. Mag.*, xxv., p. 455) that its habitat near Wareham is a water-meadow, and says (*in litt.*) that it is excessively local, both in the south of Devon and the south of Dorset (the only counties where it has occurred to him), but usually common in its special and very restricted haunts, which, in his experience, are swampy corners of water-meadows beside rivers, and the like; owing to the value of water-meadows for hay-making and grazing purposes, suitable spots are few and far between, and, hitherto, his efforts to find it in Purbeck have only resulted in the discovery of four or five larvæ. When first he met with it in Dorset, in 1889, it had only been taken in the county once previously, namely, in 1836. Watts found it in a reedy spot on the Belfast hills where *Senecio aquaticus* is abundant. Barrett later writes (*Lep. Brit. Isles*, ix., p. 352): It is found in marshy places rather than fens in Norfolk; in Wales, it is common near Pembroke and elsewhere on the Pembrokeshire coast, and also in Carmarthenshire; in Scotland, Stainton records it from the Orkneys, and Mr. A. F. Griffith found it in a marsh in the Hebrides, whilst, in Ireland, it has been taken among the hills near Belfast and Carrickfergus. In Friedland, this species is found beside ditches, and on the banks of the Datze (Stange); [in south Holland, near Leiden, on marshy ground (de Graaf).] In Spain, July 12th-16th, 1904, at Puerto de Pajares, the road from Leon to Oviedo crosses the Cantabrian range at a height of 4500 feet; much of the region hereabout is not unlike a Scotch moorland, and, in many of the marshy bogs about, *Senecio aquaticus* is common, and among this *P. isodactylus* is abundant, just as the *Senecio* is coming into flower (Chapman).

British localities.—Exceedingly local in England, Scotland and Ireland, but abundant where it occurs. Antrim: Belfast Hills—Knockagh, near Carrickfergus (Watts). Carmarthen: Carmarthen (Hearder). Cork: Glengariff (Tutt coll.). Devon: between Haldon and Teignmouth (Jordan), Dartmouth (Bankes), Exmouth (Leech). Dorset: near Wareham, Isle of Purbeck (Bankes), Dorchester (Dale). [Edinburgh: Merchiston (Evans).] Galway: Moycullen (Kane). Hebrides: South Uist (Griffith). [Hants: Isle of Wight—New Forest

(Stephens).] Kerry: Cromaglaun Glen—near Tower Lodge, on the upper Lake of Killarney (Birchall), foot of the Eagle's Nest Mountain (Kane). Kincardine: Stonehaven (Tutt coll.). Londonderry: Londonderry district (Barrett). Norfolk: banks of the Yare—Norwich (Barrett). Pembroke: coast districts of Pembroke (Barrett), Saundersfoot (Blandford). Shetlands and Orkneys: Orkney (*teste* Stainton). Sligo: Markree Castle (Kane), Culleenamore (Leech). [Suffolk (Meyrick).]

Distribution.—An exceedingly local and little known species, and, no doubt, from its recorded localities, much overlooked. So far only recorded from northwest Germany, Batavia, England and the Channel Isles. [Belgium (*teste* Barrett; wants confirmation).] Channel Isles: Guernsey (Ansted). Germany: Friedland—on the Fohlenkoppel (Stange). [Holland: South Holland, near Leiden (de Graaf *teste* Snellen).] Spain: Puerto de Pajares, where the road from Leon to Oviedo crosses the Cantabrian range (Chapman). [The Silesian records of *isodactylus* do not refer to this species (*teste* Hofmann). The Leiden specimens have been compared, and found to correspond, with British examples (*teste* Snellen).]

Platyptilia gonodactyla, Schiffermüller and Denis.

Synonymy.—Species: **Gonodactyla,** Schiff. and Den., "Schmett. Wien.," 1st ed., p. 320 (1775); Goeze, "Ent. Beit.," iv., pt. 3, p. 177 (1783); Illig., "Schmett. Wien.," 2nd ed., p. 130 (1801); Zell., "Isis," p. 882 (1841); Staud. and Wocke, "Cat.," 2nd ed., p. 342 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 784 (1877); Frey, "Lep. der Schweiz," p. 428 (1880); Barr., "Ent. Mo. Mag.," xviii., p. 177 (1882); Tutt, "Ent.," xviii., pp. 169, 195 (1885); Sorh., "Kleinschmett. Brand.," p. 2 (1886); Leech, "Brit. Pyr.," p. 53 (1886); Tutt, "Ent.," xx., p. 211 (1887); xxi., p. 259 (1888); "Ent. Mo. Mag.," xxv., pp. 104-107 (1888); "Young Nat.," x., p. 163 (1889); xi., p. 123 (1890); "Pter. Brit.," p. 40 (1895); Meyr., "Trans. Ent. Soc. Lond.," p. 486 (1890); "Handbk.," p. 434 (1895); Hofmn., "Deutsch. Pter.," p. 42 (1895); "Illus. Zeits. Ent.," iii., pp. 135, 152 (1898); Staud. and Reb., "Cat.," 3rd ed., p. 72 (1901). **Diptera,** Sulz., "Ges. Ins.," p. 163, pl. xxiii., fig. 19 (1776). **Megadactyla**, Hb., "Eur. Schmett.," Aluc. pl. ii., fig. 6 (*ante* 1804); "Verz.," p. 429 (1825). **Trigonodactyla,** Haw., "Lep. Brit.," p. 478 (1811). **Trigonodactylus,** Sam., "Ent. Comp.," p. 409 (1819); Curt., "Brit. Ent.," fo. 161 (1827); Stphs., "Illus. Haust.," iv., p. 375 (1834); Wood, "Ind. Ent.," 1st ed., p. 237, pl. li., fig. 1644 (1839); Sta., "Cat.," p. 31 (1843); "Zool.," p. 3064 (1858); "Man.," ii., p. 440 (1859); Dbldy., "Syn. List," 2nd ed., p. 36 (1859); Peers, "Ent.," ii., p. 38 (1864); Jord., "Ent. Mo, Mag.," viii., p. 137 (1871); Machin, "Ent.," xiii., p. 283 (1880); South, "Ent.," xv., pp. 31, 145, pl. iii., figs. 1*a*-1*c* (1882); xviii., p. 170 (1885); Porritt, "Buck. Larv.," ix., p. 347 (1901). **Tesseradactyla,** Treits., "Die Schmett.," ix., pt. 2, p. 230 (1833); var. *c*, Zett., "Ins. Lapp.," p. 1012 (1840); Evers., "Faun. Lep. Volg. Ural.," p. 605 (1844). **Tesseradactylus,** Dup., "Hist. Nat.," xi., p. 647, pl. 313, fig. 5 (1838); supp. iv., p. 500, pl. 88, fig. 8 (1842). **Zetterstedtii** (in part), Zell., "Isis," p. 777, var. *c* (1841); "Isis," p. 300 (1846); Dup., "Cat. Meth.," p. 381, in part (1844). **Gonodactylus,** Zell., "Linn. Ent.," vi., p. 330 (1852); H.-Sch., "Sys. Bearb.," v., p. 368, supp., pl. ii., fig. 9 (1855); Frey, "Tin. Pter. Schweiz," p. 402 (1856); Wallgrn., "Skand. Fjäder.," p. 12 (1859); Jord., "Ent. Mo. Mag.," vi., p. 121 (1869); Nolck., "Lep. Fn. Estl.," p. 800 (1871); Gregs., "Ent.," vi., p. 426 (1873); Barr., "Lep. Brit. Isles," ix., p. 352, pl. 414, figs. 1-1*a* (1904). **Ochrodactylus,** Sand, "Cat. Lep. Auv.," p. 203 (1879). **Farfara,** Gregs., "Ent.," xviii., p. 151 (1885); Tutt, "Ent.," xviii., pp., 169-171 ,195-196 (1885). **Farfarella,** South, "Ent.," xviii., p. 172 (1885). [In 1804, Hübner figured *gonodactyla*, Schiff., under the name *megadactyla*. In 1821, Charpentier examined the Schiffermüllerian collection, and stated that *gonodactyla* was a worn specimen of *calodactyla* (*zetterstedtii*) (an error that could easily be made when one recognises how little was known of the Platyptiliids at this time). Zeller notes (*Isis*, 1841, p. 882), however, that Fischer von Röslerstamm (and with this the original description agrees) states, that Schiffermüller's example is identical with the example which Zeller treats as *Pterophorus zetterstedtii* var. *c*, and with *Alucita tesseradactyla*, Tr., both of which have been since referred to the species now generally known as *gonodactyla*.]

Original description. — *Alucita gonodactyla.* — Braunlichtweisses Geistchen mit einem düstern Dreyeck fleckchen (Schiffermüller and Denis, *Sys. Verz. der Schmett. Wien.*, p. 320). [Illiger, in the 2nd ed. of the *Sys. Verz.*, etc., pp. 130-1, writes: "The plume, which I hold to be the *gonodactyla* of Schiffermüller and Denis, is of a brownish-grey tint, about as large as *P. tetradactyla*. The forewing is divided into two lobes by a longitudinal fissure for the first third of its length; at the termination of the cleft (on the costa) stands a triangular brown spot; the inner margin of the exterior part (or 'Spitzenlappens') is, like the inner margin of the forewing itself, edged with whitish. The hindwings are composed of three plumules, fringed only on their inner margins."]

Imago.—21mm.-27mm. Head, thorax and abdomen of the same colour as the wings. Anterior wings divided into two lobes; the apex sharply angulated but not much produced; the ground colour whitish-grey, the costal area darker, being sprinkled with dark scales; the inner margin also darker at the base, but paler in centre and towards anal angle; in this pale part there are generally two dark marks on the inner margin, variable in shape, one near the centre, the other nearer the anal angle; the central area comparatively clear; a dark brown triangular blotch on costa (just within cleft) is produced almost to inner margin, and externally edged by a pale line, forming roughly a lunular mark; a dark shade, hardly to be called a band, crosses the two lobes parallel to the outer margin, edged externally by another very pale line. Posterior wings divided into three plumules, of a greyish-brown colour, with paler fringes, the posterior plumule with a distinct tuft of black scales towards the anal angle.

Variation.—The newly-emerged imagines differ considerably in ground colour and intensity of markings; some are distinctly whitish-grey in ground colour, others strongly reddish-ochreous, whilst many are strongly suffused with a rosy tint. The strength of the markings, too, varies considerably, some being faintly, others quite darkly, marked. In some specimens, principally of the early brood, the ground colour is slaty-grey, the markings very rich brown, the costal and inner margins much speckled with ochreous, and thus these specimens somewhat resemble the more richly marked *F. calodactyla*. On the whole, there is much more variation in the first than in the second brood, the specimens of the early brood being, generally, much redder and more strongly marked than those of the later brood, a pale whitish-grey example being rare in the spring brood, whilst in the autumnal brood a reddish or ochreous specimen is of rare occurrence, almost all being conspicuously pale. Not only are the second brood examples paler, but they are generally smaller and not so decidedly marked, the earlier specimens of this brood especially having a bleached appearance; the colour too appears to be of a more uniform grey, and the markings also are less sharp than in most specimens of the first brood, the bleached appearance being possibly due to the fact that the larvæ hurry through their changes compared with those of the first brood. There is also a great deal of variation in size, those of the early brood being generally the larger, although very large and very small examples occur in both broods. Borgmann notes that he reared examples from larvæ in the flowerheads of *Tussilago* at Cassel, in 1878, that were nearly one-third larger than the autumnal specimens. There appears to be little, if any, fixed sexual variation in colour or size. Some individuals, one notices, have only one, or neither, of the two dark spots normally present on the inner margin; some have a dark shading at the exterior edges of the cleft in the anterior wings, whilst others are without it, and yet again we find specimens with scarcely a trace of the fascia parallel to the hindmargin, and others in which the characteristic costal spot is ill-developed. There is also considerable difference in the falcate character of the apex of the anterior wings, some being very pointed compared with others. South notes (*Ent.*, xv., p. 32) that some examples that he bred from the larval stage, in north Devon, were very pale, and had quite a bleached appearance when compared with other specimens captured in Kent and elsewhere. The following appear to be the chief forms :—

(1) Greyish-white, with ill-defined markings = ab. *pallida-obsoleta*, n. ab.

(2) Greyish-white, with well-defined markings = ab. *pallida*, n. ab.

(3) Greyish-ochreous or greyish-brown, with ill-defined markings = ab. *typica-obsoleta*, n. ab.

(4) Greyish-ochreous or greyish-brown, with well-developed markings = *gonodactyla*, Schiff.

(5) Slaty-grey, the costal and inner marginal areas ochreous, the darker markings richly reddish = ab. *clara*, n. ab.

(6) Unicolorous brownish, the markings largely absorbed in ground colour = ab. *obscura*, n. ab.

Bankes says that "although the species gets quickly worn, thereby becoming paler, a comparison of fresh specimens shows considerable variation in the ground colour of the forewings. In the palest individuals this is conspicuously white, only very partially and lightly tinged with brownish, whereas, in the darkest, it is distinctly brown or greyish-brown, partially flecked with whitish scales." Barrett observes that the species is variable in size and in the shade of white or brown ground colour. Jordan notes the autumnal specimens, taken in Scandinavia, to be, like those taken in Britain, more dusky than those caught in summer. The best example we have of ab. *obscura* was captured by Dalglish at Giffnock, June 14th, 1894.

Egglaying.—The early summer moths lay their eggs deeply among the tomentum or fluff on the underside of the leaves or on the stems; they appear to be pushed so far within the woolly coat as to give one the impression that they are laid internally. [In confinement, many were laid on the muslin with which the plant, on which the imagines were enclosed, was covered; these were pushed quite through the tiny holes in the muslin, and so had the appearance of having been laid from (as well as the reality of being laid on) the outside.] (Tutt). The eggs were found fairly plentifully on the underside of leaves of *Tussilago farfara*, growing on a piece of waste land at Upper Clapton, on July 2nd, 1899; five eggs were on one nearly fully-expanded leaf; two of which were laid close to, and the others well away from, veins; all, however, were more or less buried in the woolly texture of the leaf (Bacot). Eggs received on June 12th, 1904, from Mr. Sich, had been laid on the underside of a leaf of *Tussilago farfara*, a little sunk in the fluff of the tomentum; they were placed on a flat side, and have already a slight hollow on the top from desiccation (Chapman). In 1904, the first eggs were noticed on May 31st (four); thirteen more had been laid by June 3rd, 1904. The ova are laid on the underside of the leaves of the foodplant, more or less hidden by the tomentose hairs of the leaf. In confinement, the moths always chose this situation, which is undoubtedly the natural one, for the summer brood at any rate, for, on June 8th, I searched the leaves of wild coltsfoot in a field at Chiswick, and soon found eggs in this situation (Sich). No observation appears to have been made as to where the eggs of the autumnal imagines are laid.

Ovum.—Pale pea-green when newly laid, changing to pale pearly-yellowish as the embryo matures; smooth and shiny, with the faintest trace of a fine coarse-meshed surface reticulation; roughly oval in outline (viewed from above); laid upon the long side; about ·55mm. in length, ·3mm. in width; the micropylar end rather broader than its nadir; this end becoming black (possibly the larval head) as maturity approaches (Tutt). [In size, rather larger than those of *Porrittia galactodactyla*, differing also in shape, being more cylindrical.] Length ·5mm., width ·25mm., thickness nearly the same as width; one end tapering rather more than the other; eggs flattened on one side, but upper surface not depressed; the surface very smooth and varnished-looking, with very fine polygonal (? hexagonal) facets towards ends, possibly the remnants of a surface cellular reticulation (Bacot, July 2nd, 1899). Pale green in colour; very polished, yet with a distinct network of hardly raised ribs in irregular polygons, that run into longitudinal rows in places, *e.g.*, a set of seven or eight, or possibly more, if they could all be made out at once, are placed side by side in a row in line with the longest axis of the egg, so that their separating ribs are transverse, and their common line of margins is nearly straight, but still so far irregular that, instead of the cells appearing to be quadrangular, they are modified hexagons or pentagons; in other places they are irregularly placed, of various sizes and figures, and the ribs are often so flat and rounded as to be difficult to see. The cells of the network are about 0·03mm. in diameter. Seen from above the egg is oval, 0·60mm. long, and 0·36mm. across; seen laterally, the top and bottom are nearly parallel, and would be but that one end is slightly thicker; this end is also a good deal flattened; both top and bottom are a little hollowed; the height is 0·25mm. at the thinner end, 0·27mm. at the thicker (Chapman).

Habits of larva.—(1) *Summer feeding larvae.*—A large number of larvæ appeared July 2nd-5th, 1888, from ova deposited on the leaves of some potted plants of *Tussilago farfara;* numerous tiny mines were at once noticed in the undersurface of the leaves, and, on July 7th, a thorough examination showed a number of small round holes in the under epidermis, and mines leading from these into the leaf substance; the larvæ in the mines were very inconspicuous, and could only be traced by their black heads. On July 10th, a large number of tiny larvæ—pale green with black heads, the two following segments with a black plate and a dark dorsal streak—were observed mining under the fluff, both of leaves and stems. The larvæ were now conspicuous enough, many wandering about on the outside of the undersurface of the leaves; they were then turned out-of-doors, and soon crawled on the strong plants growing in the garden; they directly, however, bored beneath the fluffy under-epidermis. On July 19th, some of the larvæ had left the mines and were feeding externally; they were then about ·25mm. long, and very pale in colour; those that were feeding outside the mines, and quite exposed, were eating little round holes in the undersurface of the leaves, through the epidermis and parenchyma, leaving only the upper epidermis. On July 30th, some larvæ were still mining under the fluff of the undersides of the leaves, but most of them were fully exposed, and some of the latter larvæ had now quite a dark purplish-brown dorsal line. On August 19th, the larvæ were still eating round holes through the lower parts of the leaves, but leaving the upper epidermis. The larvæ were at this time practically fullfed and appeared to vary in a much less degree than those of the spring brood, being, as a whole, much paler; there were now no traces of mining, all the feeding being done outside, and one larva had already pupated in a web on the underside of a leaf. Pupation took place between this date and August 26th, by which time, many of the plants looked as if they had been riddled, for the growth of the young leaves causes the upper epidermis, which the larvæ appear to leave uneaten, to crack (Tutt). On June 17th, 1904, the young larvæ, a day or two old, were found mining in the substance of a colt's-foot leaf. No sign of their work was visible above (on June 20th), except a faint discoloration over some of the largest; below, nothing is to be seen until close observation shows the minute hole of entry, sometimes, quite close to the eggshell, at others so far from an eggshell that the larva must have travelled some distance; by holding the leaf against the light, the little larvæ and their mines are very evident, and it is by first finding the mines in this way that the other indications just noted are discovered. By July 2nd, the larvæ are still mining in the leaves, eating out the parenchyma, and leaving the upper and lower layers; they are ready, however, if the cover fails them, to use a little silk, or, if the leaf gets dry or stale, to come out and seek other quarters. The larvæ are already (some of them) in the 3rd skin, and look, in form and colouring, much like the full-fed larva. The plants on which they were placed were badly established, and the leaves failing, the larvæ had to make various pilgrimages; whether in consequence of this, or as an ordinary and natural habit, is uncertain; I find all the leaf-stalks have one or more larvæ in them, as evidenced by the small extrusion of frass (Chapman). (2) *Winter-feeding larvae.*—Little is known of the habits of the winter-feeding larvæ, from the time they hatch in September until the earliest days of April, when they are about 2·5mm. in length, *i.e.*, the second (and most probably the hybernating) instar, at which time they may be found in the hollow scapes of *Tussilago farfara*, often in the lower part, often in the solid basal part, and sometimes even extending into the rootstock. That little, however, is important, and consists of an observation made by Ovenden, in October, 1903, that the tiny larvæ mine in the leaves, near the midrib and close to the petiole, along which he suggests the larvæ bore in the autumn, and at the base of which they lie dormant until January or February, when they enter the already rapidly-growing plant. We suspect that the larva enters the upper part of the rootstock to make its hybernaculum, for it clearly attacks the young shoots and scape just as they are springing therefrom. The scape of *T. farfara* is, when well-grown, hollow from the base of the receptacle (carrying the capitulum) to within an inch or so of the point where it leaves the rootstock. Ovenden writes: "After the examination of some dozens of flowering stems of *Tussilago farfara*, I have come to the conclusion that the larva works into the flowering-stem when very minute. I found some yesterday (April 20th, 1904), no longer than from 3mm.-4mm., low down in the stem, in fact nearly into the root, whilst, in many plants, the entrance holes were plainly discernible under the leaf-like bracts that encircle the flowering-stalk. I found the large ones higher up the stem, and, when they were just beneath the capitulum they appeared to be mostly in their last instar. There were plenty of traces of eating, as well as of frass, in the stem, and, as there was not a single larva observed in the flower-head itself, although the bases of the capitula sometimes had holes in them, I incline to the opinion that the larva works up from the root to the flower, and only feeds on the fruits when the stem is cleared. It appears probable that, as I have found the larva mining in leaves in October, near the midrib and close to the stem, the larva works its way along the petiole of a leaf, lying dormant at the base thereof until January or February, at which date the previous year's leaves are still attached to the foodplant, and then enters a flower-stalk just as it begins to rise. Such small larvæ, as these are in the winter, certainly hybernate in the foodplant; they also leave clear signs of the points of entrance into the flower-stalks at the base of the surrounding bracts." About 200 flowering-stalks of *Tussilago farfara*, in very different stages of development, some being extremely small, others nearly fullgrown, collected at Strood on April 20th, 1904, by Mr. Ovenden, and sent to us, were split on the morning of April 21st. A few points appear to be clear. The smallest larvæ, now about 3mm.-4mm. in length, are in the bottom internode of the peduncle or scape, the point of entry being manifestly just at the upper point where the bottom bract joins the stem; the appearance inside leaves one with the impression that the larvæ had been within this for some time, although the eating of the inside pith in quantity, which was very evident, had been very recent; the brown tint and tiny bore of some of the burrows make one suspect this area as a possible hybernaculum, when the development of the internode has not proceeded far. Slightly larger larvæ had pushed their way up into the stem at least two inches, showing traces of feeding and frass, but with the pith of the upper part of the flowering stalk and the base of the flower quite unattacked, firm, and uneaten. Many stalks, however, which were deserted, and were not otherwise affected, had traces of attack in the lowest internode. One such flowering-stalk, about four inches in length, quite young and with the capitulum not yet opened, that had been attacked in this manner and had been deserted, had a tiny entrance hole just at the base of the sheath of the third bract below the capitulum; the gallery from this led to the pith which had been cleared out downwards for about an inch by a small larva that was present. There was no connection between this and the affected internode at the bottom, or the flower at the top of the stalk, the upper part of the pith and the receptacle, being unattacked and uneaten. In some stalks, the connection between the capitulum and the bottom node by means of a gallery in the centre of the stem was complete, and traces of eaten pith and frass were evident throughout the whole distance; a small hole in the flat receptacle, however, suggested that the stem had been entered from the top and not from the bottom, and that, by eating downwards, the particular larva had at last reached the hybernaculum of another larva; that this was certainly the case in some instances is clear, for, in one case, a small larva was making the usual borings in the lowest internode of the flower-stalk, whilst a hole in the receptacle of the same stalk, being followed downwards, showed a gallery with traces of frass and eaten pith, for a distance of five inches, when a not very large larva was reached, only separated from the one in the lowest internode by an uneaten and untouched distance of about 1½ inches. In other stalks there were distinct traces of the entry of a larva in a not yet, or scarcely, opened capitulum, the larva having entered the hollow below the receptacle which it had cleared of pith and gone down the stem for some distance where the pith was also eaten ; neither the achenes nor floral structures showed any sign of being eaten. The large proportion of larvæ that were in the receptacle and upper part of the flower-stalk, the abundance of frass here, and the absolute clearance of all the soft, cellular, pithy material in this portion, with no connection whatever with the lower part of the stalk, which was quite sound, made it quite clear that these larvæ had entered from the top, and had not worked their way up inside the stalk. Only one larva showed actual evidence of having eaten the achenes and floral structures; this was a large fullfed larva, coiled up in the cleared out receptacle, which was surrounded by the fruits in a green, juicy state, on which it had been evidently feeding heartily. This particular stem showed no trace whatever of having been attacked previously by any larva in its lower internodes, and, no doubt, the larva had left another head to complete its feeding in this one. This most careful examination has left us in a more or less uncertain state as to the habits of this larva. The larva appears, when small, to bore into the base of the undeveloped peduncle (whether in early or late winter is doubtful), and to remain there until the peduncle has grown to a height of, at least, three or four inches above the ground. [It may even very occasionally work its way up the peduncle to the capitulum through the stem, but we incline to doubt it.] It appears then to leave the lower part of the peduncle, and to enter the receptacle through the flower, feeding on the pith of the receptacle and peduncle, and moving up and down therein with the greatest ease, and almost always travelling with its head downwards. If one, containing pith, be insufficient to bring it to maturity, it leaves the peduncle and enters another just-expanding flowerhead, often, however, getting no further than the receptacle, which it clears before coiling itself to feast on the achenes and florets, growing rapidly, and in a short time coming to maturity. Although a larva from September to May, two-thirds of the growth takes place in the last three weeks of its larval life, when, from a slender larva of some 7mm. or 8mm. in length, by less than 2mm. in width, it grows to a plump, fat larva of some 20mm., with a width of 4mm.-6mm. (April 21st, 1904). In confinement, laggard larvæ of the spring brood will feed up on leaves quite comfortably, and may occasionally also be found doing so in nature (Tutt). Sich observes that, in April, when the larvæ are not more than 2·5mm. long, they will burrow a certain distance into the lower solid portion of the scape, but are more often found in the hollow portion. In some cases, the larva enters the scape by biting a hole just above the base of one of the numerous scales which clothe the scape, in other cases, the larva will burrow down among the florets (or pappus if the flower be over) and bite a hole through the receptacle, usually at the centre. Once inside, it remains concealed and feeds on the soft cellular tissue which lines the interior of the scape and lower portion of the receptacle. It never appears to eat either the florets or the achenes. It usually undergoes ecdysis in the scape, and moves readily from one to another stem. When the larva is in its last instar it occasionally eats away the tissue almost down to the outer skin of the scape, which causes the flower-head to droop. As to the variation in the larval feeding-habits in nature, Bankes states that, eleven larvæ found, April 30th, 1904, in the Isle of Purbeck, showed the following different feeding-habits: (1) Two young larvæ feeding beneath the down, on the back of a young leaf, underneath the curled-back flap of the leaf. (2) Feeding upwards inside the flower-stalk. (3) Feeding downwards inside the flower-stalk. (4) Feeding downwards through the shoot or basal portion of a stem into the rootstock (two or three well-grown larvæ were found doing this). (5) Feeding in the base of a flower in the oft-described way. Bankes adds that, from the published accounts, one would gather that, when there are plenty of tall flower-heads about, most of the larvæ would be found in them, or in the stalks just below them, but the majority of those found were in other parts of the plant, nor did the pose of the four tenanted flower-heads differ in any way, except in one instance, from that of the untenanted ones, for most of the latter hang head downwards, their stems being bent completely over above the flowers; the position of the attacked head is a mere matter of chance; if the larva happens to enter a flower-stem, erect throughout its length, and also happens to mine the portion of the stem just below the head, then the latter will droop so as to touch the scape, as South says (*Entom.*, xv., p. 145), but it does not always, by any means, bore the stem below the head, nor if it bores one of the numerous stems already bent right over, can the head droop so as to touch the scape. Chapman notes that, on May 2nd, 1903, near Lac Bourget, several larvæ were found apparently fullfed, the food of which seems to have been the receptacle and the material just below it. He notes further that, if this be insufficient, the larva will go down the stem; usually it does this for a short distance, $\frac{1}{4}$ inch or so, but more rarely goes quite to the bottom; the flowers destroyed by the larvæ succeed in seeding, or rather the achenes remain, but contain no seed, and the pappus is fully developed; the amount eaten by the larva appears to be, usually, small, only the fleshy receptacle and little else, so that it also, probably, in the rapidly-growing flower, gets a good deal of sap; the plants show no other damage, so that it would appear that the larva reaches this spot as soon as its hybernation is over, and as growth begins in the plant; it is certain that, when the shaft of the flower-stem is burrowed into, this is done from the top; these conclusions are derived from noting the damage done to the plants at Lac Bourget, and may easily omit something, an actual observation of the larva between hybernation and its full-growth in spring being still a desideratum. Gregson observes (*Ent.*, vi., p. 426) that the larvæ feed in April in the young flower-shoots of *Tussilago farfara*, causing them to be stunted and droop; towards the end of April, they leave these stems and enter more advanced flower-stalks, a little below the flower-head, and live beneath the seeds, eating them from below, or they enter a well-grown flower, before it is open, causing it to burst on one side, and take their place among the seeds as soon as they have eaten out a home to live in; on one occasion, in June, at Llanferas, a larva was found feeding in a kind of gallery, made in, or under, the woolly underside of a coltsfoot leaf. Peers (*Ent.*, ii., p. 38) and South (*Ent.*, xv., p. 32) publish notes as to the larval attack on the flower-heads. Barrett says (*Lep. Brit. Isles*, ix., p. 353) that, in April and May, the larva eats out the substance of the bud or flower or the base of the seedvessel, and that a second generation feeds in June in the upper part of the root of the same plants. Our preceding notes suggest that the latter of these statements is probably inaccurate.

Larva.—*First instar* (June 17th, 1904).—Pale greenish colour, with dark dorsal stripe and black head (Tutt); nearly 2mm. long, with body as wide or wider than the black head; the prothoracic and anal plates also black; the hairs, on the contrary, rather pale; the tubercles all single-haired, i with a shorter hair directed forwards; ii with a longer one pointing backwards; iii long and directed forwards; the spiracles large, each forming a prominent truncated flat cone; tubercles iv and v on a common base, the former carrying a very long hair directed outwards and a little backwards, whilst the latter, above and in front of iv, carries a shorter hair; this is very much directly above the other, so that unless one is careful to get a proper view, one is apt to think it is directly above it; tubercle vi seems absent. On the thoracic segments the hairs forming the 1st and 2nd pairs are near together; iii is without any accessory behind it. Two prespiracular hairs are found on prothorax; in front of the spiracle are several rows or rather a small patch of recurved short hooks, and some occur also behind the spiracles, these appear to be skin-points, not detected on other parts of the larva. *Second instar:* The larva is 3mm. long, 3·5mm. if fully extended. It differs from the previous instar in having tubercle vi present, and in having a covering of skin-points. The longer hairs on ii and iii are about 0·2mm. in length, quite simple; whilst, on the 7th and 8th abdominal segments, that on tubercle ii is about 0·25mm. long. The head, thoracic plate, legs and anal plate black. Most of the skin-points are rounded below, but terminate in a fine needle-like point. The prolegs have five hooklets as against four in the first instar. *Third instar:* In form and colouring apparently like the fullfed larva (Chapman). *? Penultimate instar* (May 1st, 1904).—About 10mm. in length, 2mm.-2·5mm. in thickness; the body more or less cylindrical, gradually (but noticeably) tapering to either end. The head and thoracic segments are rather small; the anus also is small and somewhat pointed. The segments clear and plump, without being accentuated in this respect; there is a slight central incision dividing each segment into two poorly marked subsegments. Head small, rounded, with a polished black surface. The prothoracic scutellum is conspicuous, polished similarly to the head, also jet black, but with a narrow white mediodorsal streak across it; the anal plate inconspicuous, chitinous, but coloured as a portion of the body and not distinctively; the true legs are black; the prolegs short in comparison with those of the external-feeding Alucitid larvæ. [The larva uses an abundance of silk, dropping on a thread on any and every opportunity; it also has the micro habit of crawling in jerks, and the ability to crawl backwards.] A marked lateral flange is one of its noticeable features, but this is situated rather low down, and best observed ventrally. The larval colours are pale brown beneath, reddish-brown above, with pale or dirty-white irregular bands, one on either side of the mediodorsal area, one subdorsal and one lateral. The skin-surface appears shiny, but it bears a tolerably dense coat of minute spicules, and, in addition, there is a scattered coat of short tapering black secondary hairs; these are stout enough to appear bristly under a 1-inch objective; each of them arises from a small chitinous black base, and it is these that are chiefly responsible for the rough appearance of the larva. The tubercles proper consist of primitive setæ arising from slightly raised chitinous buttons, each surrounded with a small area of chitinised skin-surface; tubercles i and ii on meso- and metathorax are set transversely, with a slightly oblique slope on metathorax, near together, but not touching; they are joined by a chitinised skin-area that is hardly marked enough to be called a plate; tubercles iii and iv are situated close together (as in Sphingid larvæ) on a single plate, vi carries a single weak hair some little distance below, while v is a plate bearing two hairs (probably the primary seta of v and the small secondary hair that is generally found near it); there is a treble-haired plate (vii) at base of legs. On the abdominal segments, tubercles i and ii are set in trapezoidal position, single-haired, ii bearing much the longer hair; iii is situated some little distance above the spiracle; close to the spiracle the usual minute tubercular point is quite noticeable, the point being larger than customary, and having a small basal plate. The spiracles are large, with slightly raised black walls tapering upwards. Tubercles iv and v are, as usual, mounted on a single plate beneath the spiracle; this plate is more raised and wart-like than any of the others. There are also two marginal setæ situated a short distance apart; their bases are distinct, but the actual setæ are not (Bacot). *Final instar :* In the last instar, the skin-points are very numerous, dark in colour, mostly flat or round-topped, but with sharp points in places, especially along the anterior border of the segments, and the long sharp needle-points are still found ventrally, especially in front of each pair of true legs. The skin-hairs are almost universal, quite different from those of *P. isodactylus* where considerable areas are without them. There are, however, as in all these species, certain small, usually circular, areas without hairs or skin-points; these are generally about 0·1mm. in diameter, and the skin-points are often in rows round them. Their number is much the same as that of the tubercles, and they seem to have equally fixed positions. The prolegs and claspers have eight or nine hooks. The prothoracic plate is dark, with darker, puckered-looking (depressed) patch near each outer end, with a central suture and six hairs on either side in typical disposition; there are also three hairs on the prespiracular plate and two on one plate at the base of legs. On the meso- and metathorax there are, on each side, four plates, each with two hairs, and a small plate with one (above and behind the third large one); on the four plates the hairs are placed: (1) trapezoidally, (2) as reversed trapezoidals, (3) upright, (4) horizontal. On the abdominal segments, i and ii are widely separate, trapezoidal, i with hair about 0·3mm. long, ii and iii with hairs about 0·5mm., iv and v on one plate, trapezoidally; vi may carry one, two, three, or four hairs (on the 1st abdominal segment it is generally a single plate with two hairs, one above the other, on the 2nd abdominal, it has usually three separate hairs, often four on the following segments, an odd segment varying from the others, in one case only one hair, all the other segments having two or more); vii has the usual three hairs; viii (?) a single small hair. The spiracles are large, circular, on a high conical base. On the 8th abdominal, the hairs of ii on either side are on a single conjoined base (a narrow transverse dark plate); on the 9th abdominal, is a dorsal quadrangular plate, with four hairs placed in square, then a small plate with two hairs trapezoidally placed, then two hairs vertically on a smaller plate, then a single hair, and, finally, a very small hair close to the ventral line. The anal plate has six (or seven) principal hairs, and four (or three) smaller ones (Chapman). Short general descriptions of the fullfed larva are given by

Peers (*Ent.*, ii., p. 38), Gregson (*Ent.*, vi., p. 426), South (*Ent.*, xv., p. 32), and Buckler (*Larvae*, etc., ix., p. 347).

Variation of larva.—Examination of a number of fullfed larvæ collected in Westcombe Park, in late April and early May, 1888, led to the conclusion that the larvæ were exceedingly variable. The ground colour varies extremely, and the amount of development of the red dorsal and subdorsal lines differs greatly in different specimens; in some, the suffusion was so complete that the whole of the dorsal area was red, in others, so faint that the larva was almost unicolorous green or whitish, according to the ground colour; in some specimens, the larvæ had decidedly brownish, rather than reddish, stripes, in others, grey. The different forms noted are:

1. Ground colour grey, with very dark reddish dorsal and subdorsal stripes. In some specimens of this form, the colour of the stripes suffuses the whole of the dorsal area, while, in others, they exist simply as fine lines, often reduced to a series of dots, by the breaking up of the lines in the neighbourhood of the abdominal incisions.
2. Ground colour green, with the reddish dorsal and subdorsal stripes, offering almost as great differences as in 1, both as to depth of colouring and area of suffusion.
3. Ground colour whitish, with very faint reddish stripes, sometimes only a faint reddish tinge in the dorsal and subdorsal areas.
4. Ground colour whitish, with indistinct, grey, narrow, dorsal and subdorsal stripes, in fact, almost unicolorous.

Some larvæ of the 2nd brood, reared in July-August, 1888, appeared to vary less, and to be on the whole, much paler than those of the spring brood. Chapman notes (*in litt.*) of larvæ collected on the shores of Lac Bourget, in March, 1903, that the general colours were pink and white; taking the pink as ground colour, there is, he says, "a broad subdorsal whitish band on line of ii, and again another below spiracle. There are whitish markings in the pink dorsally, and again, especially at level of iii, where it may be described as an abortive or interrupted white band. Beneath it is chiefly pink. Tubercles simple, black, with short hairs, general surface clothed with very short black hair, invisible without a lens. The amount of pink varies, so that, in some instances, it would be more correct to describe the larva as greenish-yellow with broad, pink, dorsal band (extending to i), a subdorsal band between, but not including either, ii or iii, and a spiracular one, all with irregular margins, and including paler and ground colour marblings." The differences in individual descriptions are considerable, as may be expected. Bankes notes the discrepancy referred to by South (*Entom.*, xv., p. 32), between his description of the larva (*loc. cit.*), and that by Peers (*Entom.*, ii., 38), in which South mentions, besides the dorsal line, *two* others, *viz.*, a "subdorsal stripe" and "spiracle line," whereas Peers only refers to *one* other, *viz.*, a "subdorsal line." He says that, "in that, Peers doubtless included in his term 'subdorsal line,' the two lines distinguished by South as 'subdorsal' and 'spiracle' respectively; these two lines might easily be regarded as one broad line, much interrupted down the centre, for their inner margins are by no means well-defined, and they appear to unite here and there. Unless Peers had regarded these two as one line, it is inconceivable that he should have made no mention of what South calls the 'spiracle line.'"

Foodplants.—*Tussilago farfara* (Bower), *T. nivea*, *T. alba* (Zeller), *Petasitis* (Sorhagen).

PUPARIUM.—The seasonal dimorphism to be observed in the mode of spinning the puparia, by spring and autumnal larvæ respectively, is very interesting. *Spring larvae.*—When fullfed, the larva usually clears out a space among the pappus on the top of the receptacle, by thrusting a few of the pappus hairs aside and spinning a few threads, which keep the hairs in position, and prevent them later from falling off. On this group of spun-together pappus hairs, the larva rests vertically with the head uppermost and surrounded on all sides by the pappus. In about three days it becomes a pupa; if a larva be late in feeding up, and cannot find an unoccupied scape, it will enter a leaf-stalk and eat out its inner substance, or, in rare instances, will eat the underside of the leaves (which, of course, it habitually does in the second, or autumnal, brood). Under these conditions, it will clear off the tomentose hairs on the undersurface of the leaf, and, mixing them among its threads of silk, form a flattish oval cocoon, in which to pupate, exactly as the larva of the later brood does. One such puparium was found on May 18th, 1904, at Chiswick, and, just in its vicinity, four other puparia were noted, formed of the spun-up pappus of the old flower-heads (Sich). The larva spins together a quantity of the pappus, so that a portion of it looks a little close together, and it may, in many cases, be pulled apart a good deal without revealing the pupa. In one case, the larva had gone to another head and made its cocoon in the pappus of a normal uninjured flower-head; the pupa stands up in the cocoon, parallel with the pappus, and with its tail to the receptaculum (Chapman). The larvæ of the first brood spin the pappus of the flower-head together, or make a slight web on the surface of a leaf, and suspend themselves therein for pupation. Even in confinement, when the larva pupates on the side of a box, it appears always to spin a slight silken puparium within which to change (Tutt). Pupation takes place in the cavity at the base of a seedhead of coltsfoot, excavated by the larva, with the terminal pappus drawn together (Barrett). It appears to be somewhat difficult to find pupæ in nature, I have only found a few, and all have been contained in a puparium formed of a tuft of the pappus spun together. Pupæ were still obtainable at Strood, up to May 19th, 1904, the first having been found in early April (Ovenden). *Autumnal larvae.*—The larvæ of the second brood appear always to spin a silken web on the undersurface of the leaves of the foodplant, usually in a fork formed by two of the veins. It is often a moderately thick structure with small pieces of the under-epidermis of the leaf woven into the silk. The larva then suspends itself in the usual Alucitid fashion within the web, and the pupa is attached by the hooks of the cremaster which is apparently almost confined to the 10th abdominal segment, so that the pupa-case remains within the web on the emergence of the moth (Tutt). Barrett says that the larvæ of the second generation are attached to a stem of the foodplant. We have never thus observed it, and, if it does so, it must be of very rare occurrence. Sorhagen notes that, in Brandenburg, even in the spring brood, it prefers to pupate on the underside of a leaf or in a stalk. Stange notes a similar preference in this brood in Mecklenburg, adding that the formation of the cocoon on the underside of a leaf, causes the latter to become quite conspicuously folded. Büttner says, also, "pupates by preference on the underside of the leaves of the foodplant," in Pomerania, so that it is possible that the habit is more frequent in the early brood than is generally supposed in Britain.

Pupa.—The pupa has a short sharp beak. It has the same markings, and sometimes the same colour as the larva, but varies much from very pale to very dark. The general outline of the pupa is characteristic of that of the group. The portion from the metathorax to the 3rd abdominal segment inclusive is fairly cylindrical (about 2mm. in diameter), but with a dorsal hollow at the 1st abdominal segment on each side by way of waist; in front of this portion, the posterior end of dorsal ridges (combined) at posterior angle of mesothorax stands up a little, and from this point the dorsal line quickly curves ventrally to apex of nosespine. The front of pupa is thus a slope of about 30° from being directly frontad, consisting of head, pro- and mesothorax. The nosespine and eyes form a ventral projection beyond the cylindrical mass of the pupa. The free abdominal segments taper at an increasing angle (and are therefore curved), to the cremaster. The pupa is very like that of *P. isodactylus*, it has a similar short nosehorn, with a slightly sharper point, and it is also without cremastral extension on the 9th abdominal segment, *i.e.*, it ranges with that of *P. isodactylus* in this respect, but, as a matter of fact, it is rather better provided, for *P. isodactylus* has two hairs, abortively hooked, and may have one or two more or less; *P. gonodactyla* has four hairs fairly well hooked, one at posterior end of anal scar, another further out opposite front of scar (these are really, therefore, on the 10th abdominal segment, but they belong to the ventral and not the terminal armature), and two on the boss of the 9th abdominal segment, arranged transversely; the terminal set consists of about 24 on either side. It differs chiefly from the pupa of *P. isodactylus* in having no trace of the spinous flange along the posterior borders of the segments. The transverse ridges are fewer on each segment, and are narrower in proportion to the spaces between them; thus, on the 5th abdominal, are thirteen, with 11-18 as the limits, according to strictness of counting, and the valleys are about three times the width of the ridges; they are quite as well provided with branch ridges, in places they might be called angulated or zigzag. The fine sculpture of pits and skin-points is much the same in distribution as in *P. isodactylus*. The tubercular hairs are about 0·05mm. long; tubercle i has about six ridges in front, and the same behind it, ii is on the last ridge, iii is in line with i; the prespiracular accessory is very distinct, and is two ridges before spiracle, and iv two behind v; vi is in an area without ridges, due to the three or four penultimate ones being here absent; it is in the line of the last ridge but one; three hairs represent vii; there is nothing ventrad to this. The scars of the prolegs look like little slits between ridges, and, in a mounted specimen, appear to have, beneath the slits, cavities as deep as wide; nothing like this is seen in *P. isodactylus*. The cover of first spiracle is almost identical with that of *P. isodactylus*. There are two pairs of hairs on each side of the meso- and metathorax, probably the two most dorsal of those in the larva; both wings are marked off by a quasi-suture. The length of the pupa, fully extended (as just before emergence), is 12mm., contracted it is about 2mm. less. The dorsal flanges are marked in front of mesothorax, meet near its posterior border, are not very marked across metathorax and the 1st abdominal segment, are plainer on the 2nd, and distinct but low on the 3rd, where, as usual, they cease.

There is a very definite ridge or flange below the spiracle on the 4th abdominal segment, which extends to the end of the cremastral spine, where it combines with the dorsal ridges, which reappear on the 8th, 9th, and 10th abdominals, to give a somewhat quadrangular section to the end of the pupa. On the wings, the veins stand out as raised ridges. The area beyond "Poulton's line" is quite flat. The appendages are free beyond the 3rd abdominal segment by about 1·8mm. This portion includes the produced wing-apices (beyond Poulton's line), about 1·4mm., angular, and behind second legs at the extremity; the second legs which reach the extremity; the tip of the proboscis appearing between them; the maxillæ behind for a great part of their length; the third pair of legs behind the second, and sometimes just beyond them, sometimes a little short. The first pair of legs end at about the end of the 3rd abdominal segment (base of free spine). The maxillæ are visible below the head for about 2·2mm., and then are hidden for 3·5mm. below the second pair of legs. The labrum is a triangular piece, beneath which the mandibles meet in the middle line for about 0·2mm.; the diamond of labium visible below them is only about 0·1mm. long and exceedingly narrow. The antennæ reach down 4mm., *i.e.*, 1·5mm. short of first legs. The latter have a square top, the flat end abutting against antenna, the 2nd pair has a rounded end where the curve of antenna bounds its upper portion. The central rough portion of the eye-piece carries two short hairs. The eye-portions are carried on dehiscence like horns in front of the pupa-case, by a slight attachment to the nearly invisible dorsal headpiece; the prothorax is somewhat roughly oval, about 0·6mm. × 0·4mm. Amongst the wing veins, the transverse vein, with two short veins (5 and 6), stopping and giving place to a fold representing the fissure, are very definitely marked (Chapman).

Variation of pupa.—There appears to be as much divergence in colour and markings in the pupal, as in the larval, stage, the pupa exhibiting, besides a number of well-marked forms, many intermediate ones. Those described by us, in May, 1888, when the pupa-cases were well-set, are:

1. Ground colour pinkish, with dark reddish dorsal and subdorsal stripes, with the wingcases darker and striated all over with fine longitudinal black lines; generally, but not always, with distinct black spiracles.

2. Ground colour grey, with dorsal, and subdorsal, lines, and wingcases as in 1, but the spiracles always very indistinct.

3. Ground colour, bright green, with no stripes, the abdominal incisions slightly paler, the wingcases of the same green colour, and no longitudinal striæ; the spiracles whitish.

4. Ground colour, unicolorous pink, with whitish wingcases, the spiracles very indistinct.

All the above varieties assume a dark appearance just before emergence.

Time of appearance.—The species is apparently distributed throughout the whole of central Europe, but appears to fail in high latitudes and altitudes, as well as in southern localities. In Britain, it is usually on the wing from mid-May to early July, and again from August to well into October, but the dates vary somewhat according to season and latitude even in our own islands. In Switzerland, Frey notes it in the lower levels as occurring at the end of May and beginning of June, and, again, at the end of July and beginning of August. In Germany, it appears to be similarly doublebrooded, *e.g.*, in May-

June and again August-September in Württemberg (Steudel), near Wiesbaden (Rössler), in Baden (Meess), and at Göttingen (Jordan); in June and August near Regensburg (Hofmann), and Munich (Hartmann), etc. Many authors only notice the early brood, although one supposes it is due to want of observation. In Scandinavia, Wallengren records it in May-June and again in July-August. In Brussa, it is reported as occurring in June, and this is the only Asiatic locality that we can find so far, for it, in fact, the actual dates at our disposal, outside the British Islands, suggest that it is really a little known species in many parts of its range. The dates we have are as follows: June 13th, 1864, at Zürichberg (Dietrich); May 29th, 1869, at Meseritz, August 2nd, 1871, at Weissenstein (Zeller); June, 1878, at Zermatt; August 20th, also on September 6th-7th, 1887, at Christiania (Jordan); June 14th-16th, 1890, at Tancarville (Leech); July 26th-31st, 1895, at Mendelpass; August 4th, 1895, in the Val Bigontina; August 6th, 1895, on the pass beyond the Tre Croci, between Cortina and Schluderbach; August 20th, 1895, between Alstätten and Gais (Tutt); July 19th, 1898, on the Mendelpass (Rebel); July-August at Gais (Peyerimhoff); July 18th-23rd, at Kemmern and Schleck, in the Riga district (Teich); July 22nd, 1903, on the Dürrensteinalpe, near Schluderbach (Meixner); August 12th, 1904, between Saas-Grund and Hüteck; August 14th-16th, 1905, between Val Tournanche and Breuil (Tutt). In the British Isles, it is recorded as being more abundant at the beginning of September than in June, in the Huddersfield district (Porritt); the earliest noted dates in the Clyde district are May 13th, 1893, and June 13th, 1894, latest dates, August 27th, 1886, and August 17th, 1883 (Dalglish); throughout June, 1880, and again September 4th, 1880, near Lea Bridge, on Hackney Marshes (Machin); August 22nd, 1881, at Seaton Carew, June 10th, 1882, in the Isle of Purbeck (Bankes); June, 1882, at Culleenamore (Russ); August 18th, 1882, some worn, near Llangennech (Richardson); June, 1883, on Hackney Marshes (Sheldon); August 16th, 1884, at Glasgow (Mackay); June 3rd, 1885, in the Isle of Purbeck (Bankes); August 27th, 1886, at Giffnock (Dalglish); September 1st, 1886, at Castle Cary (Macmillan); bred June 5th, 1887, and three weeks following, from larvæ found at Westcombe Park (Tutt); July 8th, 1887, at Giffnock (Dalglish); bred 120 imagines between June 2nd-July 1st, 1888, from larvæ found at Westcombe Park, in May (Tutt); June 27th, and July 21st, 1888, at Giffnock, August 18th, 1888, at Brig o'Turk (Dalglish); imagines bred September 4th, 1888, and following days, from larvæ that had pupated between August 19th and 26th, the eggs producing which had hatched July 2nd-5th, at Westcombe Park (Tutt); September 8th, 1888, at Portland, June 4th, 1889, near Weymouth (Richardson); June 17th, 1889, at Giffnock (Dalglish); June 19th, 1889, at Southend (Whittle); second brood from mid-August to the end of September, 1889, at Westcombe Park (Tutt); end of August and early September, 1889, at Armagh (Johnson); imagines bred May 24th, 1890, and on for nearly a month at Westcombe Park (Tutt); August 1st, 1890, at Giffnock (Dalglish); August 13th, 1890, an imago taken at Buckerell (Riding); June 17th, 1891, in the Isle of Purbeck (Bankes); July 13th, 1891, at Giffnock (Dalglish); second brood abundant September 1st-24th, 1891, at Westcombe Park (Tutt); two on a lamp September 24th, 1891, at St. Anne's-on-Sea (Baxter); May 21st-27th, 1892, at Seaton (Still); July 18th, 1892, at Giffnock (Dalglish); August 17th, 1892, at Oxton (Studd); mid-September, 1892, at Scarborough (Farren); April 1st, 1893, at Panton (Raynor); imagines April 24th, 1893, at Seaton (Still); May 13th, 1893, at Giffnock, July 13th, 1893, at Luss, August 17th, 1893, at Crookston (Dalglish); June 2nd and 14th, 1893, at Southend (Whittle); June 6th, 1893, imagines at Mansfield (Daws); June 15th, 1893, imagines common at Lee (Bower); August, 1893, common at Morecambe (Porritt); May 8th, 1894, at Prittlewell (Whittle); June, 1894, at North Berwick, July 17th, 1894, at Newpark, July 31st, 1894, at Otterston, July 4th, 1894, at Winton (Evans); June 8th, 1894, in Upper Teesdale (Bower); June 6th and 11th, 1894, at Stockton (Lofthouse); June 13th, 1894, at Giffnock (Dalglish); imagines July 9th, 1894, in Teesdale, September 17th, 1894, on Greenwich Marshes (Bower); May 22nd and September 8th, 1895, at Prittlewell (Whittle); imagines abundant near Bride, August, 1895 (Ash); June 27th, 1896, at Bransford (Edwards and Towndrow); June 6th, 1897, at Carlisle (F. H. Day); June 17th, 1897, at Harrow (Rothschild); June 17th, 1898, imagines common at Lee (Bower); August 22nd, October 29th, 1898, at Corsemalzie (Gordon); early June, 1899, at Carlisle (Day); June 15th, 1899, at Bredon (Edwards and Towndrow); July 1st, 1899, at Hazeleigh (Raynor); July 2nd, 1899, at Upper Clapton (Bacot); August 7th-20th, 1899, at Shoeburyness (Whittle); August 19th, 1899, at Chiswick (Sich); an imago bred August 23rd, 1899, at Buckerell (Riding); July 7th, 1900, at Dundonald (Dalglish); July 9th, 1900, rare at Oxton (Studd); August 1st, 1900, at Dawlish (Turner); August 18th and September 11th, 1900, at Shoeburyness, June 15th, 1901, at Prittlewell (Whittle); July 10th, 1901, at Kirn (Dalglish); end of August, 1901, at Bawdsey (Pyett); June 15th, 1902, at Birtley (Harrison); August 9th, 1902, near Ashford (Edelsten); June 18th, 1903, at Skinningrove, in the Cleveland district (Lofthouse); June 20th, 1903, at Southchurch; June 30th, 1903, at Shoeburyness; August 30th, 1903, near Great Wakering (Whittle); September 3rd-16th, 1903, at Birtley Fell (Harrison); June 4th-6th, 1903, May 25th-26th, 1904, from larvæ collected April 30th, 1904, in the Isle of Purbeck (Bankes); May 15th, 1904, and throughout the month, also on September 6th, 1904, at Strood (Ovenden); July 30th, 1904, at Burnley (Clutten); June 3rd, 1905, at Mucking (Burrows); June 3rd, 1905, abundant at Northwood (Turner).

Habits.—The imagines hide during the day either on the coltsfoot or other herbage in the neighbourhood, usually sheltered by the large leaves, and are not easily disturbed at this time. If a specimen be made to take flight it only moves a short distance and soon hides again low down on the herbage near the ground. This is also its habit abroad as we found in the Tyrol on the Tre Croci pass behind Cortina, and Zeller noted when collecting in the Oberalbula, and in his own district at Meseritz. It is much more readily disturbed in the late afternoon, and appears sometimes even to be moving about quite naturally at this time, but flies freely towards dusk, and on into the night. Sich says that the imagines commonly rest by clinging only with the pro- and mesothoracic legs, the former spread out in front of the head and wings, the latter spread out under the wings, and often hidden by them. The metathoracic legs are held under the body, crossed at the tarsal portions. The wings are horizontally outspread, the forewings covering the hindwings except the dorsal fringes. The body hangs down at right angles to the forewings with the last segments curved upwards. The antennæ are carried under the wings. After emergence the wings hang vertically from the thorax during the process of drying, as in most lepidoptera. In pairing, the moths rest one below the other. The female rests in the usual manner with the wings spread out horizontally and the abdomen hanging vertically downwards. The male's position is exactly the reverse, his abdomen, hanging from that of the female, extending vertically upwards. The male clings to any neighbouring object with the prothoracic legs, but his whole weight is borne by the female which he clasps with the prensors. They remain paired many hours—in one case at least four hours and forty minutes, from 11.50 p.m. to 4.30 a.m. This pairing may have continued longer but the moths were separated at 8.30 a.m. On June 10th, 1904, two moths were found paired in the sleeve at 9.15 a.m. The female was clinging with the pro- and mesothoracic legs to the underside of a leaf of *Tussilago farfara*. The male was hanging from the female by means of the prensors. The metathoracic legs of both moths were extended outwardly, those of the female downwards, and those of the male upwards, till they met and crossed, but it did not appear as though the male gained any support by these means, he seemed to be hanging solely by means of the claspers, his pro- and mesothoracic legs being drawn up fairly near the body and quite unattached, in fact, he was hanging in mid-air. Both moths remained apparently motionless. At 7 p.m., they were still in contact, and when last seen, at 10 p.m., they had not separated. The imago is readily attracted by light, and we have seen it repeatedly on the lamps in Westcombe Park and at Strood, and it is noted also at light at Lee (Bower), at Seaton (Still), at St. Anne's-on-Sea (Baxter), at Coxhorne (Robertson), at Corsemalzie (Gordon), in the Glasgow district (Dalglish), etc. Bankes observes that imagines captured June 4th, 1903, in the Isle of Purbeck, Dorset, were on the wing between 7.40 p.m. and 8.10 p.m. Of two bred, May 25th-26th, 1904, from Isle of Purbeck pupæ, one emerged at 9 a.m., and the other between 9 a.m. and 12 noon.

Habitat.—This species is *par excellence* the "plume" of waste places, and is to be found in most places where its foodplant springs up—on railway banks, roadsides, rough ground, and the many almost barren places which appear incapable of producing anything except *Tussilago farfara*, in England, Scotland, and Ireland. It occurs in abundance on the railway banks about Gloucester (Hudd), at Carlisle (Day), about Aberdeen (Reid), and at Westcombe Park, and other places in the London district (Tutt), as also throughout the Clydesdale district, or wherever the ground has been recently turned up in the same district (Dalglish), it is found on rough ground at Mansfield (Daws), on roadside banks at Southend (Whittle), in a garden at Enfield (Edelsten), on the cliffs at Scarborough (Farren), on the steep rough limestone cliffs at Llanferras (Gregson), on the old breeze heaps in the brickfields, as well as on the banks of the Medway, at Strood, in the chalkpits at Charlton, and almost any and every kind of waste place imaginable, where its foodplant is to be found. Barrett notes that it is still common in the suburbs of London, where the coltsfoot grows on railway banks, or the embankments of waterworks, and is to be found commonly in suitable places throughout England, probably also in Wales, etc. In Germany, it occurs in similar places; it is recorded as occurring in a sandpit at Friedland, in a chalkpit at Johannisberg

(Stange), on the railway banks near Cassel (Borgmann), in deserted stone quarries near Regensburg (Hofmann), in meadows between Grabow and Bredow, in Pomerania (Büttner), etc. In Austria, we found the species on a bare piece of limestone ground by the roadside, between Bözen and the Mendel Pass; on a piece of stony wayside between the Tre Croci and Schluderbach in the Cortina district, whilst Mann notes it on the Schneeberg, by ditch-sides and on ground where trees have been felled. Jordan records it as common among coltsfoot near Zermatt Church, and we have taken it between Stalden and Saas-Grund, as well as in the high mountain valley between Val Tournanche and Breuil. Peyerimhoff notes it as occurring in the mountains of Alsace, whilst Aurivillius maintains that, in Scandinavia, it is a somewhat rare insect, and confined practically to the mountains there. Sand records it as a mountain species in the Auvergne (but his remark that the larva is a gentian feeder, makes us wish for further records from this district). Millière notes it as common on the coast of the Mediterranean, near Cannes.

British localities.—Generally distributed throughout the British Islands. Aberdeen: near Pitcaple (Reid). Antrim: Belfast (Watts). Argyll: Kirn, abundant (Dalglish). Armagh: Armagh (Johnson). Ayr: Ayr (Fergusson), Dundonald (Dalglish). Berwick: Berwick (Barrett). Bute: King's Cross (Dalglish). Cambridge: Cambridge (Stainton). Carnarvon: Penmaenmawr (Porritt). Carmarthen: Llangennech (Richardson). Cheshire: Birkenhead (Stainton), Chester (Arkle), Wallasey (Prince), Knutsford, Holford Moss (Day). [Cork: Timoleague (Donovan), Kenmare (Dillon).] Cornwall: Paul, Penzance (Baily). Cumberland: Carlisle (Day), Bewcastle, Hayton (Routledge), Lake dist. (Stainton). Denbigh: Llanferras (Gregson). Derby: Gresley Common (Harris), Ashby Road, abundant (Baker), Burton (Brown), Bretby, abundant (Gibbs). Devon: North Devon—Lynmouth, etc. (South), Oxton (Studd), Seaton (Still), Buckerell (Riding), Dawlish (Turner), Sidmouth (Leech), Dorset: usually common (Bankes)—Portland (Richardson), Bloxworth, Swanage rare (Cambridge), Weymouth (Richardson), Isle of Purbeck (Bankes). Dublin: Howth, Clontarf (Birchall), Killasloe (Carpenter), Dublin (Barrett). Dumbarton: abundant, Luss, Milngavie (Dalglish). Durham: in Teesdale (Bower), near Stockton (Lofthouse), Birtley (Harrison), Darlington (Sang), Seaton Carew (Bankes). Edinburgh: North Berwick, Newpark, Otterston, Winton (Evans). Essex: Hazeleigh (Raynor), Southend, Shoeburyness, Southchurch, Prittlewell (Whittle), Mucking (Burrows), Colchester (Harwood), Clacton, Walton-on-the-Naze (Leech). Fermanagh: Enniskillen (Partridge). Fife (Barrett). Gloucester: plentiful and generally distributed (Hudd), Bristol (Bartlett), Coxhorne (Robertson), Painswick (Watkins). Hants: on the coast (Stephens), Isle of Wight—Ventnor not common (South). Hereford: Leominster (Hutchinson), Tarrington (Wood). Isle of Man: near Bride (Ash). Kent: Lee, Greenwich Marshes (Bower), Strood district, Cuxton, Blackheath district, Westcombe Park (Tutt), Brockley (Turner), near Ashford (Edelsten), Gravesend (Leech). Kerry (Barrett). Kincardine: rather scarce (Reid). Lanark: Carluke (Morton), round Glasgow, Cambuslang (Dalglish). Lancashire: St. Anne's-on-Sea (Baxter), Morecambe (Porritt), Manchester (Stainton), Oldham (Rogers), Burnley (Clutten). Lincoln: Panton (Raynor), Ashby, near Brigg (Cassal). Middlesex: Hackney Marshes (Sheldon), Harrow (Rothschild), Dalston (Prout), Mill Hill (South), Enfield (Edelsten), Hammersmith, Shepherd's Bush (Gates), Upper Clapton (Bacot), Chiswick (Sich). Northumberland: Newcastle (Stainton). Notts: Mansfield (Daws). Orkney (Curzon). Pembroke: Pembroke (Barrett). Perthshire: Brig o' Turk (Dalglish). Renfrew: abundant, Giffnock, Crookston (Dalglish), Paisley (Dunsmore). Roxburgh: Hawick district—Hardie's Hills (Guthrie). Sligo: Culleenamore (Russ). Somerset: plentiful in all stages (Hudd), Castle Cary (Macmillan). Stafford: Rugeley, generally distributed (Freer). Stirling: Fintry (Eggleton). Suffolk: Brandon (Barrett), Hacheston (Harker), Bawdsey (Pyett). Sussex: Hastings, St. Leonards-on-Sea (Ford). Warwick: Knowle, Sutton (Bradley), Rugby (Rugby lists). Wigtown: Corsemalzie (Gordon). Worcester: Bransford (Rea), Bredon (Edwards and Towndrow). Yorks: Wilsden, common (Butterfield), Huddersfield (Porritt), Scarborough (Farren), York (Stainton), Doncaster district, common (Corbett), Everingham, common (Sumner), Skipwith (Ash), Bishop's Wood (Prest), Flamborough Head (Horton), Goole (Harrison), Bramham (Smith), Hexthorpe, near Doncaster (Warren), Sheffield (Wilson), Cleveland district—Skinningrove (Lofthouse).

Distribution.—Central and northern Europe (except Polar region), southeast Gaul, central Italy, southeast Russia and Bithynia (Rebel). Asia: Asia Minor—near Brussa (Mann). Austro-Hungary: Bohemia—Prague (Nickerl), Moravia—near Brünn, near Schebetein, in Obraner Thale, near the Ziegelei, not rare (Gartner), Lower Austria—Vienna district (Schleicher), near Hernstein (Rogenhofer), Schneeberg, in Gräben, Holzschlägen (Mann), Tyrol—Gross Glockner district (Mann), near Innsbruck, from 1850ft.-3000ft., not rare, Taufers Valley (Weiler), Monte Sabion, Trafoi, Franzenshöhe (Heller), Mendelpass (Rebel), Cortina district (Tutt), Dürrenstein Alpe, near Schluderbach (Meixner), Carinthia—near Preth, Raibl, not common (Zeller), Hungary—Budapest district, Kovászna, Croatia—Fiume (Aigner), Styria—Graz (Meixner). Belgium: very common (Crombrugghe). Denmark (Bang-Haas). France: Normandy—Tancarville (Leech), [Auvergne—Mont Dore (Sand),] Cannes, coast districts (Millière). Germany: east and west Prussia, somewhat common—Königsberg, Waldau (Speiser), Pomerania, not rare, and generally distributed—Rügen, Stralsund (Paul and Plötz), between Grabow and Bredow (Büttner), Posen—Meseritz (Zeller), Mecklenburg—near Friedland, near the Ziegelei Johannisberg (Stange), near Parchim (Gillmer), Hamburg—Grasbrook, Harvestehude, Eppendorf (Sauber), Hanover—near Hanover (Glitz), near Göttingen (Jordan), Hesse—near Wiesbaden, Spelzmühle im Salzbachthal (Rössler), near Cassel (Borgmann), Waldeck—near Rhoden (Speyer), Thuringia, throughout (Knapp), near Sömmerda (Jordan), near Erfurt, rare (Keferstein and Werneburg), Saxony—near Halle, not rare (Stange), near Cöthen (Gillmer), Brandenburg—near Berlin, rare (Pfützner), Silesia—Lower Friedersdorf, near Neusalza (Möschler), in the Grundwalder Thal, near Reinerz, Wolfesgrund-am-Schneeberg, Thäler-am-Altvater (Wocke), near Lichtenau, Lauban (Sommer), kingdom of Saxony—Saxon Upper Lusatia, not rare (Schütze), Bavaria—near Regensburg, Tegernheim, Weintinger Holz, etc. (Hofmann), near Münich, Isarauen, Niederaschau, Tegernsee, Oberaudorf (Hartmann), Württemberg (Steudel), Baden—near Constance, Freiburg (Reutti), near Ueberlingen, Hüfingen, Schopfheim, Sulzburg, Lahr, Durlach (Meess), Alsace, in the mountains — Hoheneck, etc. (Peyerimhoff). Italy: Piedmont Valleys—between Val Tournanche and Breuil, [? Val Véni] (Tutt). Russia: Ural district, common—Orenburg, Casan, Saratov (Eversmann), Baltic Provinces—near Rambdau (Lienig), Riga district—Kemmern, Schleck (Teich). Scandinavia: rare, and usually confined to hilly districts (Wallengren), Norway—Dovre (Wallengren), Drivstuen (Bohemann), near Frutigen, Christiania (Jordan), Kaafiord (Strand), Saltdalen (Sparre-Schneider). Switzerland: at low elevations to 5500ft.—Frauenfeld, Zürich (Frey), Lenzburg, Oftringen (Wullschlegel), St. Gallen (Täschler), on the Zürichberg (Dietrich), Degersheim (Müller), Ebenalp (Peyerimhoff), Bergün (Zeller), Turtmannthal (Geneva Mus.), Upper Engadine—near Samaden, St. Moritz (Frey), Weissenstein (Zeller), the Valais, between Saas-Grund and Stalden (Tutt), Zermatt (Jordan), Gais (Tutt), Weissbad, common, the Furka, 2400 m. (Peyerimhoff).

Genus: Gillmeria, Tutt.

Synonymy.—Genus: **Gillmeria,** Tutt, "Ent. Rec.," xvii., p. 37 (1905). **Alucita,** Schiff. and Denis, "Sys. Verz.," 1st ed., p. 145 (1776); Göze, "Ent. Beit.," iv., p. 176 (1783); Haw., "Lep. Brit.," p. 478 (1811); Hb., "Schmett. Eur.," Aluc. ix., figs. 12-13 (*post* 1811); Treits., "Die Schmett.," ix., pt. 2, p. 227 (1833). **Pterophorus,** Sam., "Ent. Usef. Comp.," p. 409 (1819); Curt., "Brit. Ent.," fo. 161 (1827); Dup., "Hist. Nat.," xi., p. 641, pl. 313, fig. 2 (1838); Wood, "Ind. Ent.," p. 236, pl. li., figs. 1639 (1638 in error), 1642 (1839); Dup., "Cat. Méth.," p. 381 (1845); Zell., "Isis," p. 775 (1841); Tgstrm., "Finl. Fjär.," p. 154 (1847); Frey, "Tin. Pter. Schweiz," p. 402 (1856); Sta., "Man.," ii., p. 440 (1859); Buckl., "Ent. Mo. Mag.," xii., pp. 233-234 (1876); Porritt, "Ent. Mo. Mag.," xxii., pp. 103-105 (1885); xxiii., p. 163 (1886); "Buckler's Larvæ," pp. 338-341, pl. 163, fig. 3 (1901). **Platyptilia,** Hb., "Verz.," p. 429 (1825); Zell., "Linn. Ent.," vi., p. 327 (1852); Staud. and Wocke, "Cat.," 2nd ed. p. 341 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 782 (1877); Frey, "Lep. Schweiz," p. 428 (1880); Sang, "Ent. Mo. Mag.," xviii., pp. 143-4 (1881); South, "Ent.," xv., p. 146, pl. iii., figs. 2*a*-2*c* (1882); xviii., p. 279 (1885); Sorh., "Kleinschmett. Brandg.," p. 2 (1886); Leech, "Brit. Pyr.," p. 51 (1886); Tutt, "Young Nat.," x., pp. 163, 220 (1889); xi., pp. 18, 22 (1890); Hering, "Stett. Ent. Zeitg.," pp. 269-279 (1892); Tutt, "Pter. Brit.," p. 22 (1895);

Meyr., "Trans. Ent. Soc. Lond.," p. 486 (1890); "Handbook," etc., p. 434 (1895); Hodg., "Ent. Rec.," iii., p. 186 (1892); Hofmn., "Deutsch. Pteroph.," p. 53 (1895); Fernald, "Pter. N. Amer.," p. 33, revd. ed. p. 34 (1898); Staud. and Reb., "Cat.," 3rd ed., p. 72 (1901); Dyar, "List N. Amer. Lep.," p. 444 (1902). **Stenoptilia,** Stphs., "Ill.," iv., p. 375 (1834). **Platyptilus,** Zell., "Isis," pp. 770, 775 (1841); H.-Sch., "Sys. Bearb.," v., p. 367 (1855); Wallgrn., "Skand. Fjädermott," p. 11 (1859); Röss., "Wien. Ent. Monats.," viii., pp. 53-54 (1864); Jord., "Ent. Mo. Mag.," vi., p. 121 (1869); xviii., pp. 74-75 (1881); Nolck., "Lep. Fn. Est.," pp. 783, 800 (1871); Walsm., "Pter. Cat. Oreg.," p. 3, pl. i., fig. 3 (1880); Jord., "Ent. Mo. Mag.," xviii., pp. 74-75 (1881); Barr., "Lep. Brit. Isles," ix., p. 346, pl. 413, figs. 3-3*c* (1904). **Platyptila,** Barr., "Ent. Mo. Mag.," xviii., p. 177 (1882).

The genus *Gillmeria*, created in 1905 (*Ent. Record*, xvii., p. 37), in order to separate it from the closely allied genus *Platyptilia*, from which, however, it differs in certain marked characters, had already been placed in a separate section of the latter genus by Herrich-Schäffer (*anteà*, p. 83), Hofmann (*anteà*, p. 160), and Wallengren (*anteà*, p. 86). Herrich-Schäffer's diagnosis of the group (*Sys. Bearb.*, v., p. 367) is:

Lobus alarum posteriorum interior concolor, ante medium aut in medio dentatus. Palpi et fasciculus frontalis capite duplo longiora—*ochrodactylus*, Hb.

Wallengren's sectional diagnosis (*Kong. Svensk. Vatens. Akad. Hand.*, iii.), referring to *Gillmeria*, reads:

Frontal tuft rather long. Palpi with the terminal joint rather long, somewhat drooping. Tibiæ slender—*P. ochrodactylus*, Hb.

Hofmann's differentiation (*Die deutsch. Pteroph.*, p. 40) is as follows:

Palpi and frontal tuft much longer than the head; the frontal tuft reaches to the tips of the palpi; upper lobe very acute; fringes with darker basal line. Yellow species.

1. Ochreous-yellow, usually with very distinctly expressed brown markings—*ochrodactyla*, Hb.
2. Almost unicolorous, rusty-yellow, without clearly expressed markings—*bertrami*, Röss.

Our own diagnosis (*anteà*, p. 160) of *Gillmeria* may be extended to read:

Imago.—Palpi and frontal tuft longer than the head; the terminal joint of the palpi rather long and drooping. With the tuft of black scales on the third plumule of hindwing ill-developed (sometimes absent). The dark costal triangle ill-developed and more or less obsolete.

Pupa.—The nose-spine much longer, (0·8mm.), than in *Platyptilia* (*isodactylus* and *gonodactyla*) (0·25mm.), directed more forwards; the dorsal line, instead of proceeding in its curved ventral sweep, bends forwards along the dorsum of the spines; posterior border of abdominal segments quite smooth; a plentiful supply of hooks in the forward part of cremaster (almost absent in *Platyptilia*); the pupal pattern of the markings differ (but owing to variation not easy to define); the prominences of the dorsal ridges much more conspicuous (than in *Platyptilia*, or in fact, than in any other plume pupa).

Larva.—Form, outline and colouring very similar (to *Platyptilia*). Skin-hairs, over whole surface, divided into alternating areas, in which hairs and skin-points are—(1) dark, and (2) transparent and colourless (in *Platyptilia*, skin-hairs dark, some areas of skin without them); proleg hooks (10-12) more numerous than in *Platyptilia* (8-10); proleg hooks with attached ends squarely transverse, and consequently broad, the column rather longer (than in *Platyptilia*); the head, dorsal plates and legs pale ochreous or nearly colourless (not black as in *Platyptilia*); the meso- and metathoracic setæ paired, but quite separate, and without basal plates (in *Platyptilia* each pair on common plate), bases surrounded by skin-hairs; the hairs in each pair widely separate; these setæ more distinctly transverse round segment; no plates on the 8th and 9th abdominal segments.

The two species in this genus appear to be essentially more or less phytophagic—*ochrodactyla* being almost confined to *Tanacetum*, *pallidactyla* to *Achillea*. That they are distinct species is clear from the genitalia (*Pter. of Nth. America*, p. 35, pl. ix., figs. 4-5, and figs. 14-15). The similarity of the imagines is great, but their differences are dealt with at length (*posteà* p. 223). Mühlig (*Stett. Ent. Zeitung*, 1863, p. 213) and Rössler (*Wien. Ent. Monats.*, viii., pp. 53-54) were the first observers to discriminate between these two closely allied species, and their attachment to separate foodplants. Sang insists (*Ent. Mo. Mag.*, xviii., pp. 143-4) that *ochrodactyla* occurs only on *Tanacetum*, although *Achillea* may be plentiful in the same district, to which *pallidactyla* appears to be equally closely confined. Barrett observes (*op. cit.*, xviii., p. 177) a correlated difference in the divergent ways in which the larvæ of the two species feed. Porritt also states (*op. cit.*, xxii., pp. 104-5), that anyone having experience with both species in nature can scarcely help noticing the differences between them, and this, in spite of the fact that the larvæ of both insects correspond in having three forms of colouring in the different stages of growth, and the resemblance of the adult larvæ particularly shows their close relationship, whilst the differences, apart from the foodplants, are sufficiently wide to separate them.

GILLMERIA OCHRODACTYLA, Schiffermüller and Denis.

SYNONYMY.—Species: **Ochrodactyla,** Schiff. and Denis, "Sys. Verz.," p. 145 (1775); Göze, "Ent. Beit.," iv., pt., 3, p. 176 (1783); Hb., "Eur. Schmett.," Aluc. ix., figs. 12, 13 (*post* 1811); Charp., "Die Zünsler," etc., p. 174 (1821); Hb., "Verz.," p. 429 (1825); Treits., "Die Schmett.," ix., pt. 2, p. 228 (1833); Staud., "Cat.," 2nd ed., p. 341 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 783 (1877); Frey, "Lep. Schweiz," p. 428 (1880); Barr., "Ent. Mo. Mag.," xviii., p. 177 (1882); Sorh., "Kleinschmett. Brandg.," p. 2 (in part) (1886); Leech, "Brit. Pyr.," p. 51 (1886); Tutt, "Young Nat.," x., pp. 163, 221 (1889); xi., p. 18 (1890); Meyr., "Trans. Ent. Soc. Lond.," p. 486 (1890); Hering, "Stett. Ent. Zeitg.," pp. 269-279 (1892); Tutt, "Pter. Brit.," p. 27 (1895); Meyr., "Handbook," p. 435 (1895); Hofm., "Deutsch. Pter.," p. 453 (1895); Staud. and Reb., "Cat.," 3rd ed., p. 72 (1901). **Ochrodactylus,** [Dup., "Hist. Nat.," xi., p. 641 (in part) (1838);] Zell., "Isis," p. 775 (in part) (1841); [Dup., "Cat. Meth.," p. 381 (in part) (1845);] Zell., "Linn. Ent.," vi., p. 327 (in part) (1852); H.-Sch., "Sys. Bearb.," v., p. 367, supp. fig. 3 (1855); Frey, "Tin. Pter. Schweiz," p. 402 (1856); Sta., "Man.," ii., p. 44 (in part) (1859); Wallgrn., "Skand. Fjär.," p. 11 (1859); Röss., "Wien. Ent. Monats.," viii., pp. 53-54 (1864); Nolck., "Lep. Faun. Estl.," p. 800 (1871); Jord., "Ent. Mo. Mag.," xviii., pp. 74-75 (1881); Porritt, "Buckl. Larvæ," ix., p. 338, pl. clxiii., fig. 3 (1901). **Dichrodactylus,** Mühlig, "Stett. Ent. Zeitg.," p. 213 (1863); Sta., "Ent. Mo. Mag.," ii., pp. 137, 138 (1865); Jeffrey, "Ent. Mo. Mag.," ii., p. 165 (1865); Jord., "Ent. Mo. Mag.," vi., p. 121 (1869); Buckl., "Ent. Mo. Mag.," xii., pp. 233-234 (1876); South, "Ent.," xv., p. 146, pl. iii., figs. 2*a*-2*c* (1882); xviii., pp. 280-2 (1885); Porritt, "Ent. Mo. Mag.," xxiii., p. 163 (1886). **Dichrodactyla,** Sang, "Ent. Mo. Mag.," xviii., pp. 143-144 (1881). **Bertrami,** South, "Ent.," xviii., p. 279 (in part) (1885). **Ochrodactylus** var., Barr., "Lep. Brit. Isl.," ix., p. 346 (1903). **Dichrodactylus** var., Barr., "Lep. Brit. Isles," ix., pl. 413, figs. 3*b*-*c* (1903). [The *Alucita ochrodactyla* of Schiffermüller and Denis (*Sys. Verz. Schmett. Wien.*, p. 144) was figured by Hübner (*Eur. Schmett.*, Aluc. pl. iii., figs. 12-13) between 1811 and 1817. In 1821, Charpentier states (*Die Zünsler, Wickler*, etc., pp. 174 *et seq.*), after comparison of the plumes in the Vienna collection with the descriptions of Schiffermüller and Denis, that *ochrodactyla*, Schiff., was quite accurately figured under this name by Hübner. Fabricius' description of *ochrodactylus* (*Mantissa*, p. 258) evidently does not refer to a "plume" at all, nor can it have any connection with Schiffermüller's species of this name (see *anteà*, p. 72). Zeller says (*Isis*, 1841, p. 881), that the specimen bearing this name in the Vienna collection in 1841 (66 years after the issue of the *Schmett. Wien.*), was *Gracilaria elongella* (*Ornix signipennella*). One can only suppose that there were two species labelled *ochrodactyla* in the collection, one an Ornicid which Fabricius saw and described, and which Zeller refers to *G. elongella* (*O. signipennella*, Tr.), the other an Alucitid which Hübner figured and Charpentier saw. It is impossible to discover what changes were made from time to time in old collections, and, where supposed "types" disagree with descriptions, one must follow the descriptions and not the types.]

Original description.—Blass röthlichtgelbes Geistchen (Schiffermüller and Denis). [Hübner's figure (*Eur. Schmett.*, Alu. pl. iii., fig. 12) represents a ♂; the anterior wings pointed, of a rather deep yellow ground colour, a reddish shade extending from the costa (about one-third from apex) to the internal edge of the cleft of the anterior wings, the internal edge of this shade gradually toning down towards the centre of the wing, the inner part of the wing slightly shaded with reddish; the hindwings yellow-ochreous; head, thorax, and abdomen of the same colour as the wings. Fig. 13 is that of a ♀, with the apex more pointed, the ground colour paler yellow, with more reddish shading, a shade from the costa to end of fissure in anterior wings, as in ♂, another nearer apex of wing, and another nearer body; hindwings dark greyish. Herrich-Schäffer gives (*Sys. Bearb.*, v., p. 367) the first really separable description of the species: "*Ochrodactylus*, Hb., figs. 12, 13. The apex of the forewings not markedly sickle-shaped, fresh examples are brightly coloured and marked (Supp. fig. 3). Lin. 11-13. Ochraceus, ferrugineo-nebulosis. Ochreous-yellow, clouded with rust-brown, the costal triangular spot of the following species not so distinctly defined, the apex of the forewings sickle-shaped. Austria and Hungary, Sweden, Livland, Kasan. June and July. Among willows and other bushes on the river-banks. Near Regensburg in Weintingen wood. Everywhere rare. Twelve examples from Fischer v. Rösslerstamm's collection; six in my own."]

Imago.—Nearly pure Indian yellow*, clearly marked, and streaked with a pale shade of the same colour, and with the few costal and fringe-markings and spots dark brown to black; the markings clear and decided, with invariably a very clear, small, black spot just below the fissure, in some examples also one above united by a brown shade (Sang). [See also p. 225.]

Sexual dimorphism.—The ♂s are decidedly smaller and rather paler than the ♀s.

Variation.—There is considerable difference in the intensity of the ground colour and markings, but the special characters of the genitalia leave no doubt about the species. The following races have been described:

a. var. *borgmanni*, Röss., "Schppfl.," p. 220 (1881); Hering, *loc. cit.* (1881): Hofmn., "Die Deutsch. Pteroph.," p. 58 (1895); Staud. and Reb., "Cat.," 3rd ed., p. 72 (1901). *Ochrodactyla* var., Borgm., "Anleitung z. Schmett.," p. 191 (1878).—A form is to be noticed, which Borgmann obtained from larvæ feeding in the main stems of *Chrysanthemum corymbosum* and *Senecio sylvaticus*, and that appears to be like those of typical *ochrodactylus*, but the pupa of which tended to be red-brown in tint and dotted. The imagines are pale bone-yellow, with similar markings to *ochrodactylus*, in which the blackish border line of the forewing stands out particularly sharply. If not a distinct species, the form deserves at least to bear the name of its discoverer, as var. *borgmanni* (Rössler).

Rebel (*Cat.*, 3rd ed., p. 72) makes this a possible form of *ochrodactyla*, with the diagnosis "pallide ossea, distinctius signata." Hofmann, on the contrary, makes (*Die Deutsch. Pteroph.*, p. 58) it a form of *bertrami* (*pallidactyla*). Borgmann's original note appears to read as follows: "In the

* Sang observes (*Ent. Mo. Mag.*, xviii., p. 144) that the imagines of *dichrodactyla* fade out-of-doors very quickly, caught examples are always bleached, sometimes almost white.

young main stems of *Chrysanthemum corumbosum* growing in firwoods, near Cassel, I found larvæ of a plume, which produced imagines of a very different general appearance from *ochrodactyla*, and will probably be found to be a distinct species. The ground colour is a wholly pale bone-yellow, which allows the middle portion of the costal marking, as well as the dots on the inner margin, to stand out strongly, whilst all the other markings have nearly disappeared. The chief difference is in the pupa, which is similarly of a bone-yellow colour, covered with dark brown dots and longitudinal streaks, and is thus very different from the normal uniformly green pupa of *ochrodactyla*."

β. var. *bosniaca*, Rebel, "Ann. k.k. Nat. Hofmus.," xix., pp. 323-4 (1904). *Ochrodactyla*, Bachm., "Soc. Ent.," xii., p. 14 (1897); Rebel, "Ann. k.k. Nat. Hofmus.," p. 310 (1903).—Three ♀ s in good condition, obtained in the neighbourhood of Prozor by Hilf, on July 20th, 1904. So different are these from typical examples of *ochrodactyla*, that, in spite of the great variability of this species, I consider it as a marked local form, distinguished from *ochrodactyla* by its somewhat larger size, its much sharper and somewhat different markings of the pale bone-coloured forewings, and its darker (more grey) hindwings. The difference in the markings is exhibited in that, in the 1st lobe of the forewing, after the yellowish-white costal mark (continued as a band to the cleft), a very dark spot crosses the whole width of the lobe, and is edged externally by the sharp yellowish-white antemarginal line; in no specimens of *ochrodactyla* before me has this spot anything like the strength or prominence here exhibited. The fringes exhibit for one-third their length (as in *ochrodactyla*), a black-brown dividing line, after which the whitish colour is prevalent; but, besides this, there is, at the base of the fringe, a fine dark outer marginal line, which is wanting in *ochrodactyla*. Length of forewing, 13mm.-14mm. (in *ochrodactyla*, 12mm.-13mm.). The absence of the ochreous-yellow tint, and the strongly marked spot in the 1st lobe of the forewing, are the most essential characters of this form, which, in the pale colour of the forewing, at all events, comes nearest to *G. pallidactyla* var. *borgmanni*, Röss., but is essentially distinguished from it by the very sharp dark-spotted hind tibiæ. This last character also excludes a close relationship with *G. pallidactyla* (*bertrami*). It has since been found in West Bulgaria, at Sophia (Buresch; determined by Rebel, 1904) (Rebel).

This last-noted example is that observed (*Ann. k.k. Nat. Hofmus.*, 1903, p. 310) as captured at Kokalény-Kloster, July 4th, 1903. Rebel thinks this form may possibly occur in South Russia and Armenia.

Comparison of Gillmeria ochrodactyla and G. pallidactyla.—The continued discussion as to whether these species be distinct or not appears to be purposeless, since there are excellent distinguishing characters in the genitalia, proving them to be abundantly distinct. Fernald figures (*Pter. North America*, pl. ix., figs. 4-5 and 14-15), and notes (*op. cit.*, p. 36) that, so different are the genitalia, that, of specimens, named by Zeller, and forwarded to him, he had no hesitation in referring one of those named *pallidactyla* (*bertrami*) to *ochrodactyla*, and another of them named *ochrodactyla* to *pallidactyla*. Of the more or less characteristic differences in the imagines, Rössler, in 1864, notes (*Wien. Ent. Monats.*, viii., pp. 53-54) that *pallidactyla* are rather smaller and more uniformly ferruginous (while *ochrodactyla* are ochre-yellow), without the sharp dark brown spots described by Mühlig, and differing more especially from *ochrodactyla* in that all the rust-coloured spaces of the forewings exhibit bright yellow scales at regular intervals that make them look like a piece of wood levelled with a blunt plane (in *ochrodactyla* these marks only occur on the costa); the two dark spots before the fissure are quite absent or only very faintly indicated. On the other hand, the whitish-yellow spots on the upper wing are present as in *ochrodactyla*. The hindwings are similar in tint, rusty-brown, and the fringes of each feather are light yellow at base and darker at apex, but in a less marked degree than in *ochrodactyla*, in which the fringes have a spotted appearance from the strong contrast of the bright yellow and dark brown ; in correspondence with this, the scale-tuft on the 3rd feather of the hindwing is sharply marked with dark brown in *ochrodactyla*, whilst it only shows a slight darkening in colour in *pallidactyla*. He agrees, however, with Mühlig (*Stett. Ent. Zeitg.*, 1863, p. 213) that the most essential difference occurs in the colour of the hind-legs ; in ten specimens of *pallidactyla* examined, the two terminal unspurred joints are unicolorous yellowish-white, whilst the two upper spurred joints are unicolorous rusty-brown, with white spurs ; only towards the knee (trochanter) does the colour become gradually lighter. Stainton adds (*Ent. Mo. Mag.*, ii., pp. 137-138) that, in *ochrodactyla*, the apex of the anterior wings is more prolonged, more falcate than in *pallidactyla* (*bertrami*), and the brown scales on the hind margin of the third feather of the posterior wings should be more distinct. The best character is, however, furnished by the hindlegs ; in *bertrami* the tibiæ are slightly browned, but the tarsi are spotless whitish ; in *ochrodactyla* (*dichrodactylus*) the tibiæ are brown at the middle and apex, and there is a brown spot at the end of the 1st tarsal joint. These three dark spots have, in bred specimens, a very conspicuous appearance (Stainton). Jordan writes (*Ent. Mo. Mag.*, xviii., pp. 75-6) that a specimen of *ochrodactyla*, bred from *Tanacetum*, from Scarborough, in his possession, has a most decided black spot just above and near the end of the split, and surmises that Packard's *cervinidactylus* (*Ann. Lyc. N. Y.*, x., p. 266) may have been described from such a specimen. He further states that this is the brightest in a long series, and has long falcate anterior wings, whilst on the other hand, a type from Mühlig, the author of the name *dichrodactylus* (for the *Tanacetum* feeder), is very light in colour, and the anterior lobe truncate, without any approach to the falcate form of the former specimen. He says that he cannot see any distinct dividing line between the richly fawn-yellow specimens with falcate wings, and the pale straw-coloured insects with the apex as square as in *gonodactyla ;* the extremes of the series look most distinct, but the gradations are such as to make it very difficult to draw the boundary line. He quotes Stainton, who says (*Ent. Mo. Mag.*, ii., p. 138) that "the best character is furnished by the hindlegs, for, in *bertrami* the tibiæ are slightly browned, but the tarsi are spotless whitish, whilst in *dichrodactylus* the tibiæ are brown at the middle and apex, and there is a brown spot at the end of the 1st tarsal joint." He further notes that Heinemann makes (*Schmett. Deutsch.*, ii., p. 784) "*bertrami* very close to *dichrodactyla*, but that the forewings of the former are less sharply pointed, all the brownish-red dusting paler, the spots before the division pale, often entirely wanting, the lines at the hind border finer, whilst, on the 3rd feather of the hindwing, the black scales behind the middle are either less or wanting ; the legs are yellowish-white, the tibiæ of the forelegs are brown at the end, in the hind tibiæ the reddish-brown colour is equally spread from the middle to the end." Jordan states that these slight distinctions seem certainly inconstant in apparently fine examples, and further adds that he has a specimen from Walsingham before him, from a pupa found on *Artemisia campestris*, which has for *bertrami* remarkably pointed wings. Sang, who knew the species better perhaps than any other British lepidopterist, after describing the imagines (*Ent. Mo. Mag.*, xviii., p. 144) writes: "Besides the differences already noted in the colour, in our description of the imagines, the palpi in *dichrodactyla* are decidedly longer than in *bertrami*. The hooked apex, which, in some specimens of *bertrami*, probably ♀s, is well-marked, will be found on close examination to have a different shape in the two insects. In *dichrodactyla* the hook is much more emarginate on the lower side, so that it comes to a much finer point than in *bertrami*." Bankes writes (*in litt.*): *G. ochrodactyla* may readily be separated from *G. pallidactyla* by the following major distinctions, of which the fourth alone would be sufficient, even in the case of the most wasted specimens:

1. *G. ochrodactyla* has the apex of the forewing decidedly *more produced* and *more pointed* than *G. pallidactyla*, the termen of the upper lobe being, therefore, more emarginate, and the apex projecting much further beyond the tip of the lower lobe than in its congener.
2. In *G. ochrodactyla* the forewings are, in general colour, *entirely ochreous*, though the different shades vary from very pale to very dark, whilst in *G. pallidactyla* the palest parts of them are distinctly *whitish*, and the darker parts are more or less decidedly *brownish*, sometimes mixed with fawn colour.
3. In *G. ochrodactyla* the dark spot on the forewing just before the fissure is *black*; in *G. pallidactyla*, however, it is merely *brown*, and is, moreover, occasionally obsolete.
4. In *G. ochrodactyla*, the whitish hindlegs are conspicuously barred externally, or ringed, with bright brown above both pairs of spurs and the first tarsal joint, whereas in *G. pallidactyla* the posterior half of the hind tibia is altogether brown or brownish externally, and the first tarsal joint, which may be wholly whitish, sometimes tinged posteriorly with brownish, or wholly brownish, is never distinctly ringed.

A comparison of 30 bred and caught *pallidactyla*, with some 90 bred *ochrodactyla*, shows that the wing expanse of the latter averages decidedly larger than that of the former. He further adds: "Stainton's remark (*Ent. Mo. Mag.*, ii., 138 [1865]) that, in *bertrami* (*pallidactyla*), the tarsi are 'spotless whitish,' is quite unreliable, for the long 1st joint is sometimes partly or wholly brown. Meyrick (*Handbook Brit. Lep.*, 435) gives the scale-tooth of the hindwings as somewhat larger in *ochrodactyla* than in *bertrami*, but this varies greatly in size in both species, and in both it is sometimes obsolete. Sang, in his useful notes (*Ent. Mo. Mag.*, xviii., 143-4 [1881]), states that captured *ochrodactyla* (*dichrodactyla*) are generally almost white, whereas he never took a faded *bertrami* (*pallidactyla*); some, however, of the few *bertrami* that I have netted, are certainly 'almost white,' though it is quite likely that the former becomes bleached more rapidly than the latter. Sang (*loc. cit.*) also says that the darker shades are, in *bertrami*, indistinctly margined, and mere washes of colour, not sharply laid on as in *ochrodactyla*. This is true, as a rule, of the males of *pallidactyla*, but, in some of the females, the patches of darker colour are quite as sharply laid on, and clearly margined, as in any *ochrodactyla*, and, in my darkest form of the ♀ [which would appear to be our ab. *intermedia* (*posteà* p. 238)], the deeper shade, which is warm russet-brown, contrasts so clearly and strongly with the underlying whitish ground colour, as to give the moth a remarkably mottled appearance." South states (*Ent.*, xviii., p. 281) that the alleged points of distinction, on which reliance is placed for considering *bertrami* and *dichrodactyla*, distinct species, fail. He states, and criticises, the case for not considering them to be a single species as follows: (1) "The palpi are decidedly longer" (Sang, *Ent. Mo. Mag.*, xviii., p. 144). - South has carefully examined the palpi of both, and "quite failed to see any perceptible difference in their respective lengths." (2) "The top of the outer digit is rendered more acute by the deeper concavity of the hind margin of that digit" (Sang, *loc. cit.*).—South says that "the top of the outer digit is, in *bertrami*, variable as regards its structure; in some specimens, the hind margin of the outer digit is strongly emarginate, and the tip is, in consequence, produced and very acute." (3) "The tibiæ in *dichrodactyla* are brown at the middle and apex, and there is a brown spot at the end of the first tarsal joint" (Stainton, *Ent. Mo. Mag.*, ii., p. 138).—South says, "Identical markings exist on the hindlegs of fresh examples of *bertrami*." As noted above, the genitalia prove the absolute distinctness of the species, and it would, therefore, be purposeless to deal with Hering's long summarised article (*Stett. Ent. Zeit.*, liii., pp. 269-279), attempting to prove their specific unity, and, since Fernald has discovered in Zeller's own examples, sent to him as *pallidactyla* (*bertrami*), specimens of *ochrodactyla*, the statement of Zeller that he had bred both *pallidactyla* and *ochrodactyla* from *Tanacetum* loses all force, the assumed *pallidactyla* being probably *ochrodactyla* like the others from the same pabulum.

Egglaying.—The ♀ oviposits at night, most usually quite after dark, with its abdomen thrust down among the disc florets of the tansy-flowers; one egg will, probably, be laid on each flower (Sang).

Habits of larva.—The young larva mines down the flower-stem into the root of *Tanacetum vulgare* in early autumn, where it remains during the winter and until the fresh shoots are thrown up in the following spring, working up these as the plant grows, throwing out frass from the joints and causing the whole plant to droop, very like the effects produced by the larvæ of *Exaeretia allisella* in the stems of *Artemisia vulgaris*, and becoming fullfed about the end of June (Sang). The mouth of the mine is generally between the axil of a leaf and the stem, with a few silk threads spun from one to the other, just above it, among which the dark olive or blackish frass becomes entangled, as the larva pushes it out from time to time in its course head downward; the quantity then increases more and more, until, at length, the accumulation becomes very conspicuous, and betrays the presence of the larva. In confinement, as soon as the food began to wither, fresh sprays of tansy were provided for the larvæ, which, as often as this occurred, readily left the old stems to commence mining into the fresh ones (Buckler). The larva bores into the stem at the axils of the upper leaves, and its presence may be detected by the frass extruded from the point of entry (South). The dull whitish-green larvæ throw out the excrement from the joints of the leaves and this indicates their presence (Jeffrey). The feeding-habits of the larvæ of this species and those of *G. pallidactyla* are very similar, neither species seeming to do at all well in small stems. The stems in which the larvæ of *G. ochrodactyla* arrived, on June 13th, 1904 (having been sent originally from Durham), were from ·25in. to ·33in. thick, whereas the stems of the variety growing in my garden were only about ·22in. in thickness, and, in these smaller stems, the larvæ did not seem at all happy nor progress satisfactorily (Bacot, June 26th, 1904). The following are actual dates on which larvæ have been found—July 20th, 1861, in the shoots of *Tanacetum vulgare*, at Wiesbaden, but in early June in 1866 (Rössler); mid-June, 1850; at Chudleigh (Stainton); third week in June, 1860, at Scarborough (Jeffrey); June 4th, 1874, June 5th, 1875, at Coniscliffe, of varying size; June 10th, 1880, at Blackwell, quite small (Sang); June 18th, 1893, at Chester-le-Street (Bower); May 22nd, 1904, between Aylesford and Maidstone (Ovenden); June 11th, 1904, in the Durham district (Gardner).

Larva.—While immature, the larva is darker in its colouring than it afterwards becomes. When not more than *a quarter of an inch long* it is blackish-green; when *about three-eighths of an inch long* it is glaucous-green with grey stripes; when *fullgrown* the larva measures a little more than ½in., its figure moderately slender, cylindrical, and tapering a little from the 3rd segment to the head, which is rather rounded; it tapers also from the 11th segment to the end of the 13th; the segmental divisions are well defined on the back, and rather deeper on the belly; the legs all tolerably well developed. The colour of the head is very pale, either of a brownish-yellow or greyish-yellow, semi-pellucid and shining; the ocelli large and blackish; the mouth blackish-brown; on the 2nd segment (prothorax) is a shining plate of the same colour as the head, bearing minute blackish dots, and another plate of similar tint is on the anal tip; the rest of the back is either a lively green, or else a rather subdued transparent light green, bearing a dark olive-brownish pubescent or bristly dorsal line; a naked stripe of opaque greyish, or whitish-grey, follows at a short interval, on which the minute tubercular black dots are visible; then comes the subdorsal thinner stripe of the transparent greenish ground colour, and then another naked thin stripe of greyish, which is succeeded by a broad lateral band of the ground colour, but so thickly covered by a minute bristly kind of brown pubescence as to assume an olive hue, and just within its lower margin are the circular brownish-red spiracles, outlined with black, and surrounded by a ring of naked ground; beneath them runs an inflated and puckered stripe of opaque greyish-white, relieved below by a line of the brown pubescence; the belly and all the legs are of the pale greenish ground colour, and but very slightly pubescent; on the belly, between each pair of the anterior legs, at their base, are two black spots; the ventral legs tipped with dark brown (Buckler). The dull whitish-green larvæ have the usual lines conspicuously darker, and, when more mature, obtain a pink tinge (Jeffrey). Length 8 lines, slightly attenuated posteriorly. Head yellowish-green, with brownish mandibles, and a black spot on each cheek. Ground colour green; dorsal stripe whitish, broken at the segmental divisions; a median line of the ground colour is intersected by the darker alimentary canal; subdorsal and spiracular lines whitish, interrupted at the segmental divisions. Tubercles inconspicuous; dorsal, two rows (four on each segment), blackish, each emitting a single, short, whitish hair; subdorsal, a row of black warts, each with a single short white hair; numerous minute whitish bristles all over the body. The spiracles are dark brown with yellowish centres; anal segment tinged with yellowish and shining. Prolegs and anal claspers semi-transparent, with a greenish tinge and tipped with brown (South).

Variation of larva of Gillmeria ochrodactyla.—The larva, like that of *G. pallidactyla*, has two distinct colour forms in its later stages: (1) A brownish form. (2) A green form. I am not certain whether these belong to the penultimate and final instars respectively, as they appear to do in the case of *G. pallidactyla*, and, as their respective sizes would suggest, in *G. ochrodactyla* also, for I found, on carefully measuring a brown larva and a green one that was somewhat larger and more bulky, that their heads were of exactly the same size. From this it would appear that the period at which this coat is obtained is a variable one, or else that the brown larvæ can attain the green form without the necessity of a moult. The change in these two larval forms simply amounts to the replacement of the brown areas by a vivid green. *Description of the brown form :* The larva is quite of the normal Platyptiliid form ; head pale green, surface polished, shape rounded, with brown mouth-parts and black ocelli ; capable of partial retraction beneath prothorax. Body : The prothoracic scutellum is very distinct, of a very pale yellow-brown colour. The meso- and metathoracic segments have three nearly equal subdivisions, the central one bearing the tubercles. The subdivision of the abdominal segments consists of a large anterior subsegment carrying tubercle i, with two small subsegments behind it, the middle subsegment carrying ii. The anal plate, though large and chitinous, is not distinctively coloured. There is a clear, but only slightly raised, lateral flange. Coloration : The dorsal area is pale brown, and down the centre of this area there is a sharply marked and much darker brown band, while there are similar sharply marked subdorsal bands of the same colour, bordered by a whitish area which fades off above into the general brown of the dorsal area, and beneath into another brown band which encloses the spiracles ; below this again, the lateral flange is whitish, bordered along its lower edge by a dark brown stripe, the subventral and ventral areas being alike of a very pale brown. The prolegs are, as usual, rather long, both these and the true legs having no distinctive coloration. The spiracles are large and slightly raised with a broad dark brown chitinous rim. The body is covered by a coat of fine spicules, and there is also a fairly even coat of tapering secondary hairs. The primary setæ are of medium length, simple and tapering, with well-marked raised black chitinous bases ; in position they seem to exactly agree with those of *G. pallidactyla.* (2) *The green form :* This seems to differ only in the points above mentioned, except, perhaps, in one small particular, *viz.*, that the secondary hairs are much less noticeable on the white areas than elsewhere, and this, I think, applies specially to the green form. This seems to be due to their colour on these areas not contrasting with the skin ; certainly these hairs are not absent from these areas, and, so far as my discrimination goes, they are not less numerous (Bacot. June 26th, 1904). Buckler figured (*Larvae*, etc., pl. clxiii., figs. 3-3*a*), on June 8th, 1875, two larvæ of this species after their final moult, one representing a paler, the other a darker, green form.

Comparison of larvæ of Gillmeria ochrodactyla and G. pallidactyla.—The larva resembles that of *G. pallidactyla* a great deal. It has precisely the same outline, and the same alternation of dark and light stripes, *viz.*, a dark dorsal line, a broad pale stripe including i and ii, a narrow dark line including iii, a broad dark lateral stripe including the spiracle, a pale lateral line including iv and the flange ; below this, dark with faintly paler tint along vi and vii (?). The differences are first and chiefly (*i.e.*, most important) that the pale and dark lines are not so marked as in *G. pallidactyla*, the pale is not so pale ; the flange stripes, so clear white and porcelain-like in *G. palli-*

dactyla, are distinct enough, but of a dull creamy colour, and the lower one (marginal) would hardly be noticed, if one did not look for it to compare with that of *G. pallidactyla*; the subdorsal and supraspiracular pale bands are duller and are patchy, the dorsal dark line especially invading their area, and giving, perhaps, more nearly the aspect of what they are, *viz.*, white patches round i and ii. The ground colour of *G. pallidactyla* is definitely pale olive-green and white; that of *G. ochrodactyla* is a pinky-green with pale, nearly white, markings. All the *G. ochrodactyla* are more or less pink, of which no trace is seen in any of the *G. pallidactyla.* One specimen is especially pink, having broad patches of pink beside the dorsal line, extending far across the posterior margin of the segments, and on the 6th and 7th abdominal segments reaching the subdorsal line, which is pink also. On this specimen, one may, in fact, distinguish at least four tints:—(1) The white areas which are not so clear white as in *G. pallidactyla.* (2) A pale fuscous-brown, the dorsal line and patches of the spiracular band—the spiracles themselves being dark, surrounded by a white ring—the lower margin immediately below the white lateral line. (3) Pink, large patches beside the dorsal line invading the subdorsal pale band, the subdorsal dark line also breaking across the next pale line, in three places, *viz.*, anterior and posterior margins of segment, and along a subsegmental division which is rather behind the middle of segment. (4) The under surface is very pale, but far from white—faintly fuscous may be the right description. It is difficult to detect any exact structural differences between the living larvæ of these species. That of *G. pallidactyla* has the areas of dark hairs and points larger than those on that of *G. ochrodactyla*, but there is some individual variation, and I cannot be positive that the differences that hold good in the three specimens of each that I have carefully examined, would be found to obtain in all cases. The dorsal band is narrower in *G. ochrodactyla* than in *G. pallidactyla*, the portion between ii and iii, which is almost a good continuous line in *G. pallidactyla*, may be represented by two scraps, or by one, or be practically absent. The large portion round the spiracle, forming a lateral dark band, is smaller in *G. ochrodactyla* than in *G. pallidactyla.* The band between iv and vi is much smaller, and is broken up by pale intrusions, that between vi and vii is xery small in two specimens—wanting in one. The patch round the base of the prolegs is absent in *G. ochrodactyla*, always present in *G. pallidactyla.* In one of the *G. pallidactyla*, the dark predominates largely, but the pale lines indicated above are all present, although very much narrowed. As to the meso- and metathoracic setæ, in *G. pallidactyla* the eight hairs (four pairs of two each) on each side, *are all quite separate* and without basal plates, and, though still in pairs, the members of each pair are wider apart, and the distance between the pairs is less. Accepting the hairs as i, ii, iii, etc., then i and ii are even less trapezoidal than in the larva of *Platyptilia gonodactyla*, though, in all, i and ii are almost exactly transverse, but, if the distance from i to ii be taken as 1, then ii to iii is little more than 1·5; whilst in *P. gonodactyla*, if i to ii = 1, then ii to iii = 3. In *G. ochrodactyla*, the condition is nearly that of *G. pallidactyla*, but each hair *has* a basal plate, colourless and transparent (smaller than in *P. gonodactyla*), and, owing to the hairs being further apart, the plates do not touch, but are separated by skin-point-bearing integument. This does not hold, however, in regard to the third pair (v and vi ?) which possesses, in this species, in all cases, only one plate, and is, in one instance (out of 12), a single hair; in two cases a three-haired wart, and in nine cases, two hairs on one plate, looking in several instances rather wartlike. This variability of this pair of tubercles has no parallel in the other species, and the presence and absence of plates to these tubercles appear to afford clear proof that these two are "good" species (Chapman).

Pupation.—Although an internal feeder, this larva leaves its burrow when fullfed, spins a tough silken web, usually on the stem of its foodplant, to which it attaches itself for pupation, its beautiful colour being in the highest degree protective. It has a highly developed cremaster, the hooks in two sections, the forward on the front of the 9th or back of the 8th abdominal, the hinder on the 10th abdominal segment, by means of which it fixes itself to the silken pad. It has the normal habit of bending itself over in somersault fashion if disturbed, that is noticeable in most of the other species. Buckler observes that it is attached by its anal segment to a stem of the foodplant, whilst South notes that, in confinement, it is suspended by the tail from the underside of a leaf.

Pupa.—♂ 12·5mm. long, 1·8mm. wide at mesothorax, 1·5mm. wide at 4th abdominal. The differences in colour between the pupa of this species and that of *G. pallidactyla* are very considerable, but they may be largely individual. It is also much more slender, a difference that may be sexual. The surface is dull, that of *G. pallidactyla* is very shining and polished, the ridges on the mesothorax are wide apart, and, on the metathorax, they diverge a little laterally. Seen from above, the antennæ look more serrate, and stand out as a bordering ridge or flange; in *G .pallidactyla* they are more regular, smooth, and rounded, and fall into the general outline. The colouring is beautiful, but so elaborate as to be difficult to describe; assuming the ground colour to be green, it is overlaid by markings of pink, brown and white; the white comprises a lateral line (flange) below the spiracle and the upper and lower surfaces of the "beak;" both these are shaded with pink; the margins of the dorsal flanges on the mesothorax are also white; the wings and appendages are more olive-tinted than the rest of the pupa, the veins are not paler, but some of the interstices are olive-brown, showing up the veins; the sides of the beak are brown; below the white flange is a dark pinkish-olive band, then a broad green band shaded with pink, with dashes of olive-green down the centre of each segment, these do not form a line, as they do not reach the margins of the segments; the venter is broadly pale olive-green. Dorsally, the subdorsal ridges are pale reddish-pink on the last 4th of the mesothorax, and on the metathorax, and 1st, 2nd, and 3rd abdominal segments, culminating on the 1st, 2nd, and 3rd abdominal segments in a dark red-brown spot at the outer side of the posterior end of the portion on each segment. This colouring is repeated on the following segments (where there is no flange), but more weakly on each, so that, on the 7th abdominal segment, there is merely a pink dot representing the dark spot of previous segments. Between these is a dark olive-green dorsal line, and another (subdorsal) at an equal distance outside the flange; there is another broader band above the white lateral flange; this is somewhat irregular, and is interrupted by a pale spot round the spiracles and another behind, giving it a chain-like appearance; each antenna has a row of olive-brown dots down each side, in the hollows between the pectinations. The tubercles can be detected on the usual sites, they carry very minute hairs, thick and stubby, barely 0·03mm. long. The dorsal ones (i and ii) are very obvious on the mesothorax on the flange, one towards each end; similarly, on the 1st and 2nd abdominal segments, the flange (with the ribbing) occupies about two-thirds of the segments, and the tubercles are at each end of the flange; the posterior third of the segment is unribbed, and corresponds with what is the intersegmental membrane in movable segments. At the spiracular level, the ribbing becomes wider below, so that, in the movable incisions, there is more intersegmental membrane dorsally than ventrally, corresponding with the great curve backwards that these pupæ make. This curious feature seems to occur in all plume pupæ, though also curiously liable to escape observation. On the 3rd abdominal segment, i is at the middle of the flange; on the following segments, i is at the middle of the ribbed piece, ii at the posterior margin of the ribbed piece, the two tubercles dividing the segment into three almost equal pieces; these tubercles are closer together on the posterior segments, i passing backwards towards ii, iii being generally on the same subsegment or ridge as i. Structurally the pupa may be said to be very much like those of the other Platyptilias. The nose-horn is long and thick (vertically), with sharp dorsal edge and fairly sharp point, and rather compressed laterally above the brown edge, and, therefore, with somewhat triangular section; it is rough and ridged, but not extremely so; length 0·8mm., or a little less if measured along the lower angle. The cover of the 1st (prothoracic) spiracle is similar to that in the pupa of *Platyptilia isodactylus*, but is only of about half the length, although similarly covered with waved lines and spiculæ. The wing-venation is as in the others; tubercle iii is apt to be obsolete on the forward abdominal segments. The subspiracular flange is very marked, as is the dorsal one, which is very high over the meso- and metathorax, so that over the metathorax and posterior part of mesothorax those of each side approach each other, but keep well separate, and, diverging again, terminate behind the middle of the 3rd abdominal segment, reappearing again on the 9th and 10th abdominals, giving four marked angles to the cremastral spike; the cremastral hooks are about the same length as in the pupa of *P. isodactylus*, but are much finer and vastly more numerous; so much so, that to count them seems useless, and one says 100 on either side of the terminal set, as a round number, which cannot be much too large, and may be a great many too few. The forward set are of the same size and structure, and also very numerous, each with the end sharply bent back, and ending in a very fish-hook like point; these count about a hundred on either side, and make that figure, as an estimate of the terminal set, seem insufficient. They arise from the large genital double projection of the 9th abdominal segment, and I gather that I must have been wrong in attributing them to the 8th abdominal segment (supposing, as seems probable, their position to be uniform throughout the family); they are certainly here on the 9th. [The error is an easy one to make, as the 8th abdominal segment is here exceedingly narrow, and, in the living pupa, this ventral portion of the 9th abdominal segment is in alignment with the 8th abdominal segment, regarded laterally and dorsally.] The transverse ribbing of the abdominal segments is pronounced, the ribs count about fifteen. Probably the structure is the same in all cases, but, in this species, the ribs appear to have flat tops, with sharp margins where they meet the slopes into the valleys. The anterior margins of the segments, especially ventrally, show sharp skin-points, but these seem less widely distributed than in, say, *P. isodactylus*. In other respects the pupa is too like that species to be worth describing separately (Chapman, May 29th, 1904).

Variation in pupa of Gillmeria ochrodactyla.—The pupa is ·5in. in length, slender, with a longish beak in front, projecting at a slight angle downwards from the head, pointed at the tail; the wing-covers of moderate length, well-developed, and the ends of the leg-cases projecting free from the abdomen; its figure, in repose, is a little curved, so as to be concave, on the back. In colour it varies, some examples being very pale greenish, others light pinkish-grey, while others again are dark reddish-grey; in the pale green variety, the characteristic darker markings, though partially present in deeper tints of greenish, are more tenderly rendered than in some of the greyish varieties, which are marked as follows: the beak is white above, and black at the sides; on the thorax a blackish-brown dorsal stripe widens and then narrows, and from thence passes down of uniform width to the tail; on the thorax, it is margined with a line of white; the subdorsal line is blackish-brown and rather interrupted; between this and the dorsal stripe, on each segment, are double dark brown streaks a little divergent; these are strongly marked on the anterior segments, but more faintly, by degrees, on the hinder ones; at an interval below the subdorsal another brown line occurs, rather interrupted; the lateral line is white, bordered beneath by a stripe of black; the ventral surface of each segment has a broad, central, somewhat squarish, mark of light brownish-grey, and a fine subventral line of similar tint, much interrupted; the wing-covers brownish-grey with whitish rays (Buckler). Whitish-green, streaked dorsally and laterally with olivaceous-brown; thorax humped; from the head is a beak-like projection, which is whitish in front and blackish at the sides; the lower portion of the antenna-cases are detached from the abdomen (South). Buckler figured (*Larvae*, etc., pl. clxiii., figs. 3*b*-3*c*), on June 17th, 1875, two forms of the pupa of this species, one bright green, the other grey.

Comparison of pupæ of Gillmeria ochrodactyla and G. pallidactyla.—The difference between the pupæ of these species is very difficult to define. In the specimens compared—four of *G. pallidactyla* and ten of *G. ochrodactyla*—one might define that of *pallidactyla* as a nearly white pupa, with faint markings, and that of *ochrodactyla* as a pupa, dark from the intensity of the markings. In the latter, these markings differ from those of *Platyptilia gonodactyla* and *P. isodactylus* in being very clear and distinct, with sharp margins, not fading away into the pale areas. This difference between *G. ochrodactyla* and *G. pallidactyla*, however, is probably true only of my specimens, as I have one *ochrodactyla* that is very nearly as pale as *pallidactyla*, and, in this pale one, I cannot so easily differentiate the markings from those of *pallidactyla*. I imagine that, in a longer series, there would be much overlapping. To return to the markings of *ochrodactyla*, they consist of a dark dorsal line or band, and three more between it and the spiracle; these are fairly continuous, and differ in darker and lighter specimens in width and intensity, but always have a fairly defined margin.

The lower one usually includes the spiracle, *i.e.*, it is broad, and extends down below the spiracle; there is, however, some ground colour usually in it that would make it an union of supra- and subspiracular lines. Below the spiracle is a broad pale, and then a broad dark, band, and vi is in a narrow pale line below this. Then, ventrally, is a narrow dark line, a pale line and a dark central shade. There is a peculiarity here which I find only in *ochrodactyla*, though I think *pallidactyla* would show it if a dark enough specimen were forthcoming. This peculiarity is, that this first ventral dark line curves inwards at its lower end on each segment, and the pale line within it curves still more, so that it meets its fellow of the opposite side along the posterior border of the segment, giving the dark central shade a somewhat ocellated character. This shade tends usually to divide into two by a partial pale ventral line, and the centre of each half may be pale, aiding the ocellated effect, and, in all cases, making the ventral markings run largely in curves instead of in straight lines. The proleg scars in this region seem to be pockets as in *P. gonodactyla* (Chapman). All my pupæ of *G. pallidactyla* (some twelve in number) were of a pale green tint, darkening to a very pale wainscot-brown on the wing-cases, thoracic, and dorsal areas, before emergence. The only *G. ochrodactyla*, that has pupated, at once turned dark wainscot-brown, mottled. and striped with dark umber-brown to almost black, and some pale bone colour, almost white in places. I only had one pupa of *pallidactyla* available for comparison at this time, and this was a very small one, but I do not think that there is any marked difference in the size of normal specimens. In shape, the *ochrodactyla* looks the more slender of the two, but this is, I think, in part, due to the extra length of the nose-horn in *ochrodactyla*, but not entirely so. Certainly the nose-horn in this particular specimen is much longer than that of the *pallidactyla*. The pupa of the latter is 12mm. long, and its nose-horn, from eye to tip, is only 1·50mm., while the pupa of *ochrodactyla* is 14mm. long, and its nose-horn is 2mm. in length. The nose-horn of *pallidactyla* is also more beak-like, in that it projects outwards from the pupa further in a ventral direction, while the larger horn of *ochrodactyla* has but little ventral inclination (Bacot).

Foodplants.—*Tanacetum vulgare* (Mühlig). [*Chrysanthemum corymbosum*, *Senecio sylvaticus* (Rössler and Borgmann) (see *anteà*, pp. 222-223).]

Time of appearance.—The species is rarely out before July; usually its time of appearance in the British Islands extends from mid-July to mid-August, although, over a series of years, it extends from the end of June till towards the end of August. Wallengren also gives July and August as the dates for its appearance in Scandinavia; and Eversmann, June and July, in the Ural district of Russia. In Germany, we note it recorded in July and early August in Friedland (Stange), near Hamburg (Sauber), and near Wiesbaden; July or August, according to the season (Rössler), near Cassel (Borgmann), in Württemberg (Steudel); in June and July, in Pomerania (Paul and Plötz), also near Göttingen (Jordan), near Berlin (Pfützner), in Silesia (Wocke), near Brünn (Gartner); in June, in Saxon Upper Lusatia (Schütze); in July, in Bavaria (Hofmann and Herrich-Schäffer); in the first half of August, on Sylt Island (Werneburg), also near Hanover (Glitz); whilst, in Upper Lusatia, the end of June to August is given by Möschler. The actual dates noted are as follows: In continental localities.—July 4th, at Kokalény (Bachmetjew); August 7th, 1861, and following days, bred at Wiesbaden, from larvæ collected July 20th (Rössler); July 19th, 1867, near Rhoden (Speyer); August 20th, 1887, at Christiania and Harmer (Jordan); from June 17th-July 22nd, in the Riga district (Teich). In British localities.—One bred July 5th, 1850, from a pupa found in June at Chudleigh (Stainton); August 8th-22nd, 1854, August 15th, 1857, at Nag's Head on the banks of the Tees (Sang); a fine series bred July, 1860, the earliest specimens appeared July 5th, from larvæ taken the third week in June at Scarborough (Jeffrey); August 12th, 1865, July 24th, 1870, August 22nd, 1872, at Nag's Head on the banks of the Tees (Sang); imagines bred from June 28th-July 5th, 1875, from larvæ collected at Darlington on June 8th (Buckler); August 17th, 21st, 1886, at Saltburn (Porritt); July 14th, 1890, at Bundoran, Donegal Bay (Johnson); July 9th, 1896, at Corsemalzie (Gordon); August 17th, 1898, at Dawlish (Rea); July 21st, 1889, at Cofton (Studd); August 1st-19th, 1900, at Dawlish (Turner); August 2nd, 1900, *in cop.*, at Cofton; July 25th, 1901, at Oxton (Studd); bred 1st half of July, 1901, from larvæ collected during June at Colchester (Harwood); common in July, 1902, at St. David's, Fife (Evans); August 1st, 1902, at Starcross (James); bred July 4th-17th, 1904 (Bankes), from larvæ collected on the banks of the Wear, near Durham, on June 11th, 1904 (Gardner).

Habits.—The species is confined very closely to the beds of tansy, on which plant the larvæ feed; Sang observes that it is restricted in the Darlington district to *Tanacetum*, although *Achillea* may be plentiful in the same district, to which plant the allied *G. pallidactyla* (*bertrami*) is here equally closely confined. Porritt also insists (*Ent. Mo. Mag.*, xxiii., p. 163) on this, observing that, in the Saltburn ravine, also all over the district, in August, 1886, although yarrow was in full bloom, and in equal luxuriance with the tansy, on which he found the species there, yet not a single specimen of *G. ochrodactyla* was seen frequenting it, common as it was at the flowers of the *Tanacetum*. It appears to be a very sluggish species during the day, hiding very successfully, and is only with difficulty started up from among its foodplant; it becomes active, however, at dusk, when it is found freely at the tansy flowers, or flitting about among its foodplant. Bankes observes (*in litt.*) that the species seems very indifferent as to the time of day at which it emerges from the pupa; of the specimens on which careful observations were made, thirteen emerged between 7 a.m. and 1 p.m., eleven between 1 p.m. and 7 p.m., seventeen between 7 p.m. and 7 a.m., and 10 others between midnight and 7 a.m. There appears to be no real trouble in obtaining pairings of the species in confinement, as both Bacot and Bankes obtained them in July, 1904. On this point, Bankes notes that a ♂ and a ♀ that had both emerged early on the morning of July 15th, 1904, were put together into a small cage that day, and kept in a warm room; they did not pair during the night of the 15th, or day of the 16th, but were found *in cop.* at 10.30 p.m. on the night of the 16th, and remained so till between 8 p.m. and 9 p.m. on the 17th (nearly 24 hours!), when they separated. Bacot observes that, in spite of pairings being obtained, it was found impossible to get eggs; the moths lived for some time, waiting apparently for the tansy to throw up its flowering stalks to the proper point of development; the right condition of the flower-heads was evidently not obtained, and the moths died without laying. [Of unusual points in its habits, we note that Beadle records one imago at a laburnum flower, at Keswick (the laburnum is certainly over in the south long before the species is on the wing). Gordon notes it flying at dusk about honeysuckle, in the garden, at Corsemalzie]. Barrett records it at light at Norwich, and Studd at light at Oxton. In Germany, it is usually reported as flying in the evening around *Tanacetum*, *e.g.*, in the Island of Sylt (Werneburg), in Silesia (Wocke), in Saxon Upper Lusatia (Schütze), etc.

Habitats.—This very local species, with which its near ally *G. pallidactyla* was confused until 1863, is exceedingly localised, being confined to the near neighbourhood of the clumps of its foodplants, which one meets with in various situations. In the county of Durham, the banks of the Wear and Tees are its best known haunts, whilst, in Kent, it is to be found on the canal bank between Aylesford and Maidstone, restricted to particular tansy patches, and by no means to be found on every clump. The same is true at Colchester, and Hudd reports it as occurring on the bank of the Avon. Porritt says that it is to be found in a ravine on the coast of Yorkshire, near Saltburn, where tansy grows in large luxuriant patches, and yarrow is in equal luxuriance with tansy; yet, although *G. ochrodactyla* occurs freely on the former plant, it never frequents the yarrow. In Germany, it is recorded as occurring—in Friedland, everywhere where the foodplant grows, but especially on the sandy edges of firwoods at Stausee (Stange), in woodland meadows in Hanover (Glitz), in the swampy parts of the Oberharz (Hoffmann), in warm and sheltered spots in a high-lying wooded valley at Wiesbaden (Rössler), in firwoods around Cassel (Borgmann), in vineyards, lying fallow, around Regensburg (Hofmann and Herrich-Schäffer). Peyerimhoff notes the capture of a specimen on the Furka, at a height of 2400 metres.

British localities.—Local, but widely distributed. [The localities here given are not always clearly differentiated from those of *G. pallidactyla*]. [Anglesea: near Holyhead (Freer)]. Cavan (Kane). [Cheshire: Bromborough Pool, Wirral (Ellis), Chester (Newstead), Holford (G. O. Day)], Wallasey (*teste* Leech). [Cumberland: Keswick (Beadle).] Derby: Repton (Garneys). Devon: Chudleigh (Stainton), Oxton, Cofton (Studd), Dawlish (Rea), Exeter (*teste* Leech), Starcross (James), Lundy Island (*teste* Leech). Donegal: Bundoran, Donegal Bay (Johnson). Durham: Darlington (Buckler), Chester-le-Street (Bower), Tees-side—Nag's Head, Coniscliffe, Blackwell (Sang), banks of Wear, a few miles from Durham (Gardner). Dublin: Howth (Birchall). Essex: Colchester (Harwood), Mucking (Burrows). Fife: St. Davids, common (Evans). Galway: Galway, Clonbrock (Kane). Gloucester: scarce on the banks of the Avon (Hudd). Hants: Boscombe (Robertson). Kent: canal bank, Aylesford to Maidstone (Ovenden). Lanark: Glasgow district (Henderson). Norfolk: Norwich (Barrett), Horning (*teste* Leech). Perth: Glen Lochay (Morton), Dunblane (Henderson). Somerset: near Leigh, Portishead (Hudd). Surrey: Sutton (Blackburn). [Wigtown: Corsemalzie (Gordon).] York: Huddersfield, Saltburn (Porritt), near Scarborough (Jeffrey), York (Stainton), Darlington (Sang).

Distribution.—Central Europe, Russia, northwest and southwest Armenia (Rebel). Austro-Hungary: Bohemia—near Prague (Nickerl), Moravia—near Brünn, rare (Gartner), Lower Austria—near Vienna—the Prater, Dornbach, Brühl (Mann), Budapest district—Sopron, Nagyág (Aigner). Belgium: very common—Ixelles, etc. (Crombrugghe). Bulgaria: Kokalény-Kloster, near Sofia (Bachmetjew). Denmark (Bang-Haas). Finland: as far north as Uleåborg (Tengström). France: Dept. du Nord (Paux), Saône-et-Loire (Constant), [Indre—Nohant (Sand).] Germany: Prussia, very common—Memel, Cranz, Dammhof, Königsburg, Kalgen, Rastenburg, Steinert, Lyck, Dantzig (Speiser), [Pomerania—not rare in Neu-Vorpommern and Rügen (Paul and Plotz), Stettin, the Julow, near Nemitz, near Vogelsang, Wollin Island (Büttner)*], Mecklenburg — near Neustrelitz, Rülow, Wismar (Boll), near Friedland (Stange), Schleswig-Holstein — Sylt Island, near Westerland (Werneburg), Lower Elbe district—Steinbeck, Hamburg, common (Sauber), Heligoland (Dalla Torre), Hanover—Borkum Island (Schneider), near Hanover (Glitz), Oberharz (Hoffmann), near Quedlinburg, near Göttingen (Jordan), [Rhine Provinces—near Linn, Aachen, Crefeld, Uerdingen, rare, Elberfeld, Schwelm (Stollwerck),*] Hesse and Waldeck—near Wiesbaden, Nassau (Rössler), near Frankfurt, in the Taunus (Koch), near Cassel (Borgmann), near Rhoden (Speyer), Thuringia—near Jena (Knapp), near Mühlhausen (Jordan), Province of Saxony—near Dessau (Richter), near Aken-on-the-Elbe (Gillmer), Brandenburg—near Berlin (Pfützner), Frankfurt-on-Oder, Kornbusch (Kretschmer), Silesia, distributed (Wocke)—Upper Lusatia (Möschler), near Görlitz (Sommer), Kingdom of Saxony—Saxon Upper Lusatia (Schütze), Bavaria—near Regensburg, Weintinger Holz, Gebraching (Hofmann), Württemberg—Heudorf, Wasseralfingen (Steudel and Hofmann), Rhine Palatinate (Meess and Spuler), Alsace—La Chapelle (Umbang). Russia: [Baltic Provinces—Sassehof, near Riga (Nolcken),] Tannenhof, Kurtenhof, Sillen (Berg), Livonia (Lienig *teste* Zeller), Riga district (Teich), Ural district—Orenburg, Casan, Saratov (Eversmann). Scandinavia: South and central Sweden—Upland (Wallengren), Norway—Christiania, Harmer (Jordan). Switzerland: very rare near Zürich (Bremi).

Gillmeria pallidactyla, Haworth.

Synonymy.—Species: **Pallidactyla,** Haw., "Lep. Brit.," p. 478 (1811); Tutt, "Young Nat.," xi., p. 22 (1890); "Ent. Rec.," i., p. 92 (1890); "Pter. Brit.," p. 31 (1895); Hodg., "Ent. Rec.," iii., p. 186 (1892). **Pallidactylus,** Sam., "Ent. Comp.," p. 409 (1819); Curt., "Brit. Ent.," p. 161 (1827); Stphs., "Ill.," p. 375 (worn) (1834). **Ochrodactyla,** Treits., "Die Schmett.," ix., p. 227 (1833); Sorh., "Kleinschmett. Brand.," p. 2 (*in part*) (1886). **Migadactylus,** Curt., "Brit. Ent.," fo. 161 (1827); Stphs., "Ill.," p. 375 (1834); Wood, "Ind. Ent.," 1st ed., p. 236, pl. li., fig. 1642 (worn) (1839). **Ochrodactylus,** Dup., "Hist. Nat.," xi., p. 641, pl. 313, fig. 2 (1838); "Cat. Méth.," p. 381 (1845); Zell., "Isis," p. 775 (*in part*) (1841); "Linn. Ent.," vi., p. 327 (*in part*) (1852); Tgstrm., "Finl. Fjär.," p. 154 (1847); Kaltenbach, "Verh. Nat. Ver. Bonn," xv., p. 165 (1858); Dbldy., "Syn. List," 2nd ed., p. 36 (1859); Sta., "Man.," ii., p. 440 (*in part*) (1859); Barrt., "Lep. Brit.," ix., p. 346 (*in part*), pl. 413, figs. 3-3*a* (1904). **Marginidactylus**†, Fitch, "New Y. Rept.," i., p. 848 (1854); Fern., "Pter. Nth. Amer.," p. 33, revised ed., p. 34 (1898); Dyar, "List Lep. N. Am.," p. 444 (1902). **Nebulaedactylus**†, Fitch, "New Y. Rept.," i., p. 849 (1854). **Bertrami,** Rössl., "Wien. Ent. Mts.," viii., p. 53 (1864); Sta., "Ent. Mo. Mag.," ii., pp. 137-8 (1865); Jord., "Ent. Mo. Mag.," vi., p. 21 (1869); xviii., pp. 74-5 (1881); Staud. and Wocke, "Cat.," 2nd ed., p. 342 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 784 (1877); Walsm., "Pter. Cal. Oreg.," p. 3, pl. i., fig. 3 (1880); Sang, "Ent. Mo. Mag.," xviii., pp. 143-4 (1881); Barr., "Ent. Mo. Mag.," xviii., p. 177 (1882); South, "Ent.," xviii., p. 279 (1885); Porritt, "Ent. Mo. Mag.," xxii., pp. 103-105 (1885); xxiii., p. 163 (1886); Leech, "Brit. Pyr.," p. 52 (1886); Tutt, "Young Nat.," x., pp. 163, 221 (1889); "Pter. Brit.," p. 31 (1895); Meyr., "Trans. Ent. Soc. Lond.," p. 486 (1890); "Handb.," p. 434 (1895); Hofm., "Deutsch. Pter.," p. 55 (1895); Porrt., "Buckl. Larvæ," ix., p. 341 (1901); Staud. and Reb., "Cat.," 3rd ed., p. 72 (1901). **Bischoffi,** Zell., "Stett. Ent. Zeit.," xxviii., p. 333 (1867); "Verh. z.-b. Ges. Wien.," p. 317 (1873). **Cervinidactylus,** Pack., "Ann. Lyc. N. Yk.," x., p. 266 (1873). [Curtis, Stephens, Doubleday and the older British authors all referred this species to Haworth's *pallidactyla*, and it was not until Zeller cited this as a synonym of *ochrodactyla*, Hb., followed by Doubleday (*Zool. Syn. List*, 2nd ed., p. 36), who also treated it as a synonym of *ochrodactyla*, Hb., that it was lost to us; Stainton, in the *Manual*, following Doubleday, failed to differentiate the two species. In 1864, Rössler (*Wien. Ent. Monats.*, pp. 53-54) differentiated the pale *Achillea*-feeding insect, as a species distinct from the more cleanly marked *Tanacetum*-feeding insect, and redescribed

* Localities not separated from those of *G. pallidactyla* by this author; both species appear to be equally widely distributed in Pomerania. One suspects many other localities to be unreliable.

† Fernald writes: "The types of Fitch now belong to my collection, and I have made a critical examination of the genitalia, which agree perfectly with the genitalia of *bertrami* (*pallidactyla*)" (*Pter. North America*, p. 35).

it under the name *bertrami*, whilst Mühlig, also recognising the two species, referred the *Achillea*-feeding one to *ochrodactyla*, Hb., and named the *Tanacetum*-feeding one *dichrodactylus* (*Stett. Ent. Ztg.*, 1863, p. 213). We are at a loss to understand why Staudinger and Rebel (*Cat.*, 3rd ed., p. 72) make *pallidactyla*, Haw., a synonym of *ochrodactyla*, Hb.]

Original description.—*Alucita pallidactyla* (The pale Plume). Alis anticis ochroleucis, nebulis aliquot saturatioribus. Expansio alarum 1 unc. Alæ anticæ bifidæ; posticæ, tripartitæ fusco-ochraceæ (Haworth, *Lepidoptera Britannica*, p. 478). [Rössler was the first lepidopterist to give a comparative diagnosis of the species as apart from *ochrodactyla*, Hb. His description reads: "It is not so large as *ochrodactyla*, of more uniform rust colour, without the well defined dark brown spots of *ochrodactyla* (Mühlig's *dichrodactylus*), differing particularly in having light yellow scales at regular intervals marked on the rust-coloured ground of the forewings, producing the appearance of wood shaved by a blunt plane; the two dark spots, also, near the cleft of the forewings, are either entirely wanting or are very faint. On the other hand, the same whitish spots noticeable in *ochrodactyla* are to be seen. The hindwings rust-brown, the fringes of the plumules at the base yellow, at the tip darker, yet not so contrasted as in *ochrodactyla*, in which the fringes appear as if spotted; the position of the scale-tuft of the 3rd plumule of *ochrodactyla* is dark brown, whilst in this species it only shows as a faint dark shading. The chief difference, however, consists in the colouring of the hindlegs; in all the specimens (10) examined, the two terminal joints, without spurs, are uniform yellowish-white in colour, whilst the two upper joints are unicolorous rusty-brown, with white spurs, only towards the knee does the colour become gradually lighter. The apex somewhat less hooked in bred specimens" (*Wien. Ent. Monats.*, 1864, pp. 53-54).] (See also *anteà*, pp. 223-4.)

Imago.*—22mm.-26mm. Anterior wings moderately extended at apex. Pale ochreous, or whitish-ochreous, in tint, washed with darker ochreous along the costa, along the base of the discal area, and narrowly at the base of the inner margin; the discal area from base to fissure pale; a pale lunule from costa to end of fissure; two inconspicuous dark brown discocellular spots; the lobes washed with darker ochreous; an ill-developed, pale, transverse, lobal line parallel to hind margin, obsolete on second lobe; costal and outer marginal lines dark brown; fringes glossy white, with darker patch at anal angle and on inner margin. Posterior wings glossy ochreous-brown, costal edges of 1st and 2nd plumules darker; a slight trace of the dark scale-patch near middle of outer margin of 3rd plumule; fringes glossy grey-brown, hardly so dark as wings.

Genitalia.—Fernald gives (*Pter. Nth. America*, pl. iii., figs. 4-5) drawings of the genitalia of this species, and adds (*op. cit.*, p. 34): "For the sake of comparison the genitalia of *G. ochrodactyla* are represented on the same plate (figs. 14-15). These drawings were made from specimens received from Zeller, which are labelled in his own handwriting."

* The colour consists of shades of fawn-colour and brown, the darker shades indistinctly margined, mere washes of colour, not sharply laid on like those of *dichrodactyla*. The spot near the fissure when present at all is exceedingly faint. The hooked apex, which in some specimens, probably ♀s, is well-marked, is less emarginate on the lower side, and the apex consequently less pointed than in *ochrodactyla* (Sang).

Variation.—There is a considerable amount of variation in this species. Hodgkinson notes (*Ent. Rec.*, iii., p. 186) that specimens bred by Eales, from Witherslack, from *Senecio aquaticus*,* vary exceedingly, and that, whilst some are as yellow as *ochrodactyla*, others are nearly white, and some nearly black. Dalglish also writes (*in litt.*) that this is the most variable plume in the Clydesdale district, where it has a range from pale ochreous-yellow to rich ferruginous, with an intermediate greyish-ochreous form ; he adds that he once captured a very fine lot at Mauchline. Barrett, who combines *pallidactyla* (*bertrami*) and *ochrodactyla* (*dichrodactylus*) as one species, states that the species is variable in the shade of ground colour from ochreous-white to rather rich full ochreous, and in the deeper shades of clouding, etc. The darker are apparently the more northern forms. Our own limited experience certainly leads us to suppose that the southern *pallidactyla* are more uniformly of one type—yellow, shaded with fawn—than the northern ones. We have seen no specimen darker than an almost unicolorous warm reddish-brown form, of almost the same tint as that of *Stenoptilia pterodactyla* (*fuscus*) ; certainly we have examined nothing that could, by any stretch of imagination, be termed nearly black, as noted by Hodgkinson (*suprà*). Rebel notes the capture of a very large pale coloured ♀ in the middle of July, 1897, at Campiglio. The following is our grouping of the forms that have come under our notice—

(1) White, with very faint washes of fawn-grey ; hindwings grey = ab. *albescens*, n. ab.

(2) Whitish, with very faint washes of ochreous-brown ; hindwings brown-grey = *pallidactyla*, Haw.

(3) The whitish ground colour very reduced, strongly suffused with ochreous-brown ; hindwings red-brown = ab. *intermedia*, n. ab.

(4) Brown, costal line dark ; inner marginal fringe pale, costal point (before fissure) pale ; slightest trace of faint lobal line ; hindwings deep red-brown = ab. (et var.) *scotica*, n. ab.

a. var. (*an* ab.) *albescens*, n.var. (*an* n.ab.). *Ochrodactyla* var., Tutt, "Ent. Rec.," iii., p. 22 (1892). *Pallidactyla* var.(?), Tutt, "Ent. Rec.," iii., pp. 33, 186 (1892); Hdgkn., "Ent. Rec.," iii., p. 186 (1892) ; Tutt, "Ent. Rec.," xiii., p. 129 (1901). *Bertrami* var., Reid, "Ent. Rec.," iv., p. 82 (1893).—Anterior wings of a whitish colour, the upper lobe beyond the lunule (reaching from fissure to outer margin), the costal area (from lunule for a short distance towards base), and inner marginal line towards base, washed with very faint brownish-grey ; the costa narrowly darker brownish, the discal points traceable ; the outer marginal line dark brownish ; the fringes shiny-white. The hindwings shiny-grey (almost of same tint as darker wash of forewings), tending to be mottled ; the marginal lines rather darker ; the outer margin of 1st and 2nd plumules dotted with dark ; slight traces of dark scale-patch towards centre of hindmargin of 3rd plumule ; fringes grey, rather paler than tint of hindwings.

This whitish form, so far, appears to be recorded only from Carlisle, Glasgow, and Aberdeen. It was first noted as being bred from larvæ feeding on the underside of the leaves of *Senecio jacobaea* by Reid (*Ent. Record*, iii., p. 22 ; *Proc. Sth. Lond. Ent. Soc.*, 1891, p. 148), and afterwards (*Ent. Rec.*, iv., p. 82) referred by Reid to the same species as that found feeding on *Achillea millefolium*. It is still open to question whether we have here a distinct species, and it is unfortunate that, although the insect was bred by Reid and Eales, the details of its life-history were not published in due course. Hodgkinson's remark that it has been bred from *Senecio aquaticus* (*Ent. Rec.*, iii., p. 186) needs confirmation.

* This statement as to so unusual a foodplant is to be noticed.

β. ab. *scotica*, n. ab. *Bertrami*, South, "Ent.," xviii., pp. 280-281 (1885). *Ochrodactyla* var., Tutt, "Ent. Rec.," iii., p. 22 (1892). *Ochrodactylus*, Barr., "Lep. Brit. Isles," pl. 413, fig. 3 (1904).—Expanse 12 lines. So much suffused with an umber tint as to appear almost entirely of this colour, but the whitish ground colour shows itself along the inner margin, and again in a narrow ill-defined stripe from the costa to the digital juncture; the scales at the digital juncture hardly darker. All three feathers of the hindwings, including the fringes, are lustrous umber-brown, and there is no trace of darker scales along the inner margin of the 3rd feather. The tibiæ of hindlegs whitish to their middle, then brownish to the tarsi; the tarsi are whitish, and have three narrow brownish rings. Imago emerged July 21st, 1885, from larva sent from Tillicoultry, June 24th. The halfgrown larvæ examined differed from a fullgrown one, in that the dorsal and subdorsal stripes somewhat approached purple-brown. The fullgrown larva did not differ from that of *dichrodactylus* (already described from tansy, *Ent.*, xv., p. 146) except that the prolegs and anal claspers of the yarrow-feeding larva were tipped with black instead of brown; the position, appearance, and hirsute adornment of the tubercles were identical. The pupa agreed exactly with the description of that of *dichrodactylus* (*loc. cit.*) (South).

This dark form is merely the extreme brownish-ochreous aberration that the species reaches in Scotland. Its uniform appearance gives it a very distinct facies, and the strong development of its discal points and deep colour combined, suggest somewhat *Stenoptilia pterodactyla*, but not, of course, in any critical detail. The best we have seen were taken by Dalglish at Mauchline, July, 1892, and are almost uniformly brown. These extremes are found with ab. *intermedia* in the north, the latter not being an unusual form in our best coloured English specimens.

The American forms of this species have been described as follows:

a. *marginidactylus*, Fitch, "New York Rept.," i., p. 848 (1854). *Marginidactyla*, Fern., "Pter. Nth. Amer.," 1st ed., p. 33; 2nd ed., p. 34 (1898); Dyar, "List Nth. Am. Lep.," p. 444 (1902).—The brown-bordered plume (*P. marginidactylus*). Tawny-brown, the forewings varied with white cloud-like spots, whereof there is one on the outer margin towards the tip, and two on the inner margin; the apical and outer margins and a cloud-like central space extending from the cleft inwards, are of a dark brown colour; fringes whitish, brown at the outer and inner apical angles, and a small brown spot beyond the middle of the inner margin; underside and hindwings pale tawny-brown; legs white; thighs, anterior shanks, and apical third of the hind shanks, brownish on their outer sides. Wings expand 1 in. Occurs the latter part of June, on weeds growing along the borders of meadows (Fitch).

β. *nebulaedactylus*, Fitch, "New York Rept.," i., p. 849 (1854).—The cloudy plume (*P. nebulaedactylus*). Milky-white, the forewings clouded with pale tawny-brown, which colour occupies the basal portion, and forms two broad bands towards the apex, the last one often faint and not perceptible on the inner lobe; hindwings and their fringes, and the underside of both pairs, of the same pale tawny-brown colour; abdomen white, sides and stripe on the middle of the back pale tawny-brown; legs white. Wings expand 1 in. The tawny marks on the forewings are often obscure in old individuals, and sometimes wholly obliterated; still the species may be discriminated by the pale tawny colour of the hindwings, and the under surface of the fore ones contrasting with the whiteness of their upper surface. It is our most common species, occurring from the middle of June till the middle of July, in yards around dwellings, frequently entering open windows in the evening, being attracted by the light of the lamps (Fitch).

γ. *bischoffi*, Zell., "Stett. Ent. Zeitg.," xxviii., p. 333 (1867); "Verh. z.-b. Ges. Wien.," p. 317 (1873).—Seven ♂ specimens, some in very poor condition, from various parts of North America, which Schläger called *bischoffi*. They fully agree in the colouring of the wings and legs with *bertrami*, the principal difference being in the hindlegs, which, in the best examples, are quite plain and unicoloured, whilst in *ochrodactyla* and *bertrami* there is, at least at the tip of the first joint, a brown spot; the best examples, too, have the apex of the first lobe somewhat shorter, broader and less pointed than in these species (Zeller).

Later, Zeller wrote that it was nearest to *bertrami*, not only by the markings of the hind fibulæ, but also by the colour of the wings, the less pointed apex of the forewings, and by the unicoloured whitish hindlegs. The first specimens, he says, he received from Ohio, worn specimens being taken near Beverly in early July.

δ. *cervinidactylus*, Pack., "Ann. Lyc. Nat. Hist. New York," x., p. 266 (1873).—One ♂. Head with an unusually long and large tuft of scales projecting slightly beyond the second joint of the palpi. Wings shorter than usual, and broad in proportion; the split in the primaries quite short, the costal division very broad, the apex triangular; the apex of hinder division triangular, the outer edge very oblique, the hindermost division of the hindwings shorter and narrower than usual. Body and wings fawn-colour, vertex of head whitish-fawn, frontal tuft rather darker, antennæ annulated with whitish-fawn and brown, palpi brownish. Forewings fawn-brown, paler, subochreous along the inner edge, with a concolorous patch on the costa a little within the apex; a black dot just above and near the end of the split. Fringe concolorous with the wing. Hindwings with the first division spoon-shaped at the end, the third feather very short and blunt at end; the entire wings fawn-colour, with no dark brown scales in the fringe on third division. Legs whitish-brown; hind pair as far as middle of tibiæ, beyond, brown; spurs paler. Beneath, uniformly brown, thickly dusted with paler scales, with a large pale cloud on the costal division of primaries. Length of body, ·48 in.; of forewing, ·43 in. California (Edwards). This species may at once be known by its short hindwings, its uniform fawn-colour, and by the faded ochreous cloud near the apex of costal division of forewings. It is remotely allied to *P. pterodactylus* of Europe, but differs decidedly in the costal division of the forewings being much more acutely produced. Besides these, I have received, through Mr. Edwards, two other species of this genus from California, but too imperfectly preserved for description (Packard).

Egglaying.—The moths continued to pair almost every night for about a fortnight, but it was not until July 2nd, 1904, that eggs were observed; these may have been laid a day or two, but certainly not more, as a careful search had been instituted three days before. As suspected, the reason for delay was due to the inability to get yarrow plants with the flower-spike in the right stage of development. The ♀ s waited, therefore, until the flower-stem had run up, and the flower-head had opened out a little. The ova are placed either on the flower-head itself, or else on the small leaflets closely adjoining the flower-heads; on one head the ova have been very thickly laid, mostly on the top; in one instance, a cluster of about a dozen had been all placed quite closely together. The eggs commenced to hatch on July 18th, the egg-stage having lasted about 14 days (Bacot).

Ovum.—The eggs are of a pale but vivid green colour, slightly more opaque or cloudy-looking than usual in those of allied species, and, although smooth and shiny in appearance, they are without the highly varnished look that plume eggs so often have. In shape, they present a rather rounded oval for a plume egg, with low, but irregular, longitudinal ribs. These ribs are very low and vein-like, branching from one another. The length of the egg ·4mm.; thickness about ·2mm.; width about ·250mm. [Unlike the ova of many other species, they are so firmly cemented that it is difficult to detach them from the plant without injury, and then, owing to the plant-hairs sticking to them, they are very awkward to get into position for examination on the slide.] (Bacot). Eggs laid June 24th, 1881 (by an American example of *bischoffi*). Elliptical in outline and somewhat flattened; the longer diameter ·43mm., the shorter diameter ·3mm., the surface irregularly corrugated. When first deposited (?or on June 30th, 1881, when received) of a light cream-colour, or almost hyaline, with a glossy surface, turning after two days to deep flesh colour (Fish *teste* Fernald, *Pter. Nth. America*, p. 34).

Habits of larva.—In confinement, eggs laid in early July, 1904, had mostly hatched by July 18th, and the two flower-spikes, of the potted plants on which they had been deposited, showed signs of withering a few days later, when a careful examination, by splitting a portion of the stem lengthwise, showed that the pith of the part examined was riddled with the mines of the young larvæ, which had bored thereinto. These larvæ apparently entered at the axils near the flower-head, from which points they mined down into the stem. Others, however, do not, at first, attack the pith, many apparently feeding just beneath the surface in the juicy cambium layer, where they make small mined tracks; the favourite feeding-position would seem to be at the junction of a leafstalk with the stem; the damage done to the plant (compared with that done by the larva of *P. isodactylus*) appears to be very little, yet the plant shows the attack more than the foodplant of the latter species. The larvæ evidently hybernate young. They are rarely to be found in spring till mid-April, or even early May; they have then left their hybernacula, and have, apparently, entered the crown-shoot when very small, judging from the slight signs of entrance that are traceable; they then appear to clear out the crown as it grows, eating down into the shoot, and mining thus for a considerable distance. At this time (May 8th), no lateral shoots appear to have been attacked, and most of the larvæ appear to be in their penultimate instar. A later lot, found May 22nd, 1904, were then in their last instar, and their presence was very easily detected, compared with those of the earlier-found larvæ. In some cases, the affected shoots contained two larvæ, one working down from the crown in the usual way, the other having entered at an axil lower down the stem, and so mining below the first one (Bacot). It seems impossible to determine, from the stems of yarrow containing the early spring larvæ, where hybernation has taken place; all the young affected shoots received from Mr. Ovenden, and collected at Higham, May 15th, 1904, appeared to have been recently entered. An examination of the same plants in early April was quite fruitless, as there were no traces whatever of larvæ, nor could their place of hybernation be detected. One stem contained two larvæ; one about four inches from the top had entered at the point where a leaf left the stem; a narrow tunnel led to the centre of the stem, which was hollowed out and much stained, and in this was a larva between 4mm. and 5mm. in length. A second had bored into the growing point of the same stem, and had hollowed out a chamber of some 8mm. in length, which was also stained brown, and in this was a rather smaller larva, 4mm. in length, within 3mm. or 4mm. of the evident point of entry, which one would suspect, by the appearance of the point and the small quantity of material eaten, had taken place not more than five or six days, at most, previously. The other plants examined led one to suppose that the lowest hollows may have been formed in the autumn, and that the larvæ hybernate whilst exceedingly small, in a tiny hollow in the rootstock near the point of a bud, *i.e.*, from which a stem will spring the succeeding year (Tutt). Ovenden writes (*in litt.*) that the young larvæ of *G. pallidactyla* (observed May 15th, 1904) appear, when very young, to mine into the rising flower-stalk, feeding much like *P. gonodactyla*, entering sometimes near the root; when, however, the flower-stalk is well up, the better-grown larvæ appear to attack the head, but do not often seem to eat the heart out of the rising bloom-stalk until fullgrown. Sich writes: "On May 19th, 1904, I found five larvæ in stems of yarrow, at Chiswick, on a bank close to the river Thames. Two of these were in the penultimate instar. One of them, about to change its skin, was resting head upwards in the shoot of yarrow at the axil of a leaf. The larva chooses this angle (where the leaf springs from the stem) to enter the stem; it does not bore very deeply into the stem, preferring to come out and make a fresh hole rather than go down to the roots. The interior of the yarrow stem is rather soft, and very juicy, where the larva likes to feed. The excrement is thrown up in a heap at the entrance of the burrow. In the penultimate instar, the larva has dark purplish-brown stripes, which harmonise very well with the similarly coloured young stems of the yarrow. The youngest shoots of the yarrow are green, but they are often ornamented, when older, with deep red-brown lines. In the final instar, the larva loses all the purple colour, being at first of a somewhat olive tint, but, as it approaches maturity, it becomes paler and clearer green, and has a less solid appearance. One was fullgrown on May 21st, and another produced a parasite on the same day; the last of the larvæ spun up June 9th." Barrett says the larvæ feed in shoots of yarrow, apparently preferring the central shoot, and eating downwards towards the root, and Porritt adds that, when fullgrown, the larva leaves the shoot for pupation. The larva of *G. pallidactyla*, he says, is rather an external than an internal feeder, and its habits vary much from those of *G. ochrodactyla;* it feeds on *Achillea millefolium* and *A. ptarmica*, attacking the top of a young shoot, eating out the heart and feeding downwards for a short distance into the tender young stem, then leaves it to attack another young shoot in the same manner. Larvæ were to be found at Higham until May 26th, 1904, when most were fullfed (Ovenden); larvæ found fullfed on June 6th, 1900, pupated from June 12th, at Hazeleigh (Raynor); larvæ of various sizes from Tillycoultry, June 25th, 1885, fed up and pupated in due course, the first moth not emerging until July 24th, 1885 (Porritt). Kaltenbach, who first discovered the larvæ on the Continent, found them on May 15th, 1857, on *Achillea ptarmica*, at Aachen (Aix), living solitarily at first, between the united top leaves, but later boring into the stem, the delicate pink pith of which they eat out to the depth of an inch, the presence of the larva being very apparent from the black mass of frass which it turns out from an especially-made ejection opening (*Pflanzenfeinde*, pp. 347-8).

Larva.—*First instar* (somewhat grown, July 21st, 1904): Rather short, thick-set, with round, black, polished head, paler brownish scutellum and anal plates. Body pale yellow, of even thickness, the skin smooth and shiny with a peculiar yellow spotting, as if it had little globules of fat beneath it. No spicules visible with an 1-inch objective, hairs tapering; the incisions of segments clear and sharp; spiracles somewhat raised; the position of the tubercles seems quite normal for the group; on the meso- and metathorax i and ii are near together, i slightly in front and inside ii; iii and iv close together, v alone, in usual position below. The hairs of the same colour as the body, very indistinct. The positions of the tubercles on the abdominal segments appear to be as usual (but the light is not good enough for a detailed description) (Bacot). *Penultimate instar* (May 8th, 1904): Short, stout, heavy, of the *Platyptilia* (*gonodactyla*) type. Head of medium size, rounded, of a pale colour. Length (when crawling) 9mm. to 10mm.; width slightly exceeds 2mm.; a rather longer, more marked, tapering occurs towards anus than towards head; roughly cylindrical, with a small but distinct lateral flange; when at rest or feeding, it retracts itself considerably, the tapering being then short and abrupt. There are at least 3 subdivisions to meso- and metathorax; and at least three, or possibly four, to each abdominal segment, two small anterior ones, and another small posterior one after a large central one, but the larva is so active that this will need confirmation. The segments are distinct, and the incisions clear, but the latter are not deep, nor are the segments greatly swelled as in some of the species. In its general outward appearance, the larva is not unlike a small larva of one of the Satyrids; this effect is chiefly due to the alternate dark and light stripes, with which it is coloured, for of course, the small neck-like prothoracic segment, and finely tapered anus, with its two prolongations, are wanting. Head rounded, tolerably smooth and shining, but hardly polished; colour pale semitransparent yellow, with dark brown mouthparts, and a dark brown or black patch surrounding the ocelli; it can be partly retracted into the prothorax; hairs on head weak and pale; the prothoracic shield is chitinous in appearance, and polished; the anal plate is much rougher, as regards surface; both are of the same pale yellow colour as the head; the body is pale whitish, with just a tinge of yellow in it, there is a dark mediodorsal stripe that ends just short of the scutellum; a similar subdorsal stripe, and a very broad lateral one that encloses the spiracles within its area; below this band, the lateral flange is white, and there is another narrow stripe of the same colour just above the level of the prolegs, with a few scattered dark markings below it; the ventral area is entirely pale; both the legs and prolegs are pale, the latter rather long, considering that the larva is practically a burrowing one. The skin presents a fine coat of minute spicules, and also a coat of small stiff secondary hairs that might almost be called bristles, these hairs are very numerous in comparison with the scattered secondary hairs of the exposed feeders; both the hairs and the spicules assist in heightening the contrast of light and dark stripes, as they are pale on the former, and dark on the latter. The primary setæ are quite primitive in character, save that their bases are somewhat large and conspicuous; there are no raised skin areas, and no tendency to form warts. It is remarkable that all the primary hairs have their bases situated on the pale areas. The bases of the setæ are black-rimmed, while the hairs themselves are pale and simple. The position of the tubercles on the meso- and metathoracic segments is—i and ii some little way apart (further, apparently, than in *P. gonodactyla*), on the mesothorax set almost exactly transversely, on the metathorax very slightly obliquely, with i slightly to the front; iii and iv are two setæ some little distance apart, the lower hair being the larger; below these, and slightly posterior, is a subprimary seta, while still lower, but almost in line beneath, or slightly anterior to iii and iv, are two more hairs, a strong upper v, and a weak lower vi; above the leg, but below the flange, are two hairs, a large posterior and a smaller anterior, some little distance apart, these form tubercle vii. On the abdominal segments, i and ii are set trapezoidally, and well apart, ii being the larger, a subsegmental division coming between them; iii is directly above the spiracle; the prespiracular point has, for it, a large and distinct plate at its base, and is rather higher than usual. Below the spiracle, iv and v are situated close together, v a little above iv; both are rather small; there is a triangular group of three hairs well below iv and v, a large posterior and two small anteriors; these may represent vi and another subprimary tubercle; below these, again, is another group of three, probably the basal group vii. The spiracles are large, with broad flat black rims; as usual, those on the prothorax and 8th abdominal segment are larger than the others (Bacot). *Final instar* (nearly fullfed, May 18th, 1904): Stout, short, about 11mm. long, 2mm. wide (reminding one much of the larva of *P. gonodactyla*); green, with no pink tinge, of a dull sage-green tint with white bands, looking as if enamelled; these are (1) a broad subdorsal band (with i and ii); (2) a narrow lower one above, but almost including, iii; and (3) a lateral one below spiracles and on flange; along these white bands, the secondary hairs seem absent; really they are colourless on these, and black on the dark areas; the tubercles are small, with single, short, black hairs; the prolegs on short props (Chapman). *Another spun up for pupation* (May 22nd, 1904): Length 12·5mm., the greatest width about 2·75mm.; segments strongly marked, swollen, but subsegments not at all distinct. In shape, the body is cylindrical, and tapers very gradually towards either end, the tapering only becoming noticeable at mesothorax and 6th abdominal segment. The prothorax small (head not visible in this position); anus bluntly pointed; the mesothorax large and long in comparison, but both the metathorax and 1st abdominal short; the 3rd, 4th, 5th, 6th, and 7th abdominals fairly long; they then tail off, both as regards girth and length. Colour very different from that of last instar; the skin appears smooth and shining, of a bright but pale green, with a white dorsal area, and clear green mediodorsal stripe; there is also a broad and strongly developed white lateral band. The prothoracic plate well marked, but coloured much the same as the rest of the body; the anal plate not so distinct. The head is still pale, with black ocelli; the true legs and prolegs pale-coloured; both spicules and secondary hairs present, and, as in the earlier instar, the latter are dark, with dark bases, on the green areas, but pale, and almost colourless, on the white stripes. The primary hairs are long and tapering, with small black buttons at bases. There is no trace of any accessory hair behind spiracle (Bacot).

Variation in colour according to age of larvæ.—The larva is of the usual Alucitid form, though, perhaps, a little more slender than in some species; body cylindrical, stoutest in the middle, tapering towards the extremities; head small and polished, considerably narrower than the prothorax; segmental divisions well-defined, the skin rather glossy. When about *a quarter of an inch long*, the ground colour is pale greyish-olive, but this is almost hidden by dark purplish-brown dorsal and subdorsal stripes, which give the larva a very dark appearance; head very pale straw-colour, marked with smoky-brown; the ocelli black, and the mandibles reddish-brown; frontal plate and anterior legs polished black. When about *three-eighths of an inch* long, it has become considerably lighter in colour; the ground colour is glaucous-green, the dorsal and subdorsal stripes purple, but more interrupted than, and not so wide as, in the earlier stage; head of the same pale straw-colour, but not so much clouded with darker, though the ocelli are still black, and the mandibles reddish-brown; the frontal plate is gradually becoming pale like the head, the black being confined to the front in some specimens, in others to a black edging, more or less broken all round. Ground colour of the ventral area and the prolegs uniformly glaucous-green, the anterior legs now ringed with black only. *Fullgrown* (about half to five-eighths of an inch), the larva has a still paler appearance. Ground colour bright pea-green; head very pale straw-colour, faintly tinged with green; the large ocelli intensely black, and consequently very conspicuous; the mandibles reddish-brown; the frontal and small anal plate of the same bright green as the ground colour; the dark green (slightly brownish anteriorly) pulsating dorsal vessel forms the dorsal stripe; between it and the spiracular region are two greyish-white stripes, on which the small black tubercular spots may be seen; below the spiracles is a still cleaner and more conspicuous white stripe; spiracles black. Ventral surface uniformly of the same bright green as the dorsal area; at the front, and at the base of each anterior leg, is an intensely black spot; the prolegs are finely margined with black. It will be seen by comparing this description with that of Buckler's description of the larva of *G. ochrodactyla* (*dichrodactylus*) (Buckler's *Larvae*, ix., p. 338), that both species correspond in having three forms of colouring in the different stages of growth, and the resemblance of the adult larvæ particularly shows the close relationship of the two species, whilst the differences, apart from the foodplants, are sufficiently wide to separate them (Porritt).

FOODPLANTS.—*Achillea millefolium* (Rössler), *A. ptarmica* (Kaltenbach), [*Senecio aquaticus* (Hodgkinson *teste* Eales),] *Senecio jacobaea* (Reid), [*Artemisia vulgaris* (Sorhagen), *Artemisia campestris* (Walsingham)].

PUPATION.—The full-grown larva of *G. pallidactyla* (like that of *G. ochrodactyla*) leaves the shoot in which it has fed, and, forming a silken pad, attaches itself for pupation to a stem or other part of the plant; one was found that had pupated in a shoot of yarrow (Chapman); Porritt also notes that it leaves the shoot in which it has fed, and affixes itself by the tail to the outside of the stem or leaf, etc. A pupa was found attached to a stem of *Galium verum*, growing near *Achillea millefolium*, on July 11th, 1899, at Hazeleigh (Raynor); a pupa fastened to a grass-culm on June 8th, 1894, at Benfleet (Whittle); a pupa found on May 26th, 1904, spun up, fully exposed, on the underside of a young yarrow leaf, attached by the cremaster to a silken pad, the head upwards, standing normally close against the midrib, except that the head projects slightly; in tint not very unlike that of the main rib of the leaf (Ovenden). The larva spins a silken pad, and then seems to rest with the head turned inward ventrally; after being fixed in position, it shows the fine and very numerous transverse striations (that are frequently so marked a feature of plume pupæ) through the skin of the dorsal area (Bacot). A pupa found on a stem of *Artemisia campestris* (no *Tanacetum* near) (Jordan, *Ent. Mo. Mag.*, xviii., p. 76). The pupa, at first green, later changing to earthy-brown, was found suspended freely, without a cocoon, by the anal end, attached to the surface of a shoot of *Achillea ptarmica* (Kaltenbach).

PUPA.—The pupa is of a fine, delicate, though fairly bright, green colour, with finely projecting beak; the mesothorax somewhat prominent, and remarkable for its double, white, dorsal ridge; the wings finely striated with white, and much swollen at the inner margin, where the hindwing projects; there is a well-developed supra-spiracular white line extending from the base of the wing to the anus; whilst the abdominal segments are also lined with white longitudinally, and a mediodorsal linear depression extends from the mesothorax to the anus, an extension of the more highly-developed depression between the two prominent ridges of the mesothorax; the prominent apex of the beak, the mesothorax, and the anal points, tinged with reddish-brown [Tutt, May 27th, 1904, from pupa found at Higham.] Pupa 13·5mm. long, 2·5mm. wide at mesothorax, and 2mm. at the 4th abdominal. Seen dorsally, there is a great deal of the bulbousness of thorax noticeable in many "plume" pupæ; seen laterally, the beak in front, and the dorsal ridge or crest, take away a good deal of this. The pupa is of a delicate green tint, with reddish-pink outlining the ridges on the meso- and metathorax; a darker shade under the beak; the head dorsally, prothorax, and part of mesothorax white; there is also a white lateral line as in the larva. Dorsal line darker. The spiracle is on an interrupted paler line; there is a narrow continuous one above; then a broader, darker band; then a very broad pale one besides the dorsal line, divided, however, into two by a slender dark line; below the white lateral line is a darker one, a pale one, a very narrow dark one, then pale; the wings and appendages pale, the hollows darker; the neuration marked by raised white ribs; some of the hollows between these, at the dorsal marginal portion, pinkish-olive. The beak projects beyond the ventral line, but its lower margin curves regularly to the face and maxillæ (Chapman, May 26th, 1904). [The pupa from which the following description is made has failed to free the antennæ successfully from the head, and they have not fallen into their proper grooves, and the pupal head is bent forward, so that the well-developed central spine, or nose-horn, which stands out as a stout beak, projects ventrally, instead of directly, forwards, as it probably ought.] The pupa is green, with white markings and over-colouring. It is quite smooth, so that even tubercular bristles seem to be quite absent. At the 3rd and 4th abdominal segments it is fairly cylindrical, tapering slightly, and then more rapidly, to the cremaster, which consists of the forward and terminal groups of fine hooks, each group rather small. The only sculpturing, beyond the pronounced beak, is a strongly marked ridge on either side of the dorsum of the mesothorax, the median line being at the bottom of a groove between them. The median line is an indication of a suture. The ridges are white, conspicuous on the green ground colour, approximate as they proceed backwards, where they are broader, and tinted with pale reddish-brown; at the posterior margin of the segment they do not quite meet, the median line intervening; or they might be described as meeting without uniting. On the prothorax there are no such ridges, but the surface is waved upwards where they would have been, if present. On the metathorax, the same ridges are present, just meeting at its margins, but leaving a hollow between them at the middle of the segment; they are here broad, flat, white, with a brownish wash at their margins. On the 1st, 2nd and 3rd abdominal segments the same ridge is present, but fainter on each, till, on the 4th, one must say it is absent, though some coloration, etc., suggests that it really proceeds along all the segments in an evanescent form; on the 1st, 2nd and 3rd abdominals the ridges are broad and flat, further apart on each segment, and on its hinder margin, where they form a low prominence. To return to the thorax, where, only, they are a prominent feature, each is divided by transverse lines into a slightly beaded structure, and, together, they form a great prominence on the posterior margin of the mesothorax. The same transverse lines, that form the beaded structure on the thorax, exist all round the abdominal segments, as far back as the intersegmental membrane, and are eleven or twelve in number. On the 2nd abdominal segment, they are about twenty on the segment proper, and ten or twelve on the posterior subsegment that appears to correspond with the intersegmental membrane of free segments. A conspicuous white stripe passes subspiracularly along the abdomen, and is on a slightly raised surface. Green lines exist dorsally, subdorsally in a slight hollow below the dorsal ridges, and a slightly whiter line below this. The spiracles are faintly raised rings with hardly darker margins. The wings have the nervures well marked in whitish raised lines, rather broad and rounded; all the nervures shown are simple, except the median, which has three branches, and what looks like the subcostal, but is really, no doubt, one portion of the radial, which has two. The margin beyond "Poulton's line" is well marked, and reaches as a fine point to the apex just beyond the edge of the 3rd abdominal segment. The 3rd legs extend beyond the margin of the 4th abdominal, and the 2nd legs are a little shorter. The antennæ do not reach half way, but, not being in their grooves, their relations are not correctly shown. [Described June 14th, 1899, from pupa found wild by Raynor, near Maldon.] The pupa is a little over ·5 inch long, and exactly of the shape of that of *G. ochrodactyla* as described by Buckler (*anteà*, p. 232), though, perhaps, a little stouter, as it can hardly be called "slender," the word applied by Buckler to that species. It has a longish beak in front, projecting at a slight angle downwards from the head, pointed at the tail; the wing-cases of moderate length, well-developed, and the ends of the leg-cases projecting free from the abdomen. The colour is bright pale green, dorsal line darker green, edged on the thorax with white; beak white above, rust-colour at the sides; there is also a conspicuous streak of this rust-colour on the hind part of the thorax, and the same colour also appears (but more faintly) on the abdominal point, and at the tips of the leg-cases; subdorsal line dark green, lateral line white. Ventral surface pale green with darker green lines, and the wing-cases with whitish rays (Porritt).

Time of appearance.—The species is single-brooded, occurring in June and July, and, in late seasons, odd specimens are occasionally taken in August, but, on the whole, the species is considerably earlier than *G. ochrodactyla*, which rarely occurs before July, and frequently is found in August; Reid also observes that, in Aberdeenshire, *G. pallidactyla* occurs in June and July. This time is apparently conditioned by the flowering of the respective foodplants. In America, Fernald notes it as occurring on June 24th, in Maine; June 10th-27th, in Massachusetts; June 23rd to July 17th, in New York; May, in Missouri; June 11th-16th, in Colorado; June 1st-18th, in California. Stange observes that, near Friedland, the imago appears to fly somewhat earlier than *G. ochrodactyla*: in the Hamburg district, it occurs in June (Sauber), also in Pomerania (Büttner); in early July, at Aachen (Kaltenbach), in Hanover in July (Glitz), and at Göttingen, in July (Jordan); whilst at Wiesbaden, June and early July (Rössler), and at Waldeck, mid-June to beginning of July (Speyer), are also recorded. In France, Duponchel gives June for the Dept. du Nord, and Leech found it in Normandy, at Tancarville, June 14th-16th, 1890. Teich gives from June 17th to July 22nd, in the Riga district. Exact dates available are as follows: Bred June 23rd, and following days, from larvæ found June 3rd, 1860, at Wiesbaden (Rössler). June 17th, 1829, at Portland (Dale); July 18th-20th, 1872, at Witherslack; July 19th, 1872, at Grange (Hodgkinson); July 1st-20th, 1874, at Low Coniscliffe; July 13th, 1878, at Witherslack (Sang); July 21st, 1876, at Witherslack (Threlfall); July 10th, 1877, at Witherslack (Hodgkinson); imagines fairly common, July 15th, 1878, at Brandon (Bower); July, 1879, at Dutton (Hodgkinson); July 4th, 1883, at Deal (Tutt); imagines, early July, 1883, common, at Dover (Coverdale); July, 1884, at Mill Hill (South); July 21st, 1885, bred from Tillicoultry (South); bred July 24th, 1885, and following days, from larvæ from Tillicoultry (Porritt); July 1st-4th, 1885, at Deal, (Tutt); July 4th, 1886, at Linwood, near Paisley (Mackay); July 21st, 1886, in the Isle of Purbeck (Bankes); June 27th, 1887, at Sanderstead (Sheldon); July 12th, 1887, at Corrie (Dalglish); July 14th-16th, 1887, at Westcombe Park (Tutt); July 16th, 1887, common, at Askham Bog (Porritt); June 26th, 1889, at Maidenhead (Tutt); June 28th to July 12th, 1889, at Brentwood (Raynor); July 6th, 1890, at Lochwinnoch (Dalglish); July 14th, 1890, at Bundoran (Johnson); July 14th, 1890, at Brentwood (Raynor); August 10th, 1890, at Shoeburyness (Whittle); July 4th, 1891, at Strangford Lough (Watts); July 5th, 1891, at Brentwood (Raynor); July 9th, 1891, in the Isle of Purbeck (Bankes); early July, 1891, abundant at Newbury (Kimber); July 17th, 1891, at Leigh (Whittle); June 23rd, 1892, at Wareham (Bankes); July 10th-27th, 1892, at Aldeburgh (Cruttwell); July 15th, 1892, at Mauchline (Dalglish); July 27th, 1892, at Benfleet (Whittle); July 30th, 1892, at Witherslack (Arkle); imagines, June, 1893, at Buckerell (Riding); June 26th, 1893, at Giffnock (Dalglish); July 7th, 1893, at Aberdeen (Horne); July 5th-22nd, 1894, at Panton, and July 22nd, 1894, at Brentwood (Raynor); second week in July, 1894, at Stonehaven (Dalglish); July 22nd, 1894, at Canvey (Whittle); June, 1895, at Glen Lochay (Morton); June 20th, 1895, at Giffnock; June 30th, 1895, at Crookston (Dalglish); July 10th, 1895, at Canvey (Whittle); June 26th, 1896, at Crookston (Dalglish); July 6th, 1896, at Corsemalzie (Gordon); July 1st-9th, 1897, at Canvey (Whittle); July 9th, 1897, at Cromer (McIntyre); an imago, July 13th, 1897, at Buckerell (Riding); July 17th, 1897, at Crookston (Dalglish); July 11th, 1898, at Bushey Heath (Barraud); July 12th, 1898, at Danbury (Raynor); July 20th, 1898, at Leytonstone (McIntyre); imago, July 30th, 1898, at Chiswick (Sich); July, 1899, at Boscombe (Robertson); July 1st, 7th and 12th, 1899, at Hazeleigh (Raynor); July 21st, 1899, at Benfleet (Whittle); an imago, July 28th, 1899, at Chiswick (Sich); June, 1900, at Enfield (Edelsten); June 21st, 1900, at Bowling, and June 29th, 1900, at Crookston (Dalglish); July 24th, 1900, at Shoeburyness (Whittle); July 15th, 1901, at Northey Island (Raynor); July 17th, 1901, at Newton (Dalglish); August, 1901, at Ipswich, August 2nd, 1901, and following days, at Yoxford (Pyett); August

12th, 1902, and July 17th, 1903, in the Isle of Purbeck (Bankes); June 28th, July 5th, 23rd, 1903, at Keswick (Beadle); June 30th, 1903, in the Norfolk Broads (Edelsten); July 12th, 1903, in the Isle of Purbeck (Bankes); July 21st, 1903, at Hazeleigh (Raynor); mid-July, 1903, at Mucking (Burrows); bred June 25th, 1904, from larva found June 8th, 1904, at Benfleet, others captured on July 7th, 1904, at North Shoebury (Whittle); July 6th-13th, 1904, at Witherslack (James); July 15th, 1904, in the Isle of Purbeck (Bankes); July 6th-28th, 1905, at Great Wakering, July 15th. 1905, on Thundersley Common (Whittle); July 14th-23rd, 1905, in the Strood district (Ovenden).

Habits.—The imago is very difficult to find and to dislodge from its hiding-places during the daytime, but may be occasionally disturbed in the late afternoon from among its foodplant. Towards evening it is readily made to stir, and is to be seen later hanging about on the flowering shoots of yarrow. Bower observes that it was flying commonly in the late afternoon in mid-July, 1878, at Brandon, among *Achillea millefolium*; Bankes notes it as being on the wing, in the Isle of Purbeck, in the evening, amongst rough herbage, where *A. millefolium* is plentiful, and observes that it continues to fly till about dusk, and perhaps later; whilst in mid-July both sexes have been taken on the wing at 8.45 p.m. It is recorded as flying at dusk about the foodplant at Witherslack (James), at Sanderstead (Sheldon), at Buckerell (Riding), at Boscombe (Robertson), at Pitcaple (Reid), near Sheerness (Walker). Whittle notes that, from July 6th-28th, 1905, he found it flying earlier in the evening, where there is a good growth of milfoil at Great Wakering, whilst, later, an occasional example was taken at sugared flowers of milfoil or wild carrot. Barrett observes that the moth hides by day in the tufts of its foodplants, keeping very closely concealed, and, if shaken out, is hardly to be induced to more than scramble away to another place of concealment; at early dusk it flies gently about, and is readily seen. Miss Kimber observes that it only flies after dusk, and that, in early July, 1891, in a piece of swampy ground near Newbury, hundreds of specimens were seen flying at night, whilst hours of laborious beating in the daytime failed to disturb a single specimen from among the heath, rushes, and yarrow. It has been taken at light at Panton (Raynor), at Ipswich (Pyett), at Bushey Heath (Barraud), at Boscombe (Robertson), at Dutton (Hodgkinson), at Norwich (Barrett). The imagines pair during the late evening and night (Bacot). Sorhagen says that on one occasion he found a pair of *G. pallidactyla* (*bertrami*) *in copulâ* on *Artemisia vulgaris*.

Habitat.—The habitats of this species are very varied. We have taken it on sandy banks by the roadside, between Deal and Sandwich; on waste ground that had been shut in for building-purposes, and that became covered with yarrow, in 1887, at Westcombe Park, where it was most abundant; a few plants of yarrow that had been allowed to grow in the garden were also attacked. It abounds in the yarrow plants growing on the waste places edging the path by the side of the Thames, from Maidenhead to Cookham, and also on the waste places by the side of the road at the foot of the Leas at Folkestone. It is, like *Platyptilia gonodactyla*, essentially a species of waste ground, but confined to those places where *Achillea millefolium*, or *A. ptarmica*, is the prevalent plant, whilst *P. gonodactyla* is confined to places where *Tussilago farfara* runs rampant. Barrett says that it is common among its foodplants on the rough ground on which they grow, very often in open spaces at the sides of lanes and roads, also fields, railway embankments, hillsides, rocky places, and quarries, in all the southern and eastern counties, particularly those along the coast. Whittle notes it as occurring on the river-wall at Shoeburyness. Beadle observes that it is common on the marshes at the foot of Derwentwater, and at the head of Bassenthwaite, whilst Miss Kimber records it as very abundant on a piece of swampy ground at Newbury. It occurs on the banks of a small stream near Aberdeen (Horne), on a railway bank at Mill Hill (South), on the railway banks near Hartlepool, also in Hesleden Dene (Gardner), and on the edge of a pasture field at Buckerell (Riding). Bankes notes (*in litt.*): "The imagines have occurred to me in four different spots inside, and one just outside, the Isle of Purbeck. The specimens have been taken on a variety of soils, including limestone, stiff clay, and gravel." Near Carlisle, it occurs on grassy borders of moors amongst yarrow (Day). Sorhagen says that, at Hamburg, he captured *G. pallidactyla* (*bertrami*) on the same ground where *G. ochrodactyla* occurs, the former, however, always resting on *Artemisia vulgaris*, whilst the latter confines its attention to *Tanacetum*. At Wiesbaden, the insect is common on *Achillea ptarmica*, but on the borders of woods it appears to frequent *Achillea millefolium* (Rössler). Near Friedland, it occurs in a sandy woodland field amongst *A. millefolium* (Stange).

Localities.—Widely distributed, but locally confined to its foodplant, throughout the British Isles. Aberdeen: Aberdeen, Pitcaple district (Reid). [Anglesea (Barrett).] Antrim: near Belfast (Watts). Armagh: Bundoran (Johnson). Ayr: Mauchline (Dalglish). Berks: Newbury (Kimber), Maidenhead (Tutt). Bute: Corrie, Arran (Dalglish). Cambridge: Cambridge (Stainton). Cavan: Farnham (Kane). Cheshire: Bromborough Pool, Wirral (Ellis), Chester (Newstead), Holford (Day), Birkenhead (Stainton). Clackmannan: Tillicoultry (South). Cork: Glandore, Ummera Woods, near Timoleague, Courtmacsherry (Donovan), Cork (Carpenter). Cornwall: Penzance (Marquand). Cumberland: Carlisle (Day), Keswick (Beadle), Lake district (Stainton). Derby: Derby district (Garneys). Devon: Buckerell, not common (Riding). Donegal: Coolmore (Johnson). Dorset: Isle of Purbeck, Wareham (Bankes). Down: Strangford Lough (Watts). Dublin: Howth Hart), Kingstown, near Lucan (Kane). Dumbarton: Bowling (Dalglish). Durham: Darlington (Stainton), Coniscliffe, near Darlington (Sang), Hartlepool, Hesleden Dene (Gardner). Edinburgh: near Edinburgh (Barrett), Kirknewton (Evans). Essex: Aveley (Bacot), Brentwood, Danbury, Hazeleigh, Northey Island (Raynor), Leigh, Southend, Shoeburyness, North Shoebury, Canvey, Benfleet, Great Wakering, Thundersley Common (Whittle), Leytonstone (McIntyre), Colchester (Harwood), Mucking district (Burrows). Fife: Otterston (Evans). Galway: Clonbrock (Dillon), Connemara—Glendalough (Kane). Glamorgan: common (Barrett). Gloucester: scarce, Almondsbury (Hudd), Bristol (Stainton). Hants: Isle of Wight—Ventnor (South), Bournemouth, Boscombe (Robertson), Southampton (Buckell). Herts: Bushey Heath (Barraud), Hailey, near Hoddesden (Bacot). Isle of Man: Maughold, Ramsey (Cassal), Kent: Dover (Coverdale), Deal, Westcombe Park, Strood, Folkestone (Tutt), Higham (Ovenden), near Sheerness (Walker), Darenth Wood (Wood), Alkham, Pembury (Stainton). Kincardine: Stonehaven (Dalglish). Lanark: Carluke (Morton), Newton, Glasgow dist. (Dalglish). Lancashire: Grange, Dutton (Hodgkinson), Manchester (Stainton). Lincoln: Panton (Raynor), Ashby, near Brigg (Cassal). Middlesex: Hendon, Mill Hill (South), Enfield (Edelsten), Chiswick (Sich). Norfolk: King's Lynn (Atmore), Cromer (McIntyre), Norfolk Broads (Edelsten), Norwich (Barrett), Brandon (Bower), Thetford (Walsingham). Northumberland: Newcastle-on-Tyne (Stainton). Pembrokeshire: common (Barrett). Perthshire: Dunblane (Henderson), Glen Lochay (Morton). Renfrew: near Paisley (Dunsmore), Linwood (Mackay), Giffnock, Crookston, Lochwinnoch (Dalglish). Roxburgh: Laurieton, near Jedburgh (Elliot). Sligo: Sligo (Russ). Somerset: near Portishead (Hudd). Stirling: Alva (Porritt). Suffolk: Aldeburgh, Lowestoft, Kessingland (Cruttwell), Yoxford, Ipswich (Pyett). Surrey: Sanderstead (Sheldon). Sussex:

Hastings district, rare (Bloomfield). WATERFORD: Dunmore (Kane). WESTMORLAND: Witherslack (Hodgkinson). WIGTOWN: Corsemalzie (Gordon). YORK: Askham Bog, common (Porritt), Scarborough, York (Stainton), Skipwith (Ash), Doncaster district (Corbett), Hexthorpe (Warren), Staddlethorpe, near Howden (Prest).

DISTRIBUTION*.—Northern Europe except the Polar regions; Germany, Batavia, Anglia, Alps of Styria and Carinthia, Hungary (Rebel). AMERICA: Canada, Maine, New Hampshire, Massachusetts, New York, Pennsylvania, Colorado, California, Oregon (Fernald). AUSTRO-HUNGARY: Tyrol district—near Campiglio (Rebel), Hungary—Sopron, Nagyág (Aigner), Upper Styria (Mann), Carinthia—Wolfsberg (Höfner). BELGIUM: very local—Velthem, Uccle, Verrevinckel (Crombrugghe). BULGARIA: Sophia (Rebel). FRANCE: Normandy—Tancarville (Leech), Dept. du Nord (Duponchel). GERMANY: Pomerania, common wherever the foodplant occurs (Büttner), Mecklenburg—Friedland (Stange), Hamburg—near Lockstedt (Sauber), near Hamburg (Sorhagen), Hanover—Hanover (Glitz), near Göttingen (Jordan), Rhine-Provinces, near Linn (Stollwerck)†, Aachen (Kaltenbach), Hesse—Nassau, Wiesbaden (Rössler), near Cassel (Ebert), Waldeck (Speyer). RUSSIA: Riga district (Teich), St. Petersburg district (Erschov and Feild). SCANDINAVIA: Norway—Bergen, Christiania, Hamar (Jordan), Scania, Blekinge, Småland (Wallengren).

COMPARISON OF THE PLATYPTILIINÆ, EUCNEMIDOPHORINÆ, AMBLYPTILIINÆ, AND MARASMARCHINÆ.

The *Platyptiliinae* are essentially a subfamily with internal-feeding larvæ, recognised, in the larval stage, by the absence of the depression of the prothoracic scutellum; by an abundance of unjointed secondary skin-hairs, in addition to the usual skin-points or spiculæ; the presence of simple, tapering, primary setæ; the arrangement of tubercles i and ii in a transverse line on the meso- and metathorax; the separation of setæ iv and v although on a common basal plate; the absence of the accessory postspiracular tubercles, and the unraised character of the spiracles. The pupal characters are as distinctly marked, inasmuch as there is a poor development (or absence) of the anterior portion of the cremastral hooks, while the pupal skin is smooth, the setæ microscopic and clubbed, the nose-horn well-developed, the dorsal ridge prominent, and the posterior portion of the abdominal segments rough dorsally. The *Eucnemidophorinae*, *Amblyptiliinae*, and *Marasmarchinae*, on the other hand, are peculiar, in that they have larvæ that are internal-feeders in their earliest stadia (*i.e.*, to the hybernating period), more or less external and exposed feeders in their later stadia (*i.e.*, after hybernation); the depression of the prothoracic scutellum is generally well-marked, often strongly pigmented; the secondary skin-hairs are variable in size, markedly knobbed, or swollen, at tip; the primary setæ smooth, blunt or swollen at, or just before, tip; the setæ accompanied by secondary hairs, giving rise to incipient wart-structure; those of i and ii conjoined on either side on meso- and metathorax; of iv and v also with conjoined bases; tubercle vi usually single-haired; the accessory postspiracular tubercles usually indicated, or more or less weakly developed; the spiracles rather raised. The pupal characters are as characteristic; both portions of the cremaster are well-supplied with hooks; the skin, though smooth, bears well-developed primary setæ (almost of the same form as those of the larva); the nose-horn evanescent, or absent; the dorsal ridge variable (evanescent

* The species has not been distinguished from *G. ochrodactyla* by most continental lepidopterists; all, therefore, except the most recent lists combine the two insects, and one cannot discriminate the localities belonging respectively to *G. pallidactyla*, Haw., and *G. ochrodactyla*, Hb.

† See also Stollwerck's list (*anteà*, p. 236) for localities of *G. ochrodactyla*.

in *Eucnemidophorus*, fairly-developed, and carrying strongly-developed halbert-like processes, in *Amblyptilia* and *Marasmarcha*). In the imaginal characters, the genera *Eucnemidophorus* and *Amblyptilia* present all the naked-eye appearances of the Platyptiliines, particularly in the shape of the forewing and the dark scale-tuft on the 3rd plumule of the hindwings, whilst, in these respects, *Marasmarcha* has undergone considerable variation in the direction of the Oxyptilines.

The pupæ of *Marasmarcha* (*lunaedactyla*) and *Amblyptilia* (*cosmodactyla*) appear to be very similar, inasmuch as they show a marked development of the dorsal ridge, but Bacot says that these processes, carrying the tubercles, are really different structurally, and have probably reached their present state of perfection, independently, from a primitive common ground ; this is particularly evidenced by the differences in the character of the processes, on the segments following the 3rd abdominal, being quite as marked as in the more highly-developed ones. Chapman observes that the essential structural difference between the pupæ of the two genera is that, in that of *Marasmarcha*, there is an inner posterior set of humps like those of some Oxyptilid pupæ. He thinks that the pupal armature of these may have arisen in common, whilst that of *Amblyptilia* may be an earlier stage of the same development (branching off a little in another direction), but is more probably a separate, though similar, development. Bacot further adds that the pupa of *Amblyptilia* is nearer the Stenoptiliines in slenderness and shape, whilst that of *Marasmarcha* is less slender, and has a less marked dorsal band, inclining rather to the Oxyptilid form.

As to the differences in the larval characters, Bacot observes that the larvæ appear to show greater divergences than the pupæ, the secondary skin-hairs in *Marasmarcha* being few in number compared with those in *Amblyptilia*, although both vary much, whilst the depressed scutellar spots are not pigmented in the former as in the latter, that of *Amblyptilia* falling in closely, in this respect, with the Stenoptiliines, *Marasmarcha*, on the other hand, being apparently rather more distant therefrom. The amount of wart-development places *Amblyptilia* rather nearer the *Adkinia* species (*bipunctidactyla* and *zophodactylus*), whilst that of *Marasmarcha* runs nearer that of *Stenoptilia* (*pterodactyla*), possibly due to a parallelism in the larval habits as exhibited in the amount of external-feeding. Chapman says that too much stress must not be placed on the number of secondary hairs met with in the larvæ of *Marasmarcha*, because some have hardly any, whilst others have quite as many as the larvæ of *Amblyptilia*.

We have above referred to the pupal dorsal ridge (or ridges). These are peculiar structures, found only in the *Platyptiliidae*, double in character, inasmuch as there is one on either side of the dorsal line, arising on the prothorax, and passing backwards as far as tubercle ii on the 3rd abdominal segment, and then abruptly ceasing. They approach the middle line most nearly at the posterior border of the mesothorax, and are, perhaps, best seen in the genus *Gillmeria*; they are almost evanescent on the abdominal segments of *Platyptilia isodactylus*, especially of the summer brood. In *Marasmarcha lunaedactyla*, and the *Amblyptiliae*, they terminate in the great halbert-shaped processes of the 3rd abdominal segment, as in the other groups, the similar processes on the following segments being isolated, and without any ridge connecting each with the next. That the subdorsal ridges on the last segments, running down into the cremastral pen, are a reappearance of the same structure, is possible, but certainly doubtful; there is never any continuous ridge from the forward to the posterior portion. In the Agdistid pupæ some traces of a similar structure exist, at least on the thorax, and are marked on the mesothorax of *Herbertia tamaricis*, for example, but they appear to be more correctly regarded as the pupal representatives of the larval horns and processes, as connecting ridges are wanting, as in the after-warts of the pupæ of *Amblyptilia*. When we turn to the Alucitids, we find structures that at first sight appear to be these dorsal ridges, as, for example, on the pupa of *Orendenia septodactyla* (*lienigianus*), where the fan of hairs on the mesothorax, especially when seen from above, has all the aspect of such a ridge; when looked at laterally, it is seen, however, to continue so far as hairs arise, *i.e.*, it is really a specially formed wart, but it does not continue beyond, or run from, segment to segment. No doubt these fan-shaped warts, the after-warts of *Amblyptilia*, etc., are all expressions of a readiness of the skin structures to assume special forms, of which the dorsal ridges are one; no doubt also, in a sense, they are similar responses of this readiness to similar stimuli; but it seems highly probable that they are separate responses in separate cases, and not variations of one original ancestral development (Chapman).

So far as the three constituent groups included in this discussion are concerned, their general characters suggest them not as a homogeneous group, like the Platyptiliines or Stenoptiliines, but as separate sections. This comes out particularly in the genital appendages. This could be met by making each the centre of a group equal in value to the *Platyptiliinae* or *Stenoptiliinae*, as we have done, or by treating them as three separate tribes in a subfamily *Amblyptiliinae*. The important thing is to get the differences defined. The units, at any rate, have no close alliance, as have those of the *Platyptiliinae*, *Stenoptiliinae* or *Oxyptilinae*; we think it very possible that a sufficiently detailed knowledge of the early stages of a greater number of extra-British forms would strongly support us in making each the centre of a subfamily of equal classificatory value with the three subfamilies above mentioned.

Subfamily: Eucnemidophorinæ.

Tribe: Eucnemidophoridi.

This subfamily is much more distinctly Platyptiliine, than are the two succeeding subfamilies. So much is this so, that Bacot considers that the *Eucnemidophoridi* would be perhaps better placed as a tribe of the *Platyptiliinae* than united with *Amblyptiliinae*, but the differences between them are also great, and so we separate it from both. In the larva of *Eucnemidophorus*, the depression of the prothoracic scutellum is hardly noticeable; the primary setæ are smooth and tapering (sometimes knobbed); the accessory postspiraculars are marked by the presence of slightly better-developed secondary hairs, the skin-hairs being of distinctly Amblyptiliine pattern. In this stage, Bacot observes that there is a strong growth of secondary skin-hairs, and that the Eucnemidophorid larva presents also a suggestion that the accessory postspiracular tubercles form, as it were, a sort of link between the

Stenoptiliines and the Platyptiliines. Chapman observes that the larval hairs of *Eucnemidophorus* are much as in *Marasmarcha*, the skin-hairs distinctly of Amblyptiliid type, whilst many of the primary setæ are knobbed; he further notes that the postspiracular hairs, representing the accessory tubercles, are well-represented on some segments, absent on others, and again not so very different from those of *Marasmarcha*. It is a most important fact that these well-developed secondary skin-hairs are distinctly Amblyptiliid (not Platyptiliid), *i.e.*, they are jointed secondary hairs, as in the more external-feeding larvæ of the Platyptiliid stirps, and not minute unjointed skin-points, as in the internal-feeding Platyptiliid larvæ.

In the Eucnemidophorid pupa, the dorsal ridge is rather poorly indicated; there is a suspicion of a pupal nose-horn; the skin is smooth, and innocent of processes, except the ordinary primary setæ, which are as long as those of the larva, but sometimes knobbed towards the tip. Bacot observes that the pupa is of Platyptiliid outline, nearer to that of *Marasmarcha* than *Amblyptilia*, and far removed from those of *Stenoptilia* and *Adkinia;* the hairs, he says, are very long, and, in this character, it agrees neither with the Platyptiliines, nor the Amblyptiliines. Chapman observes that these hairs are exceedingly long, compared with those in Platyptiliine pupæ, whilst he suggests that the pupa of *Marasmarcha* shows distinct Oxyptilid indications; strangely enough, the pupa of *Eucnemidophorus* has much more in common with that of *Buckleria* (*paludum*) than with that of any of the Platyptilias.

The special characters above noted, are, perhaps, partly due to the fact that the larva of *Eucnemidophorus* is not so truly an external feeder as the members of the allied subfamilies just considered, and that something of a cocoon is always spun for pupation, there being, therefore, less need for complicated development in these directions. Bacot notes that, in its cocoon-forming habit, *Eucnemidophorus* inclines to the Platyptiliines, as also in the manner in which it lies therein, rather than is attached, in the manner of the Amblyptiliines, by means of a complicated cremaster on the 8th and 10th abdominal segments.

It is quite open to question, as already noted, whether this tribe should really be considered as of full subfamily rank; it is, in its larval and pupal characters, as we have shown, much more inclined to the Platyptiliines than to the Stenoptiliines in the imaginal, larval, and pupal stages, and retains the, for this superfamily, peculiar cocoon-spinning habit in an enhanced form, seen nowhere among the Alucitids (*sens. lat.*), except in the Platyptiliids (that of *Adaina* not being a true spun cocoon).

Genus: Eucnemidophorus,* Wallengren.

Synonymy.—Genus: **Eucnemidophorus,** Wllgrn., "Ent. Tids.," ii., p. 96 (1881): Walsm., "Ent. Mo. Mag.," xxxi., p. 41 (1895); Hofmn., "Deutsch. Pter.," p. 33 (1895); "Illus. Zeits. Ent.," iii., p. 131, fig. 4 (1898). **Alucita,** Schiff. and Den., "Schmett. Wien.," 1st ed., p. 146 (1775); Goeze, "Ent. Beit.," iv., p. 177 (1783); de Vill., "Linn. Ent. Faun. Suec.," iv., p. 547 (1789); Ill., "Schmett. Wien.," 2nd ed., p. 130 (1801); Hb., "Eur. Schmett.," Aluc. pl. ii., fig. 8 (*anteà*, 1804); Haw., "Lep. Brit.," p. 478 (1811); Tr., "Die Schmett.," ix., pt. 2, p. 228 (1833). **Pterophorus,** Fab., "Mant. Ins.," ii., p. 258 (1787); "Ent. Syst.," iii., p. 347 (1793); Latr., "Hist. Nat.," xiv., p. 257 (1805); Sam., "Ent. Usef. Comp.," p. 409 (1819); Curt., "Brit. Ent.," fo. 161 (1827); Dup., "Hist. Nat.,"

* Wrongly spelt *Eucnaemidophorus*, *anteà*, p. 96.

xi., p. 644, pl. 313, fig. 4 (1838); Wood, "Ind. Ent.," 1st ed., p. 237, pl. li., fig. 1645 (1839); Zell., "Isis," p. 772 (1841); Dup., "Cat. Méth.," p. 381 (1845); Tgstrm., "Finl. Fjär.," p. 154 (1847); Frey, "Die Tin. Pter.," p. 401 (1856); Dbldy., "Syn. Cat.," 2nd ed., p. 36 (1859); Sta., "Man.," ii., p. 440 (1859); Porritt, "Ent.," viii., p. 183 (1875); "Ent. Mo. Mag.," xii., pp. 88-89 (1875); "Buckler's Larvæ," ix., p. 337, pl. 163, fig. 2 (1901). **Platyptilia,** Hb., "Verz.," p. 429 (1825); Stphs., "Illus. Brit. Ent.," iv., p. 375; app. p. 424 (1834); Zell., "Linn. Ent.," vi., p. 326 (1852); Meyr., "Trans. Ent. Soc. Lond.," p. 486 (1890); "Handbook," etc., p. 430 (1895); Dyar, "Ent. Rec.," xi., p. 39, pl. i., fig. 4 (1898); Staud. and Reb., "Cat.," 3rd ed., p. 72 (1901). **Platyptilus,** Zell., "Isis," p. 770 (1841); H.-Sch., "Sys. Bearb.," v., p. 366 (1855); Nolck., "Lep. Fn. Estl.," p. 799 (1871); Dyar, "Journ. N. Y. Ent. Soc.," iii., p. 21 (1895). **Cnaemidophorus,*** Wallgrn., "Skand. Fjäder.," p. 10 (1859); Jord., "Ent. Mo. Mag.," vi., p. 120 (1869); Staud. and Wocke, "Cat.," 2nd ed., p. 341 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 782 (1877); Frey, "Lep. der Schweiz," p. 427 (1880); Staud., "Hor. Soc. Ent. Ross.," xv., p. 423 (1880); South, "Ent.," xviii., p. 275, pl. i., figs. 3-3*d* (1885); Leech, "Brit. Pyral.," p. 51, pl. xvi., fig. 2 (1886); Tutt, "Young Nat.," x., pp. 163, 201 (1889); "Pter. Brit.," p. 18 (1895). **Cnemidophorus,** Sorh., "Kleinsch. Brandbg.," p. 1 (1886); Barrt., "Lep. Brit. Isles," ix., p. 343, pl. 413, figs. 2-2*b* (1904). **Eucnaemidophorus,** Tutt, "Ent. Rec.," xvii., p. 96 (1905).

This genus was described by Wallengren (*Skandinaviens Fjädermott*, p. 10), under the name of *Cnaemidophorus* as follows:—

Antennæ of both sexes with very short cilia; forehead without any tuft, only a few slightly prominent hairs between the antennæ; palpi, not longer than the head, the intermediate joint thickened with down, the last joint short and pointed; legs short, all the tibiæ thickened towards the apex by a tuft of scales, the posterior tibiæ thickened in the middle; first pair of spines in the posterior tibiæ slender and very unequal, second pair nearly equal; anterior wings not divided to a third part of their length, the segments broad, the posterior segment almost hatchet-shaped, the posterior angle of both segments well marked; the divisions of the inferior wings wide, the 3rd segment with the anal angle distinct; the anterior wings flat, covering the inferior, the inner margin not toothed.

The name *Cnaemidophorus*, being preoccupied, was changed by Wallengren to *Eucnemidophorus* in 1881 (*Ent. Tids.*, ii., p. 96), and it was accepted by all workers at the group until 1890, when Meyrick (*Trans. Ent. Soc. London*, p. 485) gave a comprehensive subfamily diagnosis (that comprised the whole of the Platyptiliines) under the generic name *Platyptilia*, including *Amblyptilia*, *Fredericina*, *Platyptilia*, *Gillmeria*, and *Eucnemidophorus*. This grouping was followed up in 1895 (*Handbook*, etc., pp. 432-4), but not without a protest from Hofmann (*Die Deutsch. Pteroph.*, p. 23), who says that *Eucnemidophorus* and *Amblyptilia* are good and natural genera, as shown by the different types of their ♂ genitalia, as also by the differences of their early stages, and the very characteristic facies of the imagines. In spite of this protest, Staudinger and Rebel (*Catalog*, 3rd ed., pt. 2, p. 72) followed Meyrick, and gave the same heterogeneous mixture of species. Hofmann gives (*op. cit.*, p. 33) the following excellent diagnosis, which shows that, even on imaginal characters, the genus is abundantly distinct:—

Frons, especially between the antennæ, roughly-scaled, but without actual tuft of scales; antennæ, in both sexes, with very short ciliations; palpi small, not longer than head, projecting horizontally, 2nd joint somewhat thickened with scales beneath; 3rd joint about one-half smaller, pointed; tongue rather weak; all the tibiæ terminally, the hind tibiæ also before the first pair of spurs, thickened by a ring of scales; in the middle of the middle tibiæ, a slight thickening by raised scales; the inner spur of the first pair in the hind tibiæ longer than the outer, the second pair almost equal in length; forewings cleft to scarcely $\frac{1}{3}$, both lobes broad, and

* Preoccupied in *Lacertilia*, see *Ent. Tids.*, ii., p. 96.

with distinct anal angle; the 1st plumule of the hindwing with margin running obliquely, from within and above, to below and without, *i.e.*, wider at apex than at base, the 2nd pointed, with rounded anal angle, the 3rd with a tooth of black scales on the inner-marginal fringes near the apex; neuration perfect—II_1 and II_2 of forewing arise, one shortly after the other, before the upper angle of the median cell, II_3 and II_4 on a stalk from this angle itself, II_5 from the discocellular, which is straight as far as to the origin of this vein, and from thence runs somewhat obliquely downwards and inwards.

The main characters, however, in which *Eucnemidophorus* differs from the Platyptilias (*sens. rest.*), are exhibited in the early stages. There is in the larva an abundance of secondary hairs, and there is also a tendency for the primary hairs to be associated with a few secondaries, indicating the first step in wart structure; indications of the accessory postspiraculars are not wanting [as in the Platyptilias (*sens. rest.*)], both positions being occupied by greatly-developed secondary hairs. The pupa resembles that of the Platyptiliids, in that there are no processes or marked armature; the dorsal ridge, however, is barely indicated, and the primary setæ are nearly as well-developed as in the larva; the nose-horn, however, is evanescent. The chief characters of the early stages may be summarised as follows:—

LARVA.—Minute chitinous pointed spiculæ; secondary hairs abundant, definitely hair-like, with jointed base, variable in size, very short and thick, with knobbed tops, appear first in (?) penultimate skin; primary hairs smooth and tapering; tubercles i and ii on same base in meso- and metathorax; trapezoidal on abdomen; iv and v with conjoined bases; accessory postspiraculars indicated by well-developed secondary hairs; vi, two-haired; one or two secondary hairs associated with primary setæ.

PUPA.—Front rounded, nose-spine evanescent; surface smooth, without processes; dorsal ridges simply indicated (not strong as in Platyptilias); setæ long, almost as in larva.

EUCNEMIDOPHORUS RHODODACTYLA, Schiffermüller and Denis.

SYNONYMY.—Species: **Rhododactyla,** Schiff. and Denis, "Schmett. Wien.," 1st ed., p. 146 (1775); Göze, "Ent. Beit.," iv., pt. 3, p. 177 (1783); De Vill., "Linn. Ent. Faun. Suec.," iv., p. 547 (1789); Ill., "Schmett. Wien.," 2nd ed., p. 130 (1801); Hb., "Schmett. Eur. Aluc.," pl. ii., fig. 8 (*ante* 1804); "Raupen," etc., ix., Aluc. i, pl. xiii., figs. 1*a*-*b* (*circ.* 1800); Haw., "Lep. Brit.," p. 478 (1811); Hb., "Verz.," p. 429 (1825); Treits., "Die Schmett.," ix., pt. 2, p. 228 (1833); Stphs., "Ill. Haust.," iv., app., p. 424 (1834); Meyr., "Trans. Ent. Soc. Lond.," p. 486 (1890); "Handbook," etc., p. 435 (1895); Staud. and Reb., "Cat.," 3rd ed., p. 72 (1901). **Rhododactylus,** Fab., "Mant. Ins.," ii., p. 258 (1787); "Ent. Sys.," p. 347 (1793); Latr., "Hist. Nat.," xiv., p. 257 (1805); Sam., "Ent. Comp.," p. 409 (1819); Curt., "Brit. Ent.," fo. 161 (1827); Stphs., "Illus. Haust.," p. 375 (1834); Dup., "Hist. Nat.," xi., p. 644, pl. 313, fig. 4 (1838); Wood, "Ind. Ent.," 1st ed., p. 237, pl. li., fig. 1645 (1839); Zell., "Isis," p. 772 (1841); Dup., "Cat. Méth.," p. 381 (1845); Tgstrm., "Finl. Fjär.," p. 154 (1847); Zell., "Linn. Ent.," vi., p. 326 (1852); Richter, "Stett. Ent. Zeit.," p. 28 (1850); H.-Sch., "Sys. Bearb.," v., p. 366 (1855); Frey, "Tin. Pter. Schweiz," p. 401 (1856); Dbldy., "Syn. Cat.," 2nd ed., p. 36 (1859); Sta., "Man.," ii., p. 440 (1859); Wallgrn., "Skand. Fjäd.," p. 10 (1859); Jord., "Ent. Mo. Mag.," vi., p. 120 (1869); Staud. and Wocke, "Cat.," 2nd ed., p. 341 (1871); Nolck., "Lep. Fn. Estl.," p. 799 (1871); Porr., "Ent.," viii., p. 183 (1875); "Ent. Mo. Mag.," xii., pp. 88-89 (1875); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 782 (1877); Staud., "Hor. Soc. Ent. Ross.," xv., p. 423 (1880); Frey, "Lep. Schweiz," p. 427 (1880); South, "Ent.," xviii., p. 275, pl. i., figs. 3-3*d* (1885); Sorh., "Kleinsch. Brandbg.," p. 1 (1886); Leech, "Brit. Pyral.," p. 51 (1886); Tutt, "Young Nat.," x., pp. 163, 201 (1889); "Pter. Brit.," p. 19 (1895); Hofm., "Deutsch. Pter.," p. 34 (1895); "Illus. Zeits. Ent.," iii., p. 131 (1898); Dyar, "Jour. N. Y. Ent. Soc.," iii., p. 21 (1895); "Ent. Rec.," xi., p. 39, pl. i., fig. 4 (1898); Porritt, "Buckler's Larvæ," ix., p. 337, pl. 163, fig. 2 (1901); Barr., "Lep. Brit. Isles," ix., p. 345, pl. 413, figs. 2-2*b* (1904); Murtfeldt, "Can. Ent.," xxxvi., p. 334 (1904).

ORIGINAL DESCRIPTION*.—Heckrosen Geistchen, larv. *Rosae caninae* (Schiffermüller and Denis). [*Pterophorus rhododactylus*, alis fissis flavescentibus; strigis albis, anticis bifidis, posticis tripartitis. (*Alucita rhododactyla*, *Wien. Verz.*, p. 146, no. 5.) Habitat in Saxoniæ Rosis, Mus. Dom. Zschuck. Alæ anticæ flavæ, basi obscuriores strigis duabus albis, anteriore obliqua usque ad strigam posteriorem fissæ. Posticæ tripartitæ lobis duobus anterioribus flavescentibus, tertio albo macula magna ante apicem ferruginea. Corpus ferrugineum thoracis lateribus flavescentibus (Fabricius, *Mantissa Insectorum*, ii., p. 259).]

IMAGO.—21mm.-23mm. Head and thorax the colour of the forewings; the abdomen of the same colour but variegated with whitish scales. The anterior wings divided into two lobes, the apex pointed; the ground colour rich ochreous-brown much peppered with white scales along the costa, which develop into a large whitish blotch in the centre of the costal area; a slender white fascia, parallel to the hind-margin, extends from the costa to the inner margin; the inner margin whitish, and connected by some whitish scales with the pale costal blotch; fringes with the outer part whitish, the inner dark. The posterior wings shiny ochreous-brown, the third plumule white along its inner edge; a tooth of black scales towards apex; fringes brown, with white tips to the plumules.

GENITALIA.—The 9th dorsal plate belonging to the ♂ genitalia is tolerably large, arched, with a notch on the hind margin; the uncus (10th dorsal plate) strongly curved on its underside with a continuation projecting vertically, lunular-shaped in front, the terminal portion of the intestine passing through the inner half of it. The genital valves (appendages or flaps) large, obliquely cut off behind, with a blunt point (apex); from the lower edge of each appendage a long, thin, continuation extends straight towards the front. The 9th ventral appendage very small, extending backwards, pointed, beset with long scale-hairs (Hofmann, *Deutsch. Pteroph.*, p. 35, pl. iii., fig. 4).

EGGLAYING.—Eggs deposited by a ♀ sleeved on a rose-tree were laid on the underside of a rose-leaf. Dieroff notes that, in confinement, at Zwötzen-on-the-Elster, a ♀ laid a single egg on May 28th, on the following day two-thirds of the batch, whilst on the morning of the 30th the egglaying was finished; the eggs were scattered loosely, and not attached.

OVUM.—About ·7mm. long, and ·42mm. wide. Full yellow in colour. In outline a perfect oval, narrowing at both ends, and scarcely any wider at the micropylar end than at its nadir; the upper and lower surfaces somewhat flattened, the upper somewhat depressed centrally; the surface very shiny, with an exceedingly faint, large-meshed reticulation [Described July 13th, 1899, from eggs received from Mr. Whittle]. Green-yellow in colour at first, later turning black (Dieroff).

HABITS OF LARVA.—As the egg hatches in a few days, and the larva is comparatively small in the spring, one suspects that it hybernates through the winter, possibly in the second instar, as do other Platyptiliids; exact knowledge on the point, however, is still wanting.

* Schiffermüller and Denis simply write (*Sys. Verz.*, p. 146): "Heckrosen Geistchen, larv. *Rosae caninae*"; whilst Göze (*Ent. Beit.*, iv., 3, pp. 171 *et seq.*) simply gives the name with Schiffermüller and Denis' reference.

Small larvæ may be obtained in early May, the larvæ being fullfed towards the end of June. Warren says there appears to be really no difference, except in size, between the smallest spring larvæ observed and fullgrown ones; he once found, on a small isolated rose-bush, a number of young larvæ, mostly close to the ground, and feeding there on the young leaves; a fact that led to the supposition that a number of eggs may be laid close together near the ground; as soon as buds form, the larvæ attack the inside of them, but will always feed on young top green leaves. When coming to maturity, they undoubtedly prefer the large unopened flowers; and, in a high hedge, where the rose-bushes rise to the top and flower there, fullfed larvæ are to be obtained. The threads the larvæ spin are viscous, and the frass is not granular, but in small sections, the ends of which appear to be attached; it is eminently characteristic; the best time for the larva in Middlesex appears to be from the end of May through June (*in litt.*, June 15th, 1904). Nolcken long since mentioned this gregarious habit, observing that, on June 4th, 1858, on some young rose-bushes, buried in grass, he found a colony of the larvæ, whilst in his garden at Arensburg, and at Pichtendahl and Ilpel, he has always found the larvæ in moderate-sized colonies. Porritt notes (*Ent. Mo. Mag.*, xii., pp. 88-9) that, in May, 1875, the larvæ were found in Chattenden woods "feeding on wild rose, beneath the leaf overlapping the rosebud, eating into the unexpanded bud from the side; almost as many, however, were found feeding in similar positions at the tips of the young shoots." South says that the larva usually bores a hole through the upper portion of a flower-bud, and feeds on the folded petals; sometimes the larva may be found feeding on the stamens of a flower, the petals of which are fastened together by their outer edges with silken threads; when feeding on flower-buds, the larva conceals itself by drawing down, and securing, a leaf to the bud. Chapman observes that the larvæ bore through the calyx into the petals and stamens, burying themselves to various degrees; a larva does not disdain to attack petals direct, when exposed, and goes through these to stamens, which are, no doubt, its favourite food. South observes that the larvæ feed in flowers of dog-rose in hedges, and also in gardens on those of moss-rose, in the neighbourhood of Mill Hill. Hofmann states that, in Germany and Austria, the larva lives, in May and June, on garden- and wild-roses, boring into the flower-buds under the shelter of a slight web, and being often destructive in gardens, *e.g.*, in Dessau, in 1849 (see *Stett. Ent. Zeitg.*, 1850, p. 25). The larvæ have recently been recorded as attacking the rose-trees in gardens about St. Louis, U.S.A., it being supposed that they have been imported at some recent date with the rose-trees. The only actual dates recorded for the larvæ of this species appear to be: June 4th, 1858, at Magnusholm (Nolcken); May 26th, 1875, larvæ common at Chattenden; very small larvæ, May 16th-18th, 1880, at Chattenden (Porritt); fullfed larvæ, May 26th-June 16th, 1899, June 1st-8th, 1903, in Middlesex (Rothschild); June 16th-21st, 1903, several larvæ on dog-rose on the East Horndon side of Thorndon Park (Whittle); two larvæ taken May 29th, 1901, in loosely spun leaf-buds of wild-rose; exceedingly common, and widely distributed, on June 24th, 1902, feeding in a loose web both in leaf-buds and flower-buds; also abundant in 1903, some being almost fullfed by June 4th; halfgrown larvæ, May 23rd-27th, 1904, in the Bexley district, exceedingly rare, units this year, where dozens could have been taken in 1903 (Butterfield).

LARVA.—*Penultimate instar:* The head green, marbled with olive-green to brown, looking dark, or reddish, from the presence of the following dark markings—a large brown-black patch at hind margin, just above lateral line; another below, and behind, the ocelli, which are very black; pale brownish, or reddish, markings proceed from the first of these, at its inner extremity, down centre of head towards clypeus, and from its lower margin towards the centre of the cheek, *i.e.*, the marblings are in two irregular longitudinal streaks on either side, wide in front, and soon fading out. In form, the larva is fairly cylindrical (not flattened as is that of *Aciptilia galactodactyla*, nor, perhaps, hardly so round as is that of *Marasmarcha lunaedactyla*), tapering regularly to either end (the longitudinal section being spindle-shaped, the transverse nearly circular). The colour is yellowish rather than green, with a broad, reddish, dorsal band, which is narrowest at the 3rd abdominal, and confined to the dorsal line from the 3rd abdominal segment backwards, but widening in front, so that, on the thorax, it reaches tubercle iv, and is quite lateral as well as dorsal. Above, and behind, the spiracle, there is distinct subsegmentation, so that each segment is formed of two subsegments, the anterior subsegment being about twice the width of the posterior. A lateral flange is made up of two elements, one below the spiracle, rather rounded and prominent, the other, below this, is a little narrower, and slopes posteriorly towards the venter. Of the spiracles, the first and last are larger than the others, although all are fairly obvious, raised, and with the actual chitinous margin rather golden above. The anal plate is not obviously a plate, being coloured precisely as the rest of the larva, and of the same dull surface; it has three hairs along the hind margin, and two at front margin on either side. The tubercles on the abdominal segments are—i (on 1st subsegment) with 1 long hair; ii (on 2nd subsegment) with 1 long hair, these two tubercles are widely separate and trapezoidally placed; iii immediately above spiracle (on 1st subsegment), with 1 long hair; below the spiracle, iv and v are on the upper element of the flange, 1 hair arising from each, that on iv pointing backward, that on v forward, the two hairs arising from a plate, the posterior at a little lower level than the anterior; vi on lower segment of flange, with 1 backward-directed hair; vii carries 2 hairs at the base of the proleg. Behind the spiracle is a rather large, secondary, accessory, subspiracular tubercle, carrying a long hair (in same position of that in *Capperia heterodactyla*) that seems to be more than an ordinary secondary hair, and there is a corneous point above this. Short secondary hairs are very numerous, especially dorsally (25 to 30 in the trapezoidal area), placed irregularly and, usually, asymmetrically, and are whitish, rather clubbed at the extremity, with serrated ends; they are about $\frac{1}{10}$th the length of the primary setæ on the anterior trapezoidals (i). The irregular placing of some of these secondary hairs is notable, but the 3rd abdominal segment has three placed dorsally and quite symmetrically, and there is usually one also on the outside of i, and two on the posterior subsegment, opposite and below the spiracle. The primary setæ have spindle-shaped swellings irregularly placed, that appear to be fluid, but whether this fluid is their own secretion, or that of the glands of the rose, is not determinable. On the prothorax, the posterior subsegment (behind the plate) has tubercles placed as i, ii and iii; on the mesothorax and metathorax the three upper tubercles have each two hairs, placed—on the upper transversely, on the next nearly level, the front one rather higher; the third also has them one in front of the other. The abdominal prolegs are on slender props, and have 8 well-curved brown hooks, the anal prolegs have 9. The true legs are faintly tinged with brownish, although substantially of the same colour as larva. The general surface has very fine raised colourless points (Chapman, June 14th, 1899). *Final instar:* Of a dark sickly green tint, becoming yellower posteriorly, and with a marked yellow patch (ovaries, etc.) on the 4th and 5th abdominal segments, and a purple-red, or rich brown, dorsal band, edged with a yellow line, broadest in front, narrowing over the 4th and 5th abdominal segments, and but little broader posteriorly to this. Head yellow, or yellow with black patches dorsally and near mouth, with other similar variation. The whole combination gives an impression of debility and decomposition, perhaps corresponding closely with a bud of foodplant dying off, as secondary ones often do, giving reddish and sickly yellow tints combined with green. The whole larva is covered with secondary hairs; these are very short and yellow, the primary hairs are long, single (one to each tubercle), whitish, or tinted darker apically. Tubercles i and ii are wide apart; the setæ on i and iii porrect; on ii, slightly backwards; iv and v on flange, the setæ well separate, one directly below spiracle, the other a little higher, and in front of it. The seta on tubercle vi, at back of segment, directed backwards; three hairs at base of prolegs. A secondary hair behind iii at back of segment is very large and strong, as is another between it and iii. The following details of the tubercles and hairs of fullgrown larva are to be noted—on the prothorax, the usual six on each side of plate; the three front about equal, 0·6mm. long, the central, posterior, about 0·7mm., and the two others about 0·4mm.; apparently three hairs in prespiracular group, 0·2mm.-0·4mm. long, not on one plate, but without skin-points between them; two hairs at base of legs. On the meso- and metathorax are the usual four pairs of hairs; the dorsal pair trapezoidal, on separate plates, nearly joined on mesothorax, with skin-points between on metathorax; the second pair on the same plate (reversed trapezoidals); third pair with the addition of a third above and behind, making an oblique row of three, all on separate bases; the 4th pair at base of legs on same plate and at the same level; the hairs rather larger on mesothorax, the 1st, 0·4mm., the 2nd, 1·2mm., the 3rd, 0·4mm., the 4th, 1·0mm., the 5th and 6th, about 0·6mm., an extra hair about 0·4mm., the 7th and 8th about 0·3mm. and 0·2mm. long. The true legs have the first two joints darkest, and the 1st joint has a margin of very minute spicules; the 2nd joint has four or five long bristles (half as long again as joint); the last joint is paler, half as long again as either of others (total length of these joints about 0·45mm.), claw, fine, straight, accompanied by a hair of about equal length. On the 1st abdominal, the hair representing tubercle i is about 0·8mm. long, ii about 1·0mm.; they are widely apart, but placed in ordinary trapezoidal position; that on iii is about 1·0mm.; iv and v rather apart, but apparently with a plate in common, iv lower and behind, about 1·0mm., and v about 0·6mm. in length; vi is at back of segment, about 0·6mm. long; vii carries a posterior hair about 0·3mm. and two in front about 0·2mm. long; these appear to have skin-points between their bases; on the 8th abdominal, vii has only two hairs, with a ventral hair below, which also occurs on all the other abdominal segments in front; the 9th abdominal has three pairs of hairs, each pair on a common base, and trapezoidally arranged; below them a single strong hair, and the usual weak ventral one. It is not easy to homologise these hairs on the 9th abdominal; the first pair are like i and ii; the second is iii (the second hair of this pair may be the minute accessory spiracular); the third is in line with iv and v; if the solitary hair is vi, then vii is absent. The anal plate carries seven hairs on either side. All these hairs are quite smooth and unspiculated, but most of them are slightly swollen at the tips. The secondary hairs are very numerous, about 40 on an abdominal segment from dorsum to spiracle. They vary much in size, the mass are, perhaps, about 0·1mm. long, but some are not much over 0·05mm., and a few reach to nearly 0·25mm.; all are of similar structure, nearly as thick as the primary hairs are, *i.e.*, proportionally very thick, tapering a little, and then swelling out again apically, with a truncate, sometimes slightly notched, end, sharply demarcated from the skin at their bases, but without any separate chitinous plate; the larger examples are rather solitary, behind the spiracle, in attendance on tubercles i, ii, iii, etc., but equally missing from these positions, so that no definite and constant positions can be assigned them. The skin-points are small, sharp, with their longest diameter usually longitudinally placed. This implies, as is the fact, that they are really two-and-a-half times as long as broad. The true legs are black in one specimen, yellow in another. The prolegs on long props, hooks of prolegs about 16, of anal claspers, 20 (Chapman, June 5th, 1905). Length about ·5in., and of tolerable bulk in proportion; the body cylindrical, and strongly attenuated towards the extremities, is considerably retractile, and, when at rest, has a dumpy appearance; the head is small, globular, smooth and shining, about the same width as, or perhaps very slightly narrower than, the 2nd segment; the segmental divisions distinctly marked; the skin soft, but with a slightly rough appearance, and is sparingly, though conspicuously, clothed with short hairs. The ground colour is a rather bright greenish-yellow, in some specimens yellowish-green; the head is greyish, with the cheeks and mandibles shining black. A very conspicuous purple stripe forms the mediodorsal line; from the 2nd to the 6th segment, this stripe appears as if composed of round purplish marks joined at the segmental divisions, consequently, the stripe is rather broad; on the remaining segments, it is much narrower and more uniform, but equally distinct; the subdorsal and spiracular lines are yellow, but only faintly indicated, the segmental divisions are also yellow. The ventral surface and prolegs are uniformly dingy-green or yellowish, according to the ground of the dorsal surface; legs black and shining (Porritt). The larva is also described by South (*Entom.*, xviii., p. 276), by Barrett (*Lep. Brit. Isles*, ix., p. 345), and by Dyar (*Jour. New Y. Ent. Soc.*, iii., p. 21). Buckler figured larvæ in three different stages of growth, June 22nd, 1877 (*Larvae*, etc., ix., pl. clxiii., figs. 2, 2a, 2b).

Variation of larva.—In the last instar, the larvæ vary in colour, from almost pure yellow to pure green (of a dingy shade, however), with a purplish dorsal stripe, which varies somewhat in width; the subdorsal and spiracular lines vary in distinctness, pale yellowish in colour.

Foodplants.—*Rosa canina* (Schiffermüller), *R. centifolia* (Treitschke).

Pupation.—The larva makes some pretension to spinning a cocoon, although it is a very slight one; it hardly amounts to a hammock, there being simply a few silken threads used to draw a leaf or two together at the junction of the leaflets with the leaf-stalk, or the sepals together over the centre of the flower after the petals have fallen, and some silk over the leaf surface. The hooks of the 8th abdominal segment, as well as those of the anal armature, are involved in the support of the pupa, although the pupal position appears to be rather that of lying in a hammock than the normal attachment to a pad of silk (Bacot). When full-grown, the larvæ, that have been feeding on the buds, affix themselves to the side of the leaf close by the bud, and draw the leaf and the bud together by means of a few silken threads; the others draw together, in a similar way, several leaves at the end of the young shoot (Porritt). The pupa is attached by the anal segment to the flower-stem just below the ovary, and protected by a slight network of silk, which unites a leaf with a flower-bud. The pupa stands erect, and, in this position, bears a superficial resemblance to a stunted rosebud (South). Barrett erroneously states that the pupa "hangs loosely from a small tuft of silk." On the contrary, it is fixed firmly in true Alucitid fashion by the 8th and 10th abdominal cremastral hooks, with its venter closely appressed to the stalk, leaf, or bud, of which its loosely spun puparium is formed. Chapman observes that the larva spins quite a cocoon of very sparse cables, forming a loose open web, extending more than its own length in most directions, and pulling together the surrounding leaves, etc.; the pupa is suspended in a nearly inverted position, its actual attachment, however, being by the usual two sets of hooks, forming the anal and ventral parts of the cremaster. Warren says that, when the species is found in a high hedge, where the rose-bushes rise to the top and flower there, one will always find the puparia, containing empty pupæ (and therefore unemerged ones at the right time), between the stunted bud and a leaf growing hard by, but a favourite position in younger bushes is beneath two or three leaves slightly fastened, but not drawn altogether out of place; four pupæ were once found, one behind the other, on an exposed stalk by the side of a dusty road, the whole branch being both cobwebby and dusty. Hofmann notes that the larva pupates within its feeding-place; Steudel, that it fixes itself for pupation in a thin web between the rose-leaves. Butterfield also observes that the larvæ pupate in the webs in which they have fed up.

Pupa.—Length 7mm.-7·5mm.; width at widest part 1·9mm. The colour has some claim to be called white*; it is really green, but with a whitish porcellanous tone that is very pronounced about the anterior portion of the pupa and dominates the wings, especially after they commence to get a little developed. In this respect, it reminds one somewhat of the pupa of *Gillmeria pallidactyla*, Reverting to colouring,

* Grass-green in colour, paler, and white, on wings and anteriorly; a narrow black margin round wings, of which, however, the antennæ form one border; the latter are black, but basally each segment has a little green colour; the face has a black streak on each side, and the maxillæ and 1st legs are also largely black. The lateral dorsal ridge (containing trapezoidals) is faintly yellow, especially where it

the antennæ, and all the appendages behind the level of the eye, are black, and a delicate black line encircles the wings, bringing out very distinctly the waving of the dorsal and hind margins; there is a dark dorsal line, and an interrupted dark shading between ii and iii, a fainter one along spiracles, and another below iv and v: this is more nearly a line than the others; below it are more dark blotches; the venter is green. The pupa has a more Sphingid-like outline (*e.g.*, pupa of *Sesia stellatarum*) than usual in "plumes." The head projects a little ventrally; the appendages are not straight in ventral line, but arch forwards; the greatest prominence being opposite the 3rd abdominal; then the 5th and 6th abdominals are more prominent dorsally, and the pen of cremaster points forward again, so that the curvature of the Sphingid pupa is well reproduced. The maxillæ disappear below, meeting the 1st legs, as usual, a little less than half-way down appendages. The 1st leg is broad, and no femur is shown. The antennæ stop at $\frac{4}{5}$ths, the 1st legs at $\frac{9}{10}$ths, of the length, the 2nd legs and wing-tips equal; the extreme tips only of the 3rd legs visible beyond, as the 2nd legs meet in middle line beyond the 1st. There appear to be no humps, tubercles, ridges, flanges or processes, but the hairs are pronounced. Dorsally, i and ii arise close together, ii but little further out than i; i has a strong hair sloping forwards; ii a longer one sloping backwards; these are at a little more than a right angle with each other at origin, but their curvature makes them seem much more so; i is about 0·7mm. long, ii about 0·9mm.; i is marked by a dark dot, ii has no coloration where it arises; iii is about 0·8mm. long, and points upwards and forwards; iv and v appear to be represented by a hair, about 0·4mm., immediately below spiracle, another about 0·5mm., a little lower and a good way behind it, both curved forwards; vi is at posterior margin of segment, about 0·6mm., first exposed on the 4th abdominal, where another lower one also appears, one of a pair seen in following segments (0·2mm.), and representing those at base of proleg; all these are directed backwards. [The measurements given are the longest of each series, others are shorter.] The spiracles are faintly brown-tinted, slightly projecting, circles. The legs both reach up at top to eye level, the antenna passing transversely across the top of both before turning down. The statement as to no ridges, etc., must be modified to the extent of noticing that the first tibia carries a rather sharp ridge. The labrum (or lower part of clypeus) carries two hairs on either side, and there is another one well up in front, with another on cheek below eye. There are also two in centre of eye, *i.e.*, against 1st leg, on the ordinary surface, round which the glazed (and other) eye curves, and two at base of antenna on either side (about 0·4mm. long); hairs of i, ii and iii (or similarly placed ones) on prothorax; i and ii on mesothorax, two further out in front, and one further back; on meso- and metathorax there is just an indication of the dorsal ridges (*Platyptilia*, etc.). There is no trace of hair on any of the appendages. The anal cremaster consists of about 40 hooks or

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is most distinct in front and at the tubercles; these latter are combined (i + ii), and carry each two hairs, one directed forwards, and one backwards; the subspiracular is a double tubercle on a yellowish lateral flange; there are various hairs on the thoracic segments, the hair of supraspiracular directed forwards; none on wings or appendages; each tubercle has only one hair; there is a dark dorsal shading on the meso- and metathorax (Chapman. Another description).

hairs, about 0·1mm. long, faintly reddish-brown, darker at the tips, which are swollen as if recurved, and a sharp point directed basally. The ventral cremaster has exactly similar hooks, but comparatively few in number (Chapman, June 27th, 1905). Length of pupa measures between 8mm. and 9mm.; width at mesothorax and 5th abdominal about 1·75mm., and thickness rather less; the pupa below the wingcases is nearly cylindrical. It is very distinctively coloured—pale whitish-green, with a dark green dorsal band, which is interrupted and broken towards the anus. The wings are outlined by a narrow streak of dark green, and delicately shaded towards their extremities with soft green, not so dark as the surrounding line. The whole of the head-pieces, eye-cases, leg- and antenna-cases, are dark green, and show up as a most conspicuous shield. Some fainter green shading is also present at base of wings, and on the thoracic segments dorsally, as well as a much broken and interrupted faint subdorsal line of delicate green, which shows towards anal end of abdominal segments. There is a stronger, but still broken, lateral band, and also a subventral one, and the area immediately surrounding the spiracles is faintly tinged with darker green. The spiracles are large, and rather prominent, but are not raised to anything like the extent that they are in *Ovendenia septodactyla* (*lienigianus*), or even *Oidaematophorus lithodactyla*. The hairs are long and tapering, either quite simple, or very finely serrated, probably the latter, as they seem to pick up dust very readily. No secondaries are present on abdominal segments; nor are there the fringes of fine hairs on the wing-, leg-, or antenna-cases, like those found in the pupæ of *Porrittia galactodactyla*, *Oidaematophorus lithodactyla*, and *Ovendenia septodactyla*. All tubercles are single-haired, as in the larva, the tubercles at base being primitive and cone-shaped; i and ii are a short distance apart on a single longitudinal mound; they are much farther apart on the 1st and 2nd abdominal segments than on the following one, and the ridge becomes more definite, and continues nearly the whole length of the segment, becoming higher and converging towards the mediodorsal line, culminating in a twin ridge or process on the mesothorax; i bears a long hair lying forwards; ii a very much longer hair, pointing backwards; iii is a short distance above, and slightly posterior to spiracle, bearing a hair of about equal length to i, bending forwards; iv and v are well separated; v, exactly subspiracular, bears the smaller hair; iv, posterior to spiracle, but nearly in same horizontal plane, bears a longer hair; iv slopes ventrally; v slopes forwards; vi carries a single hair, beneath iv; and vii, marginal, consists of 3 hairs in line*. The pupa-case is very thin and semitransparent in parts, exceedingly finely striated or wrinkled transversely. This is also a feature of the other species, and is well-marked in the pupæ of *Ovendenia septodactyla* (*lienigianus*) and *Porrittia galactodactyla*, but the wrinkles are large and coarse in *Oidaematophorus lithodactyla*. They are also present in the pupa of *Adactylus bennetii*, and are very fine in this species and more regular than in others [Described June 26th, 1899; additional notes made from empty pupa-cases, December, 1903] (Bacot). Porritt says: "The pupa is about $\frac{3}{8}$ in. to

* Barrett says (*Lep. Brit. Isles*, ix., p. 345) that "the pupa is curiously sprinkled with fine hairs or long bristles, especially on the dorsal surface." The "curiously sprinkled hairs" appear to be the ordinary pupal setæ, in normal position.

½ in. in length; pale green, the wing-cases whitish, the eye-, antenna-, and leg-cases, also the edging of the wing-cases, smoky-black." South writes: "Dingy-green, with a dorsal line, strongly suffused with rose-colour or violet; hairs as in the larva; the paler wing-cases stand out prominently from the thorax, thus giving the pupa a swollen appearance at this point." Buckler figured (*Larvae*, etc., pl. clxiii., fig. 2*c*) the pupa of this species on June 22nd, 1877. Hofmann notes (*Die Deutsch. Pteroph.*, pp. 35-36) that the pupal colour changes greatly as development proceeds. It is greenish at first, then it becomes more and more violet, until at last it is of a very dark violet hue, the markings all the time becoming less and less distinct.

Variation of pupa.—The colour of the pupa is very definite, greenish in hue, the wings green, edged with black, often with whitish nervures, whilst the forks between are filled up with blackish; between the antennal sheaths the space is filled up with blackish-green; the warts are whitish or whitish-green, as also are the hind margins of the abdominal segments, and the upper edges of the cremaster. In the most strongly marked pupæ there is a black, longitudinal, mediodorsal stripe, with two very similar, but less distinct, lateral stripes at the height of the upper row of tubercles and above the spiracles; there are also two blackish longitudinal stripes lower down the sides (Hofmann). Butterfield says that the pupæ vary in colour, from uniform pale green, and green blotched with umber, to dark umber, almost black.

Time of appearance.—In Britain, the species first appears at the beginning of July, and continues to emerge throughout the month; in the middle of July, 1874, imagines were reared from pupæ and larvæ found at Chattenden a little earlier (Porritt); in the next year the imagines were on the wing for some two or three weeks, in the same locality, from about July 5th (Tutt). On the continent, the time of appearance varies a little according to elevation, from June to mid-August, *e.g.*, June at Autun (Constant); August 5th-12th, at La Grave, in the Dauphiny Alps (Tutt); July and August, in Switzerland (Frey); June to the beginning of August, at Frankfort-on-Oder (Metzner), also in Upper Lusatia (Möschler), Saxon Upper Lusatia (Schütze), and Crefeld, near Uerdingen (Stollwerck); although July alone is given for most German localities—Baden, etc.; and Hofmann says end of June, and July, throughout Austria and Germany. Actual dates noted are: August 2nd, 1855, in the Waldrande, near Zürich (Frey); bred June 17th, 1858, and following days, from larvæ and pupæ found June 4th, at Magnusholm; also from July 1st-27th, from Arensburg, Pichtendahl and Ilpel (Nolcken); several from July 30th, 1877, in a garden at Schöneberg, near Berlin (Sorhagen); July 1st, 1903, at Duzi, in Bosnia (Hilf-Leonhardt); May 27th, 1904, a very early season, abundant at Zwötzen-on-the-Elster (Dieroff). British records; July 13th-18th, 1874, at Chattenden (Porritt); between July 6th and 31st, 1875, at Chattenden (Tugwell); bred July 7th-16th, 1877, from larvæ, obtained at Chattenden, that pupated June 22nd, 1877, and following days (Buckler); bred June 22nd, 1898, others bred July 16th, 1899, and following days, from larvæ obtained in Middlesex (Tutt); bred July 4th-20th, 1899; July 7th-11th, 1900, from larvæ found in Middlesex (Rothschild); July 22nd, 1900, at Worcester Park (Kaye);

bred July 4th, 1901, from larvæ found in Middlesex (Rothschild); bred July 12th-16th, 1903, from larvæ found in Middlesex (Tutt); bred July 12th, 1903, from larva found at Thorndon Park (Whittle); imagines emerged July 5th-12th, 1902, from larvæ collected June 24th, that pupated between June 25th-30th; others emerged June 29th-July 10th, 1903, from larvæ collected June 4th, in the Bexley district (Butterfield); bred July 11th-17th, 1903, from larvæ obtained in the Bexley district, on June 10th (Bankes); imagines also observed wild, July 4th, 1904, in the same district (Butterfield).

Habits.—The species is essentially a dusk and late evening flier, yet Butterfield, who has bred large numbers, says that the imagines almost always emerge in the early morning. In July, 1874, and 1875, specimens were frequently observed by Mr. Ovenden and myself, flying, after dark, around the rose-bushes in Chattenden woods, the females apparently busily laying their eggs, and, on at least one or two occasions, if memory serves, they appeared to be busy at the sweets. Porritt also has recorded it as flying about the rose-bushes at Chattenden, whilst Sorhagen says that, in Brandenburg, it sometimes swarms around rose-bushes. Claxton has taken the species at light at Navestock, near Romford, and Kaye, also at light, at Worcester Park; it is further recorded as abundant at light at Zwötzen-on-the-Elster (Dieroff). We were much surprised, at the end of one or two afternoons in early August, 1896, at finding three or four specimens on yarrow-flowers, under some rose-bushes, on a hedgebank at La Grave, in Dauphiny, whence we must have dislodged them, as we were working the bank pretty closely for micro-lepidoptera. As a rule, however, the species, even in confinement, appears to be chary of moving in the daytime. Warren says that he has only seen one wild imago in Middlesex; on this occasion he beat about six yards of the undergrowth of a hedge before dislodging this specimen, a female, which flew about a yard, and then settled on a grass-culm, and, being again disturbed, would only flit a foot or so; the insect also seems strangely lazy in confinement. Wocke observes that, when at rest, the forewings of the insect are spread out flat, standing at right angles to the body, and the hindwings are hidden beneath them. Dieroff observes that, on the evening of May 27th, the weather being sultry, and a thunderstorm threatening, he saw, at Zwötzen-on-the-Elster, no fewer than five pairs *in copulâ*; at this time the ♀ clings with the two front legs to a grass-culm, etc., the ♂ hanging free, and suspended only by its attachment to the ♀.

Habitat.—In Britain, the species appears to frequent the rose-bushes on the outskirts of woods, or in the ridings and more open parts of the woods in north Kent (Tutt); at Lewisham, it was taken in a garden (Stainton); in Middlesex, it is reported from hedgerows and gardens (South). Warren says that, in Middlesex, the species is spread, to his certain knowledge, over an area of four or five miles, and he has no doubt it extends further; it occurs round, and in, two villages, and close to the outskirts of one fairly large town; moreover, it seems to prefer rose-bushes growing by the sides of roads, and is frequently common there; it certainly does not avoid such. On the continent, it occurs throughout the greater part of the lowlands of Central Europe, and often does considerable damage to the cultivated roses in gardens. Hofmann says it occurs everywhere in Germany, from the sea-level to well up the mountain valleys, and, in Austria, from the low levels also well up the alpine valleys. It occurs freely in Heligoland. At Zwötzen-on-the-Elster, it abounds, in some years, on the so-called Lasur, a small chalk-range, *e.g.*, in May, 1904, which was a very dry month, and the grass burnt up, thus early, and in what is usually the rainy-season ; later in the year, it was found along the margins of fields and roads by Hecta (Dieroff). It often occurs also at a considerable elevation, *e.g.*, Bruand notes it as occurring in the high mountains of the Doubs dept. In Dauphiny, at La Grave, the imagines were apparently disturbed from wild rose-bushes growing on a bank beside the road just below the inn, in a most exposed situation, and at an elevation of at least 5000 feet; the specimens being found below the bushes on the herbage, or feeding at yarrow flowers. In Spain, Chapman found it at Tragacete, on the Albarracin Sierra, and at Soria on the Sierra de la Demanda.

Localities.—Very local in the British Isles, and only recorded from the southeast counties of England. Essex : Navestock, near Romford (Claxton), Thorndon Park (Whittle), Loughton (Machin). Kent : Chattenden (Porritt), Lewisham (Stainton), Bexley district (Butterfield). Middlesex : near Mill Hill Station (South), Finchley Station (Meek *teste* South), Kingsbury (Bond), Hackney (Stephens). Surrey : Worcester Park (Kaye), near Coombe Wood (Stephens).

Distribution.—Europe, central and southern (except Batavia), Finland, Livonia, Bithynia, Armenia (Rebel). America : St. Louis (Murtfeldt). Asia : Asia Minor—near Brussa, not rare (Mann), Amasia — South Caucasus (Staudinger). Austro-Hungary : everywhere from the low levels up into the alpine valleys (Hofmann), Bohemia (Fischer v. R.), Budapest, Sopron, Nagyág (Aigner), Brünn, not common (Gartner), Taufers valley (Weiler), Slavonia (Koça), Fiume, Dalmatia (*teste* Rebel), Vienna district (Kollar). Belgium : Liège (Deltour). Bosnia and Hercegovina : Dervent (Hilf), Kalinovik (Schreitter), Duzi (Hilf). Bulgaria : Varna (Lederer), near Sophia (Bachmetjew). France : widely distributed, Paris district (Latreille), Montmorency (Bégrand), Saône-et-Loire—Autun (Constant), the high mountains of the Doubs (Bruand), Dauphiny Alps—La Grave (Tutt), Aube (Jourdheuille), Cher—St. Florent, Indre—Nohant (Sand). Germany : everywhere from the sea-level to the alpine valleys (Hofmann), West Prussia, rare, (v. Siebold), Pomerania—Grabow, near Stettin (Büttner), Heligoland (Dalla Torre), Stettin (Büttner), near Dessau (Richter), near Göttingen, Quedlinburg, Mühlhausen (*teste* Jordan), near Berlin (Kliewer), Potsdam (Hinneberg), Havelland, not rare (Moritz), near Schöneberg (Sorhagen), Frankfort-on-Oder (Metzner), the Schwetiger Forest (Kretschmer), Silesia, rare—Breslau (Wocke), Upper Lusatia (Möschler), Saxony — near Freiberg (Fritzsche), Saxon Upper Lusatia — on the Proitschenberg, Klix (Schütze), near Strehla (Köhler). Thuringia, general (Knapp), Hesse (Glaser), Frankfort-on-Main, Wiesbaden (Koch), Nassau (Rössler), near Uerdingen, very rare (Stollwerck), near Trier, common, Crefeld (v. Hymmen), Aix, rare (Förster), the Pfalz (Bertram), Spires (Linz), Baden—Gailingen, Waldshut, Freiburg, Kaiserstuhl, Lahr, Carlsruhe, Bruchsal, Wertheim (Meess and Spuler), Saxony—Dresden (Fischer), Württemberg (Steudel and Hofmann), Regensburg district — Keilstein, Winzerberge, Wörth (Hoffmann and Herrich-Schäffer), Alsace—on the Bastberg, near Bouswillien, St. Pierre Bois, common, La Chapelle (Peyerimhoff). Italy : Sicily (Mina-Palumbo). Roumania : the Dobrudscha (Caradja). Russia : Baltic provinces—Magnusholm, Arensburg, Pichtendahl, Ilpel (Nolcken). Scandinavia : Sweden — Schonen (Zetterstedt), Scania, Norway (Wallengren), Akershus (Schöyen). Spain : Tragacete, Soria (Chapman). Switzerland : Zürich (Frey), Chur (Caflisch). Turkey : Roumelia—Batmisch, near Slivno (Rebel).

Subfamily : Amblyptiliinæ.

Tribe : Amblyptiliidi.

This subfamily is much more distinctly developed in the Stenoptiliine direction, than is the last (*Eucnemidophorinae*), particularly in its larval characters. The Amblyptiliid larva has the depression of the prothoracic scutellum black; the fairly abundant secondary skin-hairs, variable in size, smooth, and swollen at the tips, are very similar to those of *Eucnemidophorus;* some of these secondary hairs being very large; the primary setæ are swollen just below the pointed tip, and are not blunt, as in the Stenoptilias proper; the tubercles i and ii on either side of the mesothorax and metathorax are conjoined, as also, on the abdominals, are iv and v (which are separate in *Eucnemidophorus*), whilst, in the later stadia, these tubercles, as well as vi, assume a primitive wart-like structure; both the accessory postspiracular tubercles are also weakly developed as warts, the lower less strong than the upper*; the spiracles, too, are well-raised (in this particular more Stenoptiliid than Eucnemidophorid). In the pupal characters, the tribe is very specialised; the dorsal ridge, strongly marked in *Platyptilia*, and indicated in *Eucnemidophorus*, is, in *Amblyptilia*, well-developed. The trapezoidal tubercles are carried on halbert-shaped processes, the first, terminating the dorsal ridge on the 3rd abdominal segment, being especially large; the absence of the nosehorn is markedly Stenoptiliid, and the well-developed cremaster indicates a similar relationship. The imago is, in its general facies, entirely Platyptiliid, and not Stenoptiliid, and, in this respect, agrees with *Eucnemidophorus* and not *Marasmarcha.*

Genus: AMBLYPTILIA (AMPLYPTILIA, *by error*), Hübner.

SYNONYMY.—Genus: **Amplyptilia** (*by error*), Hub., "Verz.," p. 430 (1825). **Amblyptilia,** Stphs., "Illus. Haust.," iv., p. 376; app. p. 424 (1834); Zell., "Isis," p. 770 (1841); Staud. and Wocke, "Cat.," 2nd ed., p. 342 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 787 (1877); Frey, "Lep. Schweiz," p. 428 (1880); Barrt., "Ent. Mo. Mag.," xviii., p. 177 (1882); Willms., "Ent. Mo. Mag.," xviii., pp. 212-213 (1882); Sorhgn., "Kleinschm. Brandbg.," p. 3 (1886); Leech, "Brit. Pyr.," p. 54, pl. xvi., fig. 9 (1886); South, "Ent.," xxii., p. 31 (1889); Tutt, "Young Nat.," x., p. 164 (1889); "Brit. Nat.," i., p. 37 (1891); "Pter. Brit.," p. 51 (1895); "Ent. Rec.," xi., p. 238 (1899); Hofmn., "Deutsch. Pter.," p. 58 (1895). **Pterophorus,** Fab., "Mant. Ins.," p. 258 (1787); "Ent. Syst.," iii., p. 346 (1793); Sam., "Ent. Usef. Comp.," p. 409 (1819); Curt., "Brit, Ent.," fo. 161 (1827); Dup., "Hist. Nat.," xi., p. 650 (1838); Wood, "Ind. Ent.," 1st ed., p. 237 (1839); Zell., "Isis," p. 784 (1841); pp. 38, 902 (1847); Dup., "Cat. Meth.," p. 383 (1845); Tgstrm., "Finl. Fjär.," p. 155 (1847); Zell., "Linn. Ent.," vi., p. 326 (1852); Frey, "Tin. Pter. Schweiz," p. 405 (1856); Sta., "Man.," ii., p. 441 (1859); Porritt, "Ent. Mo. Mag.," xxi., p. 208 (1885); xxii., p. 149 (1885); xxiii., p. 132 (1886); "Buckler's Larvæ," ix., p. 351 (1901). **Alucita,** de Vill., "Linn. Ent. Faun. Suec.," iv., p. 546 (1789); Haw., "Lep. Brit.," 478 (1811); Hb., "Raupen," etc., ix., Aluc. i., pl. c., figs. *a-d* (*circ.* 1800); "Schmett. Eur.," Aluc. v., figs. 23-24 (*post* 1811); pl. vii., figs. 35-36 (1823); Tr., "Die Schmett.," ix., p. 232 (1833); Zett., "Ins. Lapp.," p. 1012 (1840). **Platyptilia,** Stphs., "Illus. Haust.," p. 376; app. p. 424 (1835); Zell., "Linn. Ent.," vi., p. 338 (1852); Meyr., "Trans. Ent. Soc. Lond.," p. 485 (1890); "Handbook," etc., p. 433 (1895); Walsm., "Ent. Mo. Mag.," xxxiv., p. 192 (1898); Fern., "Pter. Nth. Amer.," 1st ed., p. 24; 2nd ed., p. 25 (1898); Staud.

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* A secondary hair takes a fixed place behind spiracle, in the position of the upper accessory postspiracular tubercle, and might be regarded as subprimary; a lower accessory postspiracular is not constant, and one that often looks like it is rather accidental. In *Marasmarcha* (*lunaedactyla*) both are present, and have much more the character of primary setæ than of secondary hairs. These setæ (in these two genera) look like secondary skin-hairs, that, instead of varying in position like the others, were selecting positions of rest. One could, of course, frame the opposite hypothesis, that subprimary hairs ought to be here, and were just beginning to assert themselves, but if so, one is constrained to enquire why they begin as ordinary secondary skin-hairs, at first doubtful as to whether they have any special local claims (Chapman).

and Reb., "Cat.," 3rd ed., p. 73 (1901); Dyar, "List Nth. Amer. Lep.," p. 442 (1902); "Proc. Un. Sta. Nat. Mus.," xxv., p. 399 (1902); xxvii., p. 922 (1904). **Platyptilus,** Zell., "Isis," p. 770 (1841); H.-Sch., "Sys. Bearb.," v., p. 369 (1855); Frey, "Mitt. Schw. Ent. Gesell.," i., p. 335 (1865); iii., p. 290 (1870); Nolck., "Lep. Fn. Estl.," p. 802 (1871). **Amblyptilus,** Wallgrn., "Skand. Fjäd.," p. 13 (1859); Jord., "Ent. Mo. Mag.," vi., p. 121 (1869); xviii., p. 117 (1881); Wals., "Pter. Cal. Oreg.," p. 23, pl. ii., figs. 2-4 (1880); Barr., "Lep. Brit. Isles," ix., p. 338; pl. 414, figs. 4-5 (1904).

The genus *Amblyptilia* (spelt, evidently *by error*, *Amplyptilia*), as first described by Hübner (*Verzeichniss*, p. 430), was exceedingly heterotypical, containing, besides the two species here grouped under this generic title, species of the subfamilies *Oxyptilinae* and *Marasmarchinae*. That this alliance was, on general grounds, well-founded, may be seen from our own grouping. Of detailed structural differences, there are, however, many separating them. Hübner's original description reads as follows :—

Amblyptiliæ.—Die Schwingen fast buntschekig und glänzend bezeichnet—*Amplyptilia acanthodactyla*, Hübn., Alu. 23, 24. *Cosmodactyla*, Hübn., Alu. 35, 36. *Trichodactyla*, *Didactyla*, et *Chrysodactyla*, Schiff., Verz., Alu. A. 3, 2, 11. Hübn., Alu. 9, 18. *Phaeodactyla*, Hübn., Alu. 14, 15.

From this time onward the genus has been called *Amblyptilia*, not *Amplyptilia* (evidently a misprint, as the coitus is called *Amblyptiliae*). Zeller first dealt with the genus by removing *acanthodactyla* and *cosmodactyla* to *Platyptilus*, and founding *Oxyptilus* for the remainder, to which he refers *Amblyptilia*, Hb., as a synonym (*Isis*, 1841, p. 710). This action was so evidently *ultra vires*, and his entirely dropping *Amblyptilia*, Hb., as a valid genus, so unaccountable, that one is astonished that Herrich-Schäffer (*Sys. Bearb.*, v., pp. 361 *et seq.*) should follow him. However, in 1862, Wallengren rescued *Amblyptilia* (under the name of *Amblyptilus*), restricting it to *acanthodactyla*, Hb., whilst Staudinger and Wocke (*Cat.*, 2nd ed., p. 87) maintained the restriction, and restored the earlier spelling, *viz.*, *Amblyptilia*. Until 1886, the genus was generally used for the two species, *punctidactyla*, Haw., and *acanthodactyla*, Tr., but, in that year, Meyrick, on general family characters connected with neuration, sunk the *Platyptiliinae*, *Eucnemidophorinae*, and *Amblyptiliinae* into one genus *Platyptilia*, and has been followed in this retrograde movement by Fernald and Rebel. A mere glance at the larvæ and pupæ, of the heterogeneric species thus lumped together, would have sufficed to show the unsoundness of this action. There is no real excuse for either of these latter authors, since Hofmann, in 1895, had already shown, even on imaginal characters, the unsatisfactory conclusions of Meyrick, and had given sufficient facts relating to all the stages to show that his own conclusions were as incomparably ahead of those of his predecessors, as were the detailed facts, on which the conclusions were based, absolutely unknown to them.

We have already noted that Wallengren first limited the genus *Amblyptilia* to its present boundaries. His diagnosis thereof (*Kong. Svensk. Vetens. Akad. Handl.*, iii., p. 13) reads as follows :—

Antennæ of both sexes with very short cilia; the forehead ornamented with a very short pyramid of scales; palpi longer than the head, thick, laterally compressed, ascending, with the last joint short, slender, and pointed; legs slender, long, the tibiæ only in the least degree thickened towards the apex; first pair of spines in the posterior tibiæ nearly equal; longer than the second pair; the anterior wings furnished with a tooth of scales on their inner margin, not cleft to the third part of their length; the segments broad, the posterior segment almost hatchet-shaped, the posterior angle of the segments well marked; the segments of the inferior wings slender, the third segment with the anal angle sufficiently distinct, nearer the apex, furnished with a tuft of scales; the anterior wings flat, covering the posterior when at rest.

The genus is exceedingly restricted. There are four described Palæarctic species—*punctidactyla*, Haw., *seeboldi*, Hofm., *moerens*, Snell., and *cosmodactyla*, Hb., of which the first and last are British. In the Nearctic region, also, there appear, according to Fernald and Dyar (*List Nth. Amer. Lep.*, p. 442) to be four (or five) species—*pica*, Walsm., *cosmodactyla*, Hb., *marmarodactyla*, Dyar, *punctidactyla*, Haw., *? edwardsii*, Fish, *i.e.*, two species are common to the Palæarctic and Nearctic regions. The closeness of these two insects is as great as that between *Gillmeria ochrodactyla* and *G. pallidactyla*, and, like these, doubtful specimens can be separated by their genitalia, although Hofmann says that he cannot find any difference in them. Chapman, however, writes (*in litt.*) that, although he approached the question with the idea that Hofmann's statement was true, on examining five preparations of the brown species (*cosmodactyla*), and two of the greenish species (*punctidactyla*), he found a constant difference in the clasps. He says that "in the brown form the extreme length of the clasp is 1·00mm., in the greenish 1·08mm., and the bird's-head-shaped end is rounder, and with a shorter beak, in the brown form, flatter, and with a longer beak, in the green. The ædœagus in these specimens is much larger in the greenish form, though obviously variable in both; its form and structure appear to be identical, but the extreme length, over all, varies from 0·42mm. to 0·56mm. in the brown form, and the two of the greenish form are, respectively, 0·62mm. and 0·71mm.* It may be observed that, in these species, there exists, as a separate small apophysis, the extra clasp that is so well-developed in the Oxyptilids. No trace of this has been detected in other genera, even in *Marasmarcha*, which appears in some respects nearest the Oxyptilids."

In their general appearance, the two British species belonging to this genus, are similar to each other, but, even on superficial characters, are readily distinguishable, *e.g.*, *A. punctidactyla* is greenish in tint; *A. cosmodactyla* is red-brown. In their larval characters, they are very close, and apparently occur together on the same food-plants, yet there is (*teste* Hofmann) a distinct difference in the structure of the larval warts, and Porritt connects (*Ent. Mo. Mag.*, xxiii., p. 133) certain

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* It may appear desirable that I should express my opinion as to the value of this difference in the appendages of the two forms. I do not think it is in any way conclusive. Were the two forms only found at widely distant localities, I should have no hesitation in saying the differences were merely expressions of varietal divergence, a long way from necessarily implying specific distinction; but, as the forms occur together in the same localities, the value of these differences is considerably greater, and adds an additional weight to the considerations, whatever value they may possess, that already are accepted as proof of true separation. I would, however, say that my number of preparations is by no means sufficiently great to deserve absolute dependence on their indications, clear as they may be, especially in view of the considerable variation they show to exist in each form, in the dimensions of the ædœagus. A much greater difference in size in the appendages exists between those of *Erebia aethiops* from Scotland, and from the Engadine, but one does not dream (perhaps, however, wrongly) of suggesting more than geographical variety, abundantly within the limits of specific identity in that species. Did these two forms occur on the same ground, without intermediates, one would attach great importance to them. A deeper research may show that there are intermediates in the case of *Amblyptilia*; so far, I have not found them (Chapman).

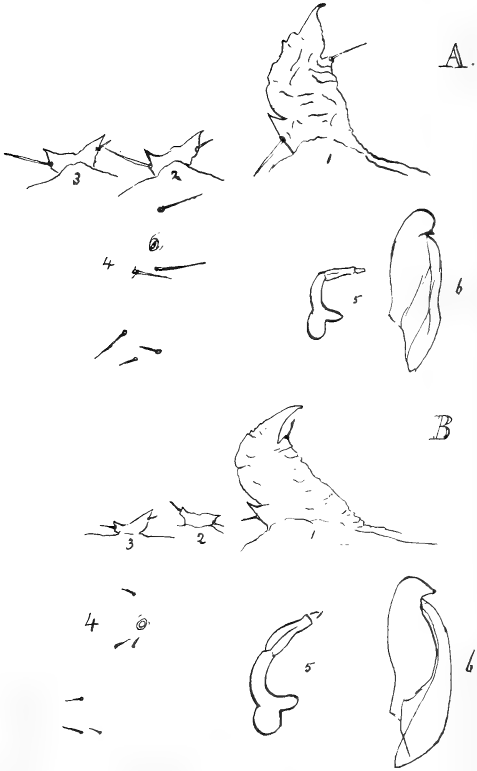
PLATE I.

[*To be bound facing p.* 270.]

PUPAL ARMATURE AND ANCILLARY APPENDAGES OF AMBLYPTILIA COSMODACTYLA AND A. PUNCTIDACTYLA × 24.

A. Figs. 1-4.—Pupal armature of *Amblyptilia cosmodactyla.*
Fig. 1.—Halbert-shaped process of 3rd abdominal segment.
Fig. 2.—Dorsal process of 5th abdominal segment.
Fig. 3.—Dorsal process of 6th abdominal segment.
Fig. 4.—Tubercles iii, iv, v, vi and vii of 4th abdominal segment.
Figs. 5-6.—Ancillary appendages of *Amblyptilia cosmodactyla.*
Fig. 5.—Clasp.
Fig. 6.—Ædœagus.

B. Figs. 1-4.—Pupal armature of *Amblyptilia punctidactyla.*
Fig. 1.—Halbert-shaped process of 3rd abdominal segment.
Fig. 2.—Dorsal process of 5th abdominal segment.
Fig. 3.—Dorsal process of 6th abdominal segment.
Fig. 4.—Tubercles iii, iv, v, vi and vii of *Amblyptilia punctidactyla.*
Figs. 5-6.—Ancillary appendages of *Amblyptilia punctidactyla.*
Fig. 5.—Clasp.
Fig. 6.—Ædœagus.



Pupal armature and Ancillary appendages of (A) Amblyptilia cosmodactyla and (B) A. punctidactyla × 24.
(From camera sketches by T. A. Chapman.)

Natural History of British Lepidoptera, 1906.

[For explanation see back.]

larval differences with the two species, and concludes that the larval characters are sufficiently distinctive; Chapman also finds certain distinctive pupal characters (see *posteà*).

As to the names to be applied to the two British species, there appears to be considerable doubt. The oldest name for the red-brown species is, no doubt, *calodactylus*, Fab. (*Mant. Ins.*, ii., p. 258), a title, however, that belongs by right to *zetterstedtii*, Zell. (see *anteà*, p. 162). In 1811, Haworth gave the name *punctidactyla* (*Lep. Brit.*, pt. 3, p. 479) to the greenish species. Between 1811 and 1817, Hübner figured (*Schmett. Eur.*, Alu. v., figs. 23-24) a deep dull-brown insect marked with tawny, as *acanthadactyla*, having already, about 1800, figured in his *Raupen*, etc., ix., Aluc. i., pl. c, figs. *a-d*, the larva and pupa of the red-brown form on *Ononis spinosa* as *calodactyla*. In 1823, he figured (*Schmett. Eur.*, Alu. vii., figs. 35-36), under the name of *cosmodactyla*, a reddish-brown insect, marked with yellow. In other words, both *acanthadactyla*, Hb., figs. 23-24, and *cosmodactyla*, Hb., figs. 35 36, are wanting in the characteristic greenish colour of *punctidactyla*, Haw. In 1833, Treitschke (*Die Schmett.*, ix., pt. 2, p. 234) described the red-brown species as *acanthodactyla*, Hb., and the greenish species as *cosmodactyla*, Hb., giving his own colour diagnoses as "obscure-fuscous," and "olivaceous-fuscous," respectively, and hence came into our lists the general use of these names for the two species. Strangely enough, after describing the insects in the terms just noted, Treitschke adds that his *cosmodactyla* accords exactly with the Hübnerian figure, in which, however, we detect no trace of "olive" or "greenish." In 1890, we girded at the application of the name *cosmodactyla*, Hb., to the greenish species, pointing out that Hübner's figures 35 and 36 of *cosmodactyla* were not greenish, and, in 1891 (*British Nat.*, i., p. 38), we also offered some remarks on the subject. Later, in 1899 (*Ent. Rec.*, xi., p. 238), we suggested that Hübner's figs. 23-24, *acanthadactyla*, were referable to the "olive-grey" or "olive-fuscous" species, *punctidactyla* (although the figures were in no wise characteristic), and also that his figs. 35 and 36, *cosmodactyla*, were referable to the red-brown species, *i.e.*, exactly the opposite conclusion to that at which Treitschke had arrived. There appears to be some little difference in the tinting of the figures in different copies of Hübner's plates, and, after much reconsideration and study, we came to the conclusion that Hübner's *acanthadactyla*, with deep dull-brown wings, and the reddish-brown *cosmodactyla*, might possibly have to be referred to the same species, *i.e.*, that neither is sufficiently characteristic to be placed with certainty with the greenish species, *punctidactyla*, Haw. One thing is, however, abundantly certain, as we have before said (*Pter. Brit.*, p. 57), *viz.*, that Hübner's *cosmodactyla*, figs. 35 and 36, cannot possibly be *punctidactyla*, Haw., nor would we assert too positively that Hübner's *acanthadactyla*, figs. 23-24, can. In this dilemma we appealed to Bankes, and he writes (*in litt.*, 3, iv. 1906): "I have no hesitation whatever, after carefully examining Hübner's figures (as represented in 'Fletcher's' copy), and then comparing them with my long bred series of both species, in saying that figs. 23-24, which Hübner calls '*acanthadactyla*,' most certainly are intended to represent the olivaceous insect known in Britain as '*punctidactyla*,' Haw., and that figs. 35-36, called by Hübner '*cosmodactyla*,' equally certainly represent the common reddish-brown species to which British authors have almost invariably applied the name '*acanthodactyla*,' though these latter figures do not show the shape of the wings at all accurately, making the costa decidedly too much arched, and the wings too short in proportion to their breadth. In Fletcher's copy of 'Hübner' (which formerly belonged to Zeller, and bears his identifications written below some of the names on the plates, though not below the names in question), the colours alone, poor as they are, would suggest the above determinations, for figs. 23-24 recall the unmistakable olive-brown livery, characteristic of *punctidactyla*, Haw., more uniform than that of *acanthodactyla*, Tr., while fig. 35 (fig. 36 only shows the underside) exhibits, in places, and especially on the basal two-thirds of the forewings, the equally unmistakable ruddy hue of *acanthodactyla*, Tr., which is never found in *punctidactyla*. But, ignoring colour altogether, the markedly produced apex, the produced tornus, and the shape and prominence of the large dorsal scale-tooth of the forewing, together with the shape and prominence of the dorsal scale-tooth of the hindwing, prove conclusively, in my opinion, that figs. 23-24 can only be meant for *punctidactyla*, Haw., whereas the less produced apex and tornus and the less conspicuous dorsal scale-tooth of the forewing, with the broader and shorter dorsal scale-tooth of the hindwing, prove, with equal certainty, that figs. 35-36 cannot be intended to represent *punctidactyla*, Haw., and remind one so strongly of *acanthodactyla*, Tr., that, in spite of the incorrect shape of the wing, one feels justified in accepting these figures as meant for this species. You will note that my conclusions are identical with your own, as set forth in *Ent. Rec.*, xi., pp. 238-9, and Fletcher (*in litt.*) has come to the same conclusion." Fletcher writes (April 2nd, 1906): "Hübner's figs. 35-36 are most clumsily drawn, but show some tufts on the inner margins of the wings. If we are to divide figs. 23-24, and figs. 35-36, between the two species, I think the one we have known as *punctidactyla* must take figs. 23-24, on the ground that the apices and anal angles of the wings are most sharply produced in these figures, and that the general colouring of the forewings and that of the blotchings do not differ much in intensity, whilst that which we have known as *acanthodactyla* will have to go with the ill-drawn figs. 35-36, so that Tutt's verdict (*Ent. Rec.*, xi., p. 238) stands. The colour of figs. 23-24 is bad; still there is the uniformity in intensity shown." One doubts very much whether our *punctidactyla* was really well-known to the majority of continental lepidopterists; and one supposes that, so far as his knowledge went, Zeller's contention that *cosmodactyla*, Hb., was simply a form of *acanthadactyla*, Hb., was, so far as concerned most continental specimens passing under the former name, quite true. (On this point see Walsingham, *Pter. Cal. Oreg.*, p. 24.) Frey, after stating (*Stett. Ent. Zeitg.*, 1886, p. 62) that Zeller could not discriminate specifically between *cosmodactyla*, Hb., and *acanthadactyla*, Hb., says, in distinguishing these two forms from his *stachydalis* and *calaminthae*, that all the *Amblyptilia* forms described are brown, *i.e.*, *acanthodactyla* = brown mixed with red, *cosmodactyla* = chestnut-brown, *stachydalis* = light yellow-brown, *calaminthae* = light grey; so that his preceding note on *stachydalis* (*Stett. Ent. Ztg.*, 1871, p. 121) that it was of a bright olive-brown hue, might lead one to suppose that his term "olive-brown" was only "yellow-brown," and not really greenish, as in our best-coloured *punctidactyla*, if his types were not really specially brightly-coloured examples; whilst his remark that *cosmodactyla* is chestnut-brown does not at all apply to our *punctidactyla* as we know it, although no doubt he is here referring to the dark examples in the "Frey collection" in the British Museum, which are entirely different from any British examples that we have yet seen of *punctidactyla*. Nolcken, also, who appears to have known the species through Zeller and Frey, notes (*Lep. Faun. Estland*, etc., p. 82) that he took examples of *cosmodactyla*, Hb. (evidently *punctidactyla*), of a fresh light-grey colour melting into greenish (as noted by Frey), and, later, some perfectly typical specimens, without saying, however, what he considered "typical," although, according to his account of *acanthodactyla*, Tr., he appears to have considered that *punctidactyla* ("*cosmodactyla*") was only distinguished from *acanthodactyla*, Tr., by its greyer colour, and white-spotted costal margin. Altogether the figures of Hübner are very puzzling. At any rate, the greenish species must be called *punctidactyla*, Haw., and, in our opinion, the brown species is *cosmodactyla*, Hb. Of the two species, Hofmann says (*Die Deutsch. Pteroph.*, p. 60): "The genus consists of only two species standing very closely to each other, both of which occur in several (2-3) different forms. Besides the difference in habits, the distinctions lie in the coloration and scaling peculiar to each species, in which I have never observed any intermediate forms, and in the position of the black scale-tooth of the 3rd plumule. As the larvæ and pupæ also exhibit slight differences, the title to specific rank should be well founded." His diagnoses of the two species in the imaginal form (*op. cit.*, p. 61) read as follows :—

The scale-tooth on the 3rd plumule of the hindwing lies fairly exactly in the middle of the wing (taking the inner margin as the space measured). Forewings narrow, ferruginous-brown, reddish-brown, or brownish-grey, with darker similarly coloured markings and sparse white scaling. Body slender ... *cosmodactyla*, Hb.

The scale-tooth of the 3rd plumule lies distinctly beyond the middle, nearer the apex. Forewings broader, blackish, appearing light, and as if marbled, by reason of the rich white and yellow scaling, often with transverse rows of white scales. Markings black, body stouter ... ... *punctidactyla*, Haw.

To Hofmann also we owe the discovery of an actual larval distinction between these two species. His distinction (since verified by Chapman) appears to be as follows (*Die Deutsch. Pteroph.*, pp. 63 and 66) :—

Tubercles large, white, many-haired, mostly with one longer and two or three shorter bristles, the latter knobbed. These many-haired tubercles are different from those of the larvæ of *A. punctidactyla*, which have 2-haired tubercles only on the flange. The prothorax green, with a finely drawn open black triangle in the middle, and two small black spots on each side ... ... *cosmodactyla*, Hb.

Tubercles small, of the colour of the body, single-haired, only those on the flange bearing two hairs. The body is also thickly covered, especially dorsally, with fine short, white, not clubbed, hairs (only distinctly visible under a lens). The prothorax green ... ... *punctidactyla*, Haw.

Amblyptilia cosmodactyla, Hübner.

Synonymy.—Species : **Cosmodactyla,** Hb., "Schmett. Eur.," Aluc. pl. viii., 35-36 (1823) ; "Verz.," p. 430 (1825) ; Stphs., "Illus.," iv., app. p. 424 (1834); Tutt, "Ent. Rec.," xi., p. 238 (1899) ; Bankes, "Ent. Rec.," xviii., p. 39 (1906). **Calodactylus,** Fab., "Mant. Ins.," ii., p. 258 (1787) ; "Ent. Syst.," iii., p. 346 (1793) ; ?Sam., "Ent. Usef. Comp.," p. 409 (1819) ; Curt., "Brit. Ent.," fo. 161 (1827) ; Stphs., "Illus. Haust.," iv., p. 376 (1834) ; Wood, "Ind. Ent.," 1st ed., p. 237, pl. li., fig. 1646 (1839). **Calodactyla,** de Vill., "Linn. Ent. Faun. Suec.," iv., p. 546 (1789) ; Hb., "Raupen," etc., ix., Aluc. i., pl. c., figs. *a-d* (*circ.* 1800) ; Haw., "Lep. Brit.," p. 478 (1811) ; Treits., "Die Schmett.," ix., pt. 2, p. 232 (1833); Stphs., "Illus.," etc., iv., app. p. 424 (1834). **Acanthodactyla,** Tr., "Die Schmett.," ix., pt. 2, p. 234 (1833); Staud. and Wocke, "Cat.," 2nd ed., p. 342 (*in part*) (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 787 (1877); Frey, "Lep. Schweiz," p. 428 (1880); Willms., "Ent. Mo. Mag.," xviii., pp. 212-213 (1882); Sorh., "Kleinschmett. Brand.," p. 3 (1886); Leech, "Brit. Pyr.," p. 54, pl. xvi., fig. 9 (1886); South, "Ent.," xxii., p. 31 (1889); Meyr., "Trans. Ent. Soc. Lond.," p. 486 (1890); Tutt, "Brit. Nat.," i., p. 38 (1891); "Pter. Brit.," p. 53 (1895); Meyr., "Handbook," etc., p. 433 (1895); Hofm., "Deutsch. Pteroph.," p. 61 (1895); Fern., "Pter. N. Amer.," p. 25 (1898); Staud. and Reb., "Cat.," 3rd ed., p. 73 (1901); Dyar, "List N. Amer. Lep.," p. 443 (1902). **Acanthodactylus,** Dup., "Hist. Nat.," xi., p. 650, pl. 313, fig. 6 (1838); "Cat. Meth.," p. 383 (1845); Zell., "Isis," p. 784, vars. *a*, *b* (1841); pp. 38, 902 (1847); "Linn. Ent.," vi., p. 338, vars. *a*, *b* (1852); Tgstrm., "Finl. Fjär.," p. 155 (1847); H.-Sch., "Sys. Bearb.," v., p. 369 (1855); supp. fig. 5 (1853); Frey, "Tin. Pter. Schw.," p. 405 (1856); Sta., "Man.," ii., p. 441 (1859); Wallgrn., "Skand. Fjäd.," p. 13 (1859); Jord., "Ent. Mo. Mag.," vi., p. 121 (1869); xviii., p. 177 (1881); Nolck., "Lep. Faun. Estl.," p. 802 (1871); Sta., "Ent. Mo. Mag.," viii., p. 236 (1872); Tutt, "Young Nat.," x., p. 164 (1889); Porrt., "Ent. Mo. Mag.," xxi., p. 208; xxii., p. 149 (1885); xxiii., p. 132 (1886); "Buckl. Larvæ," etc., ix., p. 351, pl. 163, fig. 5 (1901); Walsm., "Ent. Mo. Mag.," xxxiv., p. 192 (1898); Barr., "Lep. Brit. Isles," p. 358, pl. 414, figs. 4-4*a* (1904). **Cosmodactylus,** Stphs., "Illus.," iv., p. 377 (1834); Wood, "Ind. Ent.," 1st ed., p. 237, fig. 1649 (1839). [The first certain description of this species is given by Fabricius, under the name of *calodactylus*, in 1787, and under this name Hübner figured its larva and pupa on *Ononis arvensis*. The name, however, had been applied by Schiffermüller and Denis to *zetterstedtii*, Zell., and, as *calodactyla*, the latter species was figured by Hübner. Two species, therefore, were for a time masquerading as *calodactyla*, *viz.*—(1) *calodactyla*, Schiff., Hb. (fig. 7) = *zetterstedtii*, Zell., and (2) *calodactylus*, Fab., Hb. (*Larvae*, pl. c., figs. *a-d*) = *cosmodactyla*, Hb. = *acanthodactyla*, Tr. Hübner's figs. 35-36, named *cosmodactyla*, are, we think, most probably this species. Treitschke applied this latter name to *punctidactyla*, Haw. = *acanthadactyla*, Hb., in which he was followed by Zeller, Staudinger and Wocke, so that *punctidactyla*, Haw., was generally known as *cosmodactyla*, Hb. At the same time, this species was referred by Treitschke, Zeller, and Staudinger and Wocke to *acanthadactyla*, Hb. Hence a reversal of Hübner's names took place, which we attempted to put straight in 1899. Staudinger and Rebel quote this correction in their synonymy, but maintain the reversal of the names.]

Description of original figures.—Fig. 35, *cosmodactyla*. Exp. al., 20mm. Forewing, in length 9·5mm., in breadth 2mm. in middle, 3·5mm. at tornus; costa much arched throughout; apex but little produced, not sharply pointed, decidedly falcate; tornus blunt, hardly produced; termen hardly concave; colour silky rufous-tawny, sparingly marked with blackish anteriorly, much obscured by it towards termen. Anterior two-thirds of costa blackish, strigulated with ochreous except at base; a narrow oblique whitish fascia at 3·5mm., with a broader primrose-yellow one at 2mm., from apex, and a subapical cluster of silvery dots. Middle third of disc with a pale bluish-grey wash along centre. Centres of fasciæ united by a primrose streak, like an inverted dagger-blade, but the termen, though slightly notched in the middle, shows no fissure (set specimens resemble Hübner's figure in this respect). Cilia white, tipped with black (? necessary shading), with, on dorsum, a roundish, black, projecting scale-tooth rather beyond middle, a small blackish spot beyond it, and a larger one at tornus. Hindwings silky, rufous-tawny anteriorly, much obscured by blackish posteriorly; third plumule with ochreous dorsal vitta; upper fissure extending almost to middle, lower one nearly to base; cilia bluish-grey, with a mediodorsal, very broad, short, blackish scale-tooth, not projecting beyond general line of cilia. Abdomen (suggestive of ♂) pale rufous-tawny, with a subdorsal row of primrose spots along either side. Fig. 36, *cosmodactyla*, represents the imago with the wings almost closed over the back, the *undersides* of the two right wings alone being shown. Forewing silky drab-brown, much speckled and mottled with blackish; costa posteriorly white-marked, an oblique bright ochreous costal spot preceding an oblique whitish subapical fascia, from the centre of which a whitish streak, like a dagger-blade, projects inwardly; dorsum partially washed with rufous-tawny beyond middle; termen slightly notched in centre, but showing no fissure; cilia and scale-tooth much as in fig. 35, but a small, slightly-projecting, black scale-tooth replaces the blackish spot in cilia between central scale-tooth and tornus. Hindwing drab-brown, speckled with blackish, darker posteriorly; upper plumule with a straight, bright ochreous, subterminal fascia; cilia lilac-grey, with a broad, central, blackish, mediodorsal scale-tooth (Bankes. From W. H. B. Fletcher's copy of Hübner's *Europ. Schmett.*, pl. vii., figs. 35-36).

Earliest description.—The oldest description of this species reads as follows:—*Pterophorus calodactylus*, alis fissis fuscis; anticis subfalcatis fissis fulvo-maculatis, posticis tripartitis. [*Alucita calodactyla*, "Wien. Verz.," 146, 4.] Habitat in Austria, Mus. Dom. Schieffermyller. Statura præcedentium. Alæ anticæ cinereo fuscæ apice obscuriores macula magna fulva. Margo interior dentatus, posticus fissus. Posticæ tripartitæ nigræ. Pedes albo annulati (Fabricius, *Mantissa Insectorum*, p. 258).

Imago.—20mm.-22mm. Forewings divided into two lobes; apex pointed, slightly falcate; anal angle of hinder lobe slightly prolonged; a small lobe on inner margin of hindwing. Ground-colour of forewings of a rich reddish-brown, showing longitudinally along costa, near inner margin, from anal angle to base, and above the cleft of upper lobe; the median area from cleft to base pale flesh-colour (due to thick sprinkling of white scales), interrupted with two (or three) short longitudinal dark brown discal spots; a deep velvety-brown triangular costal spot, of which apex reaches below the cleft, its outer edge margined with white; a deep, rich, velvety-brown (almost black externally) band across the upper and lower lobes, the inner edge irregular, the outer edged with a fine, white, transverse line; the upper lobe strongly covered with white scales, the costal and outer margin brown, the anal angle and outer margin with black scales (variable in number); the lower lobe less thickly covered with white scales, the margins and anal angle strongly suffused with black; the costa marked with short white oblique dashes, the inner margin with white fringes chequered with black scales; the outer fringes grey with white bases, at the anal angle black; the cleft-fringes grey, darker towards the base of cleft, where there is a white lunular mark, with a black discal point terminating the cleft. Hindwings divided into three plumules, the second cleft much more deeply cut than the first; dark grey-brown in colour; the fringes dark grey; those of the outer margin of the 3rd plumule with paler bases, with a well-marked scale-patch medially, with isolated black scales extending to base, and sometimes to apex.

Variation.—Extreme colour aberrations of this species seem to be remarkably few, yet there is considerable racial distinction in specimens reared under different environmental conditions, and, amongst our British examples, one notes many interesting races, and observes that, although our specimens from the south of England—Devonshire, Dorsetshire, Kent, Essex, Sussex, etc.—show comparatively little variation, being of a fairly uniform ground colour, and without striking markings, those from the north of England, Scotland and Ireland, show much more marked variation in their local characteristics. The specimens from Glengariff are almost of the same size and general appearance as our south of England specimens, perhaps a little paler in the middle of the forewing, but those from Sligo are a very marked race, rather below average size, bright in tint, of an almost unicolorous reddish hue, with rosy tint: the costa narrowly, as well as the costal triangle and the lobal band, of a rather darker reddish or reddish-brown hue, with pale shading outside the costal triangle, and a pale line across the lobes of forewing=var. *hibernica*, n. var. Strangely, our nearest example to this race, in size and colour, comes from Kingsdown, in Kent, where, however, it must be a pure aberration. The specimens from Aberdeen are very fine, large in size, almost slaty in hue, and with a violet tinge in the median area of forewings; the costa deep red-brown, as also is the costal triangle and lobal band. Beyond the lobal line the outer marginal area is almost white, as is also the shading on the outer edge of the costal triangle; the costa itself, however, is little spotted =var. *scotica*. An almost similar example came from Ben Donich; but the most remarkable specimen in our collection came also from the heathery slopes on the sides of Ben Donich, above Lochgoilhead. This is a brilliant (rather small) specimen of var. *scotica* in its most extreme form, the slaty-white and red standing out in striking contrast, but with the costa as conspicuously spotted with white as in the best marked *punctidactyla*=ab. *variegata*, n. ab. Of the dwarf "heath" race, from Selby, mention is made below; and the melanic form of this dwarf variety in the "Frey collection," at the Natural History Museum, is worthy of study. The other dwarf race, var. *calaminthae*, grey in tint, of which the types are also in the "Frey collection," is also dealt with *infrà*. The variation in the species is, on the whole, therefore, more particularly noticeable perhaps in size than in tint, and the Selby form and var. *calaminthae* appear to be, as a rule, quite dwarf races. Of this size variation, Bankes notes: "In general, all the specimens that I have bred and captured, whether on the heaths or elsewhere, both in Devon and Dorset, have been of good size, many of them showing an expanse of wing of 22mm., and some of as much as 23mm. My smallest and palest individual, bred from *Stachys sylvatica* in 1892, only expands 16mm., but I have never met with any nearly so small in nature. The Rev. C. D. Ash, however, takes examples of a dwarfed race near Selby, Yorks, of which my two representatives only have an expanse of 14mm., and 17mm. respectively. Such small examples might be called ab. *minor*, n. ab." Of the colour variation, Bankes writes (*in litt.*): "With the exception of ab. *nivea*, I have seen no extreme colour aberrations of this species, but, among some 1300 bred specimens, the ground colour varies from pale ashy-brown, through bright red-brown, to dark reddish-brown, relieved, of course, in each case by a powdering, or partial clouding, of whitish scales." Hofmann writes: "Coloration of the forewings in the typical form ferruginous-brown or reddish-brown, but intermediate forms in brown-grey of different depths also occur." We may here note the *acanthodactyla* var. *a* of South (*Ent.*, xxii., pp. 31-32), which is described as having "forewings ochreous-grey with a rosy tinge; markings as in the type, but more clearly defined, and with oblique striæ, similar to the same character in *punctidactyla* (*cosmodactyla*), but not so conspicuous," and which was bred from a pupa found on *Stachys sylvatica*, in Pelham Woods, Ventnor, on September 1st, 1883. One of the few specimens in the Frey collection also has these lines fairly well-marked (see also our notes on one of the types of var. *calaminthae*, Frey). The following are the described forms of the insect :—

α. ab. *nivea*, Bankes, "Ent. Rec.," xviii., p. 39 (1906).—Head and thorax whitish, dusted with fuscous; forewings white, dusted with brown towards the costa; the clearly-defined antemedian costal spot, postmedian costal blotch, and subterminal bar crossing the lobes, with the terminal portion of the lower lobe, are brownish-black; terminal cilia blackish, chequered with white; hindwings brownish-black, with the dorsal margin of the third feather whitish; cilia brownish, partially dark-spotted; scale-teeth of all the cilia blackish; abdomen dorsally and ventrally white, dusted with fuscous, laterally blackish; legs white, broadly barred with brownish-black. The above description of this most striking and beautiful aberration was recently made from two British examples (♂ and ♀) in Mr. W. H. B. Fletcher's collection. They were taken, either as imagines or larvæ, by Mr. W. Salvage several years ago, probably in Sutherlandshire, though this is uncertain. If other lepidopterists secured examples of this albinic aberration from Mr. Salvage, perhaps they will kindly make known the data received from him, for there seems little doubt that he only met with it in one locality, where it occurred rarely during a single season. These two specimens are the only ones I have seen. To prevent confusion, it seems advisable to add that the name *cosmodactyla* is used above for the common reddish-brown species, popularly known in Britain as *acanthodactyla*, and not for the rare olive-brown insect generally known as *punctidactyla* or *cosmodactyla*. In *Ent. Record*, xi., 238 (1899), Mr. Tutt showed that the former is the true *cosmodactyla*, Hb., while the latter is really *acanthadactyla*, Hb., but in the *Catalog* by Staudinger and Rebel (1901), although the reference to his note is given, the erroneous use of Hübner's names is maintained (Bankes).

β. var. *tetralicella*, Hofm., "Deutsch. Pteroph.," p. 62 (1895); Staud. and Rebel, "Cat.," 3rd ed., p. 73 (1901).—The ground colour yellow-grey, the dark markings are partly dark ferruginous-brown, partly more blackish-brown; in the discal area, where the colouring is mixed, sometimes white and sometimes black predominates; the markings differ neither on the upper nor the underside from the typical form, but the underside of the 1st and 3rd plumules, in most examples, is rather blackish-grey than brown; the triangular scale-tuft of the 3rd plumule is longer, and generally more like that of *A. punctidactyla* (*cosmodactyla*) in shape. To this form are to be referred several specimens received from Stettin, and bred by Hering from *Erica tetralix*. Examples quite similarly coloured, and agreeing in the form of the scale-tuft of the 3rd plumule also occur at Regensburg, where, indeed, this form appears to be commoner than the ferruginous-brown form, and is reared from larvæ found on *Clinopodium vulgare* (Hofmann).

Rebel says (*Cat.*, p. 73) "flavo-grisescens," and from this it might be assumed to be merely this colour form, not particularly confined to any foodplant, although perhaps more frequent, as pointed out by Hofmann, in connection with certain environmental conditions of which a special food may be an important factor. This, however, is not so, and it is clearly the darker markings that give character to the form. [In the "Frey collection" are two ♂s and one ♀, from which the label is unfortunately missing, but which we suspect to have been received from Hering. They are placed beneath the typical examples of *calaminthae*, and are unnamed, although set apart as something quite distinct. They appear to be a "heath" form, are very dark in colour, almost as small as *calaminthae*, and tending to have quite a melanic general appearance, the ground colour being largely suppressed by the spread of the dark markings, in which blackish predominates. The nearest approach we have seen to this small race among British examples, are the specimens taken on the heaths at Selby by Ash; and we suspect that it will be generally found to be a "heath" form, although from some "heath" localities the specimens are of normal size and brightness.] Hofmann does not note that his "heath" race is abnormally small.

γ. var. *calaminthae*, Frey, "Stett. Ent. Ztg.," p. 62 (1886); Hofm., "Die Deutsch. Pteroph.," pp. 62-63 (1895); Staud. and Reb., "Cat.," p. 73 (1901).—*Amblyptilia calaminthae*, Schmid. Schmid discovered, in 1880, very late in the autumn, near Regensburg, this interesting species, which belongs to the *acanthodactyla* group. Zeller and I always differed on the specific value of *cosmodactyla*, Hb., which he considered a variety of *acanthadactyla*, Hb., nor was his opinion shaken by my discovery concerning the larva. Later, when, owing to the destruction of the forests around Zürich, the larva of *cosmodactyla* (*i.e.*, *punctidactyla*) became very rare on the seeds of *Aquilegia* in the late autumn, I discovered a larva, some four to six weeks earlier, feeding on the bloom of *Stachys sylvatica*. I described it, with some reservation, under the name of *stachydalis*, as being possibly the first brood of *cosmodactyla*. I believe the insect is double-brooded, as I have taken *cosmodactyla* from August to the end of June, and an Alucitid is not likely to exist for ten months in a single brood. Further, I have several *cosmodactyla* which closely resemble *stachydalis*. Now we have Schmid's find, which has caused me much trouble, yet I feel perfectly satisfied that his *calaminthae* is a distinct species, though nearly related to *acanthodactyla* and *cosmodactyla*. First, it is considerably smaller, even smaller than *stachydalis*, the forewings narrower and drawn out to a sharper point. An important detail in its distinction is offered by the ground colour of the forewings, for whereas, in the allied species described hitherto, the colour is brown (in *acanthodactyla* mixed with reddish, in *cosmodactyla* chestnut-brown, in *stachydalis* much lighter yellow-brown), this slenderly-built insect is of a light-grey; otherwise the markings are typical. Across the two lobes of the forewing is a distinct white line. The costal mark is similar to those of the other species, and on this I lay no particular stress. The third plumule of the hindwings has narrower black fringes, and a small black scale-tooth on the margin as in the other species, but the fringes of the hind margin are not white, but grey (Frey). Hofmann gave us the following description of the larva: "Found September 12th, 1884, on the buds of *Calamintha nepeta*, eating thereinto. About 8mm. long, slightly tapering at the head and anus; dirty reddish or lilac in tint, of the colour of the flowers on which it feeds (the larvæ of *cosmodactyla* and *stachydalis* are pale green); the underside of the abdomen greenish-yellow. Head glossy black, with yellow lines and spots about the mouth-parts; the prothoracic shield yellowish, bordered with white in front, with three black spots, of which the central is largest, triangular, and bordered with white raised lines; the tubercles are white, with white stellate hairs; these tubercles run along each side of the body in three longitudinal lines, two rows near each other above, and one beneath, the stigmata; the anal flap yellowish, with black dots; the anal claspers and ventral prolegs of the same colour as the venter; true legs black. [Described from a living larva not quite fullgrown.] From Regensburg."

The types of this small race (♂ and ♀) are in the "Frey collection" at the British (Natural History) Museum. They are of a pale grey tint, one being much marked with transverse white lines as in *punctidactyla*, are labelled "*calaminthae*, Regensburg," and are accompanied by the empty pupa-cases from which they were bred. Rebel says of the form "gracilior, dilute grisescens, nigro-signata. Bavaria" (*Cat.*, 3rd ed., p. 73), and Frey himself, comparing his *cosmodactyla*, *acanthodactyla*, *stachydalis*, and *calaminthae*, says that they were "chestnut-brown," "brown mixed with red," "light yellow-brown," and "light grey," respectively. Of this last-named form, Hofmann says (*Die Deutsch. Pteroph.*, p. 62) that the colour is "bright grey, the dark markings the same as in the typical form, but never brown, always pure black. The costal triangle is often absent, and, in that case, the spots at the fissure, either separated or united into a transverse stripe, stand out conspicuously. The underside of the 1st and 3rd plumules is black, with rather large and abundant white scales, which form, at the apex of the 1st plumule, an indistinct white, sometimes angulated, transverse line. The scale-tuft of the 3rd plumule is usually weakly developed, short, with an elongated base, coming nearest to that of the typical form. Schmid says that the imagines of var. *calaminthae* appear from September up to late autumn, near Ratisbon. Larvæ were found on the Schlossberg, in Donaustauf, on *Calamintha nepeta*. These fixed themselves up in the usual manner, and changed into dark pupæ, smaller than those of *acanthodactyla*, on the stem of the foodplant.

Comparison of the imagines of Amblyptilia cosmodactyla and A. punctidactyla.—Bankes says that the following appear to be the most important, striking, and reliable distinctions between *punctidactyla*, Haw., and *cosmodactyla*, Hb.:—

(1) In *punctidactyla*, the apex of the forewing is decidedly more produced, slender, and falcate than in *cosmodactyla*. A comparison of the relative distance to which the apex of the upper lobe projects beyond that of the lower lobe, shows a great difference between the two species, while the dissimilarity in the breadth and shape of the apex is equally well-marked.

(2) The large black scale-tooth in the middle of the dorsal cilia of the hindwing is, in *punctidactyla*, noticeably longer from the centre of the base to the apex than in *cosmodactyla*, and this distinction seems perfectly constant.

(3) *Punctidactyla* has much of the whitish scaling on the forewing grouped into numerous small more or less ill-defined spots, suggesting interrupted transverse striæ, whereas, in *cosmodactyla*, on the contrary, the whitish scales do not thus thoroughly break up the ground colour, but only form clouds overlying it here and there, or else are scattered singly over parts of it.

(4) In all the ordinary forms the ground colour of the forewing of *punctidactyla* is of a strongly olivaceous tint, which is never present in its ally, and the few extreme aberrations, where the colour causes any hesitation, can be recognised with absolute certainty by the characteristics mentioned above in 1 and 2.

Egglaying.—Some eggs were laid on August 27th-28th, 1904, on *Stachys sylvatica* and *Erica tetralix*. On the latter, among the flowers; on the former, not on the flowers but near them; they began to hatch on September 1st (Chapman). A ♀, in confinement, deposited eggs on the calyx of *Mimulus cardinalis*, growing in a greenhouse, on August 21st, 1898, from which larvæ appeared in due course (McIntyre); eggs laid June 17th, 1888, at Llangennech, also produced larvæ, etc., in due course (Richardson).

Ovum.—When first laid, of a pale straw colour, getting yellower, till almost orange, and finally leaden-coloured when about to hatch. The egg is rather long, narrow, a little flattened at one end, towards which it is just perceptibly narrower and higher; length 0·46mm.; width 0·27mm. at wider end, 0·23mm. near flat end; height 0·23mm. near flat end, falling off to about 0·20mm. at the other end; the end view is nearly circular; the sculpturing is in irregular polygons about 0·024mm. across; the cells are flat-bottomed, the separating ribs broad and rounded; the shrinking, due to drying, produces longitudinal furrows, that are not, strictly speaking, structural, but follow in some degree the network where its ribbing is arranged longitudinally (Chapman). [We have a second description of eggs that differed somewhat (in tint) from the above: "Pale green in colour; considerably larger than the eggs of *Adkinia bipunctidactyla*, with which they were compared; oval in outline, plump, yet considerably flattened on the upper face; the two ends appearing to be almost equally rounded; no trace of any surface markings." Examined simply with a hand-lens; described August 17th, 1901, from four eggs, laid on a setting-board, captured the same day at Bobbie. We had at the time, and still have, every belief that the eggs were those of the species to which they are referred; it is, of course, possible that we may be wrong. The appearance of them when laid on leaves and on paper, respectively, may be different, and partly account for the difference in colour noted.]

Habits of larva.—The young larvæ hatch very soon after the eggs are laid (comparing thus, remarkably, with those of *Oidaematophorus lithodactyla*). Those under observation burrowed at once into the flower-buds of *Erica* or *Stachys*, and, if an unhatched egg be in the way of a larva, it will devour it, as seen in the case of two larvæ, one of which had attacked a third egg without having well cleared up the second out of a little group of four; its anal end, at the time, being comfortably placed between flower-buds of *Erica tetralix*. A week later (September 8th, 1904), the plants were examined; the *Stachys* had not kept well, and some larvæ appeared to have perished in consequence; some others had wandered off the plants, and of others no trace could be found. Of the living larvæ, some were still small in the 1st instar, others not very far from moult, and not very much smaller than some of those in 2nd instar; their being in the 1st instar was proved by the size of the head, which agreed precisely with that of newly-hatched larvæ. The larva, fullgrown in 1st instar, was all but 2mm. long, very smooth, the hairs looking very minute; the prolegs and claspers very small, and short, in proportion to its size, being, of course, those of first skin; those of second skin larvæ were of due proportion; these larvæ were over 2mm. long, one or two nearly 3·0mm., but none were fullgrown in this instar. The favourite food, at this stage, seemed evidently to be the filaments of the stamens, both of the heath and of the *Stachys*, but any other part of the floral interior seemed to be eaten. The interior of the flower is reached whilst it is still a bud, by perforating the corolla with a minute hole. Second stage larvæ were twice found at large on the plant, being driven out of the *Stachys* flowers by their decay. In the case of heads of *Erica* so little advanced that the corollæ are still invisible, the larva bores into the mass of flowers from the top, and throws out some frass at the place where it entered. In the case of entering a flower, the frass is not extruded, but left inside the corolla. Unless the small hole of entrance can be found, the larva in a flower gives no indication of its presence so long as it stays there. It is difficult to say whether it should be called an internal-feeder, or no. When it is small, the residence is always within a flower; I doubt whether it could exist on leaves, though young leaf-buds might, perhaps, serve. It will live comfortably in the head of unopened flowers of *Pelargonium* or *Erica*, eating the filaments, and even the anthers of the stamens, and, to get at them, acts more as a burrower or internal-feeder than when it merely gets into a fairly-developed flower of *Erica* or *Stachys*. It preserves precisely the same habits up to full-growth, except when it is too large to get into the flower, and so has to be satisfied with getting only the anterior segments inside. It will, however, moult into last skin inside the bell of a flower of *Erica tetralix*. I fed most of mine on this plant, as I found *Stachys* inconvenient in several ways. Like several "plumes" that I have been able to follow through with precision, this species has four larval instars. In other cases, whether the instars be four or five is a matter of inference, or of measuring the diameters of the larval heads, which is a very reliable method of determining the point, but here I was able to follow individual larvæ from the egg onwards. The following data, referring to the changes of some of the latest larvæ, may prove interesting :—

(1 and 2)

Sept. 17th. Second instar.
,, 19th. Near moult.
,, 20th. Third instar.
,, 22nd. Well grown.
,, 24th. Laid up for moult.
,, 25th. Fourth (last) instar.
Oct. 20th. One imago emerged.
,, 21st. The second imago emerged.

(3)

Sept. 17th. First instar.
,, 19th. Second instar.
,, 22nd. Fullgrown in second instar.
,, 24th. Third instar.
,, 28th. Laid up for moult.
,, 30th. Fourth (last) instar.
Oct. 4th. Fullgrown (but still feeding).
,, 23rd. Imago emerged.

(4)

Sept. 17th. Second instar (well grown).
,, 19th. Third instar (half-grown).
,, 20th. Fullgrown in third instar.
,, 22nd. Laid up for moult.
,, 24th. Fourth (last) instar.
,, 28th. Fullfed.
,, 30th. Hung up for pupation.
Oct. 18th. Imago emerged.

Of other larvæ, one was noticed feeding inside a *Pelargonium* bud, another feeding on *Stachys*, its head being buried in a bud, both larvæ in the 3rd stadium. On September 6th, 1904, on some *Stachys sylvatica* collected at Corfe Castle for food, two fullfed larvæ were found, a suggestion that larvæ of this species must be abundant where larvæ thus occur on foodplants taken at random. The larvæ shoot their frass about in all directions, as do the larvæ of other "plumes," and certain other lepidoptera, by a jerk of the last segment, and not by the use of an anal comb; they eat the immature seeds and the calyces around them (Chapman. September 6th, 1904). Riding says: "I cannot separate the larvæ of *A. punctidactyla* and *A. cosmodactyla*, Hb. (*acanthodactyla*, Tr.), and the following notes may refer to either: 20 to 30 larvæ taken on *Stachys sylvatica*, August 20th to 21st, 1892, at Buckerell; 9 larvæ and 2 pupæ (flowers of *Stachys* nearly over), in Harpford Woods, August 10th, 1893; 2 larvæ on Buckerell Knap, on *Stachys*, July 11th, 1895; 40 to 50 larvæ and a few pupæ, on *S. sylvatica*, at Harpford Woods, August 13th, 1898; 4 larvæ, on Buckerell Knap, August 14th, 1898; more larvæ taken in the lanes, and by edges of fields, about Buckerell, August 20th-24th, 1898; 9 larvæ of medium size, taken at Harpford Woods, August 9th, 1899; 8 larvæ, in lanes around Buckerell, August 11th, 1899; and 2 more on August 12th." The following notes were made of the larvæ collected in 1892: "Some examples of a dull reddish-purple (colour of flower of *Stachys*), with darker dorsal vessel, and whitish subdorsal and spiracular lines; others yellowish-green, with darker dorsal vessel, and with band (longitudinal) of reddish-purple along the dorsum—not continuous the whole length; others darker green with no red colour. Head, pale yellowish-brown with dark brown mottlings; a small brown plate on prothorax; tubercles white, with one or two white hairs; feed on corollæ of *Stachys* mostly, and petals of scarlet geranium." This was followed by further notes on August 25th, 1898, which read: "Two sorts of 'plume' larvæ on *Stachys*, one green, with blackish head, the other purplish-red, with greenish prothorax, and head greenish, spotted with black. From watching the larvæ feeding, I came to the conclusion that the difference in colour is protective, as I have generally found the purplish-red larvæ on the corollæ, and the greener larvæ on the stem and green parts of the plant. The purple-red larvæ also appear to be generally the smaller, and to be met with before the purplish-red corollæ have fallen off; the latter are larger and found on plants which are seeding. I do not think the larvæ of the two species are separable by colour, but a minute examination of each detail is wanted. From the larvæ thus collected both species have been reared." Steudel and Hofmann long since noted, at Kochendorf, Germany, that the larvæ attack and eat the inactive larvæ of their own species when the latter are spun up for pupation. Bankes also observes (*in litt.*) that, amongst the many hundreds of larvæ that he has reared at various times, none have ever shown any inclination to prey upon one another, the weaker ones probably owing their immunity from attack to the hairiness of their coats, but, as recorded (*Ent. Rec.*, xvii., p. 48), the larvæ have, in his experience, invariably proved fearful cannibals towards the naked pupæ of their own species, which they devour with the greatest gusto, even when supplied with an abundance of fresh food. He suspects that they are so in nature at times, as he has a note of a pupa being found, the greater part of which had been eaten away, and a larva, most probably the culprit, very suspiciously near it. In one case, he observed a pupa of this species being devoured by a Geometrid larva (sp. ?) that had been found on *Stachys sylvatica*. In another case, a pupa, of which practically the whole had been eaten, except the posterior portion of the abdomen, was still fully able to move this part about, when annoyed or touched. The following actual dates of larvæ found wild may be recorded: July 20th, 1846, at Meseritz (Zeller); August, 1855, on *Ononis*, at Plymouth (Reading); larvæ in the greatest profusion on *Ononis*, at Bolt Head, on July 7th-8th, 1870 (Mathew); larvæ collected in September, 1871, feeding on the flowers of *Bartsia odontites* in the Gravesend district (Button); August 30th, 1883, at Ventnor (South); August 6th, 1884, July 26th, August 5th-25th, 1886, in the Isle of Purbeck (Bankes); September 7th, 1886, at Worthing (Fletcher); July 30th, 1890, August 15th-October 5th, 1892, very abundant in the Isle of Purbeck (Bankes); September 22nd, 1892, at Lee, September 23rd, 1892, at Mottingham (Bower); pupæ, September 20th-26th, 1894, in Isle of Purbeck; larvæ, September 25th-October 1st, 1902, at Dartmouth; July 2nd, young larvæ, and July 24th, 1904, in the Isle of Purbeck; September 3rd-October 3rd, 1904, at Dartmouth (Bankes).

Larva.—*First instar:* Fully 1mm. long when stretched; the head black; the anal plate, and prothoracic shield, dark; the rest of the body greenish-white; the spinneret very long; the claws of true legs, long, sharp, slender. The labial palpi are longer, and more evident, than the antennæ. The props of prolegs rather long, 0·05mm., and slender, of anal claspers not quite so long (0·06mm.) or slender. In one specimen all the prolegs have but two crochets; in all the others, three seems to be the normal number; this specimen has also seven crochets on the claspers, whilst five seems to be the normal number, varying frequently, however, to six. The prothoracic spiracle is a very large, tall, boss, the others rather less. The bases of the tubercles are just perceptibly tinted. The hairs are rather long, that on i about 0·08mm., on ii 0·04mm., on iii 0·09mm., on vi 0·09mm., long. Their disposition is practically identical with most first stage "plume" larvæ. Those on i and ii curve forwards, iii backwards, iv a little backwards, length about 0·08mm., v forwards, length about 0·05mm.; i and ii are about half the width of the segment apart; and ii half as far again from the middle line as i; v rather further than usual above iv; these latter are on separate bases;

on the prothorax, the tubercular group in front of spiracle appears to have two hairs, but, in one or two specimens, a very minute third hair is detected, so that probably it exists in all; minute hairs in these small larvæ easily evade observation, and require a very good light, and a satisfactory specimen, if they are not to be missed. The prothoracic plate has the usual three hairs in front, of fairly equal size and spacing; the three posterior are much out of line, the middle one very long, and placed rather back, the outer one very small, and forwards; the usual two hairs at base of legs. On the meso- and metathorax the usual four pairs of hairs occur; the third being, however, a single hair. On the abdominal segments, vi appears not to be present. There are no skin-points (September 1st, 1904). *Second instar:* 3mm. in length when full-grown; it is rather narrow, and of nearly uniform width. Props of prolegs rather long, with four crochets in one specimen, five in another. Head and prothoracic plate black, and anal plate very dark; general colour yellowish-ochreous, with a pale, nearly white, stripe in line of i and ii, another along iii, and a set, sloping diagonally downwards and forwards, and between spiracles and iv and v; legs black; tubercles dark; hairs short; vi present; skin-points well-developed, and bearing fine needle-like points; there are, on each side, two secondary hairs, one behind spiracle, and another higher up above this; these are secondary in having widened ends and imperfectly articulated bases. The primary hairs are smooth and pointed. In this stage there is often a good deal of pink tinting. *Third instar:* Length 5mm. Dirty brown, with whitish subdorsal line, and a lower line arched on each segment, also whitish, paler below vi; head black. The whole larva so transparent, and so much of its colour due to contents, that one is in doubt as to whether the markings really have a fixed position; legs black; prolegs on long slender transparent props; hairs long, especially those of tubercle ii, about 0·3mm. at middle, and 0·4mm. at the extremities of the larva. The larva fairly cylindrical, but tapering gradually from about 1st abdominal segment to the 8th, much as so many "plume" larvæ do. In another specimen there is a subspiracular white shade, and the spiracular one looks oblique, but the subcutaneous character of the markings makes it difficult to see them all at once, as they disappear at the front or back of segment, or elsewhere, according to angle of view. In another specimen, on *Erica tetralix*, the subdorsal white line is very broad, and trespasses largely, at the same time fading out, on the broad darker dorsal band; the supraspiracular line is very plain from front of segment to iii, then stops abruptly; a white dot behind spiracle (an accessory tubercle); below vi is the paler undersurface; the posterior segments reddish, the rest transparent, and showing the dark intestinal contents. These larvæ, feeding externally, jerk the fæces away, like those in last skin. In this skin, there are five hooks to prolegs. The secondary hairs are more numerous (about nine from dorsal line to level of spiracle), thickened at each end (September 13th, 1904). *Fourth instar* (newly-moulted): Only about 6mm. long. Head fairly large, with the adult markings (hitherto entirely black). Otherwise it seems identical with full-grown larva, so that this seems to be the last skin. The head is as wide as the larva; the fullfed larva has a comparatively small head (September 16th, 1904). *Adult larva:* [Two larvæ of two different varieties found on *Stachys* collected, at Corfe Castle, as food for other larvæ being reared in confinement.] One nearly uniform dark chocolate-brown, varied only by the white primary, and the white and black secondary, hairs. The other has a nearly similar ground colour of the front segments, but becomes greener backwards, so that the latter segments are green, with no reddish tint. This larva has, on either side, two longitudinal white lines, fairly white, and very well-defined, quite linear, but interrupted. The upper is in the line of i and ii; it really only exists in front of i, but the two tubercles of nearly the same colour appear to continue it; the second, similarly, exists only in front of iii, but iii, and the secondary tubercle behind it, are of the same colour; below iv and v the green is distinctly pale, and contrasts with the darker slightly olive tint above. The dark larva has no trace of this, but is of uniform colour above and below. The tubercles are all well apart, with one definite, longish, white hair; the secondary hairs are black along the dorsal line, but, with a few exceptions, white elsewhere (September 6th, 1904). These two larvæ have very chameleon-like properties; looking at them to-day, I cannot say, without a little doubt, which is which; one, which is apparently the green one, is laid up for pupation, and is of very diminished bulk, only 8mm. long (the other 10mm.-11mm.). It is bright green, has black markings on anal plate, and two subdorsal splashes on preceding segment; tubercles iii are minute black dots, and iv and v are quite obvious black dots. The true legs are dark, as are also the dorsal secondary hairs. The prothoracic plate has a central black line, and a black spot at either side. The head is green, with black markings radiating towards the mouth from margin of epicranium, but, except marginal line, not reaching more than one-third to half-way. The other larva is nearly as green as the greener was two days ago, but it seems more likely that both have become greener, than that the greener one of two days ago has remained nearly stationary, and the dark one become quite green, the one above noted being decidedly more brightly green than the greener was, and without any olive or darker tints (or white lines). This second larva still has its head buried deep in a calyx, eating seeds. It has a darker green dorsal line, and its general tint is darker than the other one; it has very conspicuous yellow patches (glands) on the dorsum of the 5th abdominal. The anal plate is not of the same, but of a similar, pattern of black markings to that of the other. The prothoracic plate has a black mark at each outer angle. The head-pattern also is very nearly, but not quite, identical with that of the other; the ground colour is brownish-ochreous, and shows no white markings. These changes of colour (in two days) show of what little value colour is in these plume larvæ, and, though the markings always follow a similar type, they also vary a good deal (September 8th, 1904). The second larva, though not yet laid up for pupation, is now as green as the other (September 9th, 1904). In the last skin, the primary hairs are blunt-ended (not sharp as hitherto), but free from spicules, nor can they be called expanded at the ends. The secondary hairs are very numerous (30 to 40 between dorsal line and spiracle); a large one accompanies i, ii, and iii, tending to make them warts, and the postspiracular accessories are generally represented by a large secondary hair at the usual site. They are all smooth, but expanded at the ends, and apparently bifid, though this may be an optical delusion, and their usual form may be clubbed. There are only four (sometimes five) crochets to prolegs (Chapman). *Final* *instar:* Length 8mm., of a rather slender type (*i.e.*, of the Stenoptiliid form), of cylindrical section, without any marked lateral flange, tapering considerably towards head and anus. The head is small, rounded, and partially retractile beneath the anterior skin-folds of the prothorax. The segmentation is, as usual, well-marked, the subsegmentation also more distinct than is usually the case. Tubercles i well separated from ii on the abdominal segments. The skin rough and prickly, owing to the spicules being well-developed. The tubercles exhibit distinct incipient wart-structure, bearing, usually, one long primary seta, a medium-sized, and one or more small secondaries, similar to those that are pretty generally scattered over the skin-surface, and which appear sometimes to be, but doubtfully, in association with the primary tubercles. The secondary hairs have knobbed or spatulate tops, and are black or white in colour, hairs of both colours being present. The scutellum and anal plates strike one as being small; they are not distinctively coloured, and consequently do not show up in any marked contrast with the general skin-surface. The former has the two depressed dark-coloured spots as in *pterodactyla* (*fuscus*), etc. Spiracles are raised and prominent, but are not tall tubes as in *Ovendenia septodactyla* (*lienigianus*), etc. The head is smooth and polished, rounded, and of a brown colour, with mottlings of dark and light of the same hue, chiefly restricted to the upper and posterior portions; the ocelli, as usual, are prominent. The primary hairs are tall, slightly thorned, tapering, but blunt-ended, hardly knobbed, but very slightly thickened at the tip, as though the tip had been fused. Legs are dark at base, pale at tip; the prolegs are of the normal "plume" type, long and rather slender, the anal ones much shorter proportionally, and stronger looking. The prothoracic and 8th abdominal spiracles are extra large, especially those of the 8th abdominal; the 1st abdominal does not show a very appreciable increase. The thoracic tubercles are—conjoined i and ii on the middle of the three subsegments, there is no accessory group behind these, only the normal scattered secondary hairs; iii and iv form a conjoined group, with two long hairs; v now bears two hairs, one being probably vi, and the usual posterior subprimary, bearing only one hair, is present. On the abdominal segments, i is the larger, if anything, but there is but little difference in size between i and ii, the two pairs are well separated from each other; iii is rather close down to the spiracle; iv and v form a combined group beneath the spiracle; vi bears one long, and two secondary, hairs; vii forms a small group. Only one accessory post-spiracular hair is present, and this is slightly above the level of the spiracle; this is of medium length, and has one or two of the small skin-surface secondaries in doubtful association with it. In coloration, the dorsal area is a purplish-pink, shading off beneath into the green of the ventral area; there is a slightly marked median stripe; a broadly irregular, and somewhat broken, subdorsal band of whitish, and another similar lateral band, rather higher up than usual, is placed above the spiracles. Another form of the larva, or an older stage (though it is little if at all larger), is of a pale, but bright, clear green, the markings as above, but the median line shows up darker, and there is a double, yellow, dorsal spot beneath the skin (? the testes) on the 5th abdominal segment. Possibly the difference in coloration is sexual (Bacot, July 21st, 1904). Buckler figured (*Larvae*, etc., pl. clxiii., fig. 5) on July 31st, 1862, a larva of this species, after its final moult, that had been feeding on flowers of rest-harrow; the imago emerged August 31st, 1862. Hübner figured (*Raupen*, etc., ix., Aluc. i., pl. c., fig. *a*) the larva of this species on *Ononis*. Stainton refers thereto, *Ent. Ann.*, 1856, p. 59.

Variation of larva.—We have already noted two colour forms of larva in this species (*anteà*, pp. 283-285), and their connection with each other (see also p. 287). Porritt says that, in shape, the larva is exactly like the larva of *A. punctidactyla* (*cosmodactyla*), as described (*posteà*), and, as in that species, there are two distinct colour forms, whilst intermediate varieties occur, partaking more or less of the characters of each of these extreme forms. The latter, he says, may be described as:

1. The ground colour deep purple; head yellowish-grey or yellowish-brown, marked on the crown and sides with black; the mandibles brown; mediodorsal stripe smoke-coloured; subdorsal lines, and another line of equal width below it, white, but interrupted and not very conspicuous, and, below these, is another, scarcely so pale, line along the spiracles; hairs, and the distinct tubercles, white. Ventral surface, and prolegs, greenish-olive; anterior legs shining black, ringed with paler.

2. The ground colour bright pale green; head as in var. 1; the dark, smoky pulsating, vessel—in some specimens tinged with pink anteriorly—forms the dorsal stripe; subdorsal lines indistinct, whitish; below these is another line, but much interrupted and broken into short lengths; there are no lines along the spiracular region; hairs and tubercles white. Ventral surface, and prolegs, of the bright green of the dorsal area; the legs shining black, ringed with white.

Comparison of the larvæ of Amblyptilia cosmodactyla and A. punctidactyla.—The real structural differences observable in these larvæ have already been noted (*anteà*, p. 273). Of the colour differences Porritt writes: "The chief points of distinction between these larvæ that appear to be reliable are: (1) The deep purple ground colour in the larva of *A. cosmodactyla* as compared with the purplish-pink of that of *A. punctidactyla*. (2) The white subdorsal lines less conspicuous in *A. cosmodactyla*. (3) The head yellowish-brown, marked with black, in place of the very dark sienna-brown, almost black, in *A. punctidactyla*." Bankes is, however, not altogether satisfied with this conclusion, and writes (*in litt.*): "Although the imaginal characteristics of *punctidactyla*, Haw. (*acanthadactyla*, Hb.), are of themselves more than sufficient to prove that it is specifically distinct from *cosmodactyla*, Hb. (*acanthodactyla*, Tr.), I have taken great trouble to put to the test, as far as possible, the reputed larval differences to which my friend, Mr. Porritt, drew attention (*Ent. Mo. Mag.*, xxiii., 132-3, 1886), but, it must be confessed, with disappointing results, and I am still as far as ever from being able to satisfactorily separate the larvæ of these species by colour. The special points of distinction noted by Mr. Porritt are mentioned above. In 1892, I collected on *Stachys sylvatica*, probably quite 1000 Alucitid larvæ and pupæ, mostly in the former stage, from which about 450 *cosmodactyla*, Hb., and 21 *punctidactyla*, Haw., together with numbers of ichneumons (*Apanteles fuliginosus*, Wesm.), subsequently emerged. Finding that the purplish-pink ground colour in the larva was frequently not associated with either particularly conspicuous white subdorsal lines, or a blackish head, I carefully sorted out the larvæ, when in their last skin, into separate, labelled, cages, to test these supposed characteristics, each in turn, and soon proved, by breeding the imagines, that no reliance whatever could be placed on the colour of the body of the larva, or the conspicuousness of the subdorsal stripes. A batch, separated solely because their subdorsal stripes were specially conspicuous, yielded many *cosmodactyla*, Hb., but no *punctidactyla*, Haw., whereas one in which this was not the case produced two *punctidactyla* among many *cosmodactyla*, and the larvæ from which *cosmodactyla* was bred showed every shade between pink and deep purple, to say nothing of the green varieties. The heads of the larvæ showed wonderful variation, from bone-coloured, dirty-white, and greenish-white, with very faint traces of pale brown markings, or, in extreme cases, with no markings at all, through green or yellowish-brown, strongly marked with dark brown or black, down to wholly black. Very few larvæ could be included in the batch that was kept apart, solely because their heads were entirely black, their bodies being of various colours, and their subdorsal stripes varying much in intensity. These, however, yielded interesting results, for, of the four moths that emerged, three were *punctidactyla*, Haw., and only one *cosmodactyla*, Hb.! Thus encouraged, I then sorted out a number of larvæ into three cages, the first containing larvæ whose heads were wholly black, or almost wholly so, the second holding those in whose heads the paler ground colour was only about half obscured with black, whilst in the third cage were those whose heads showed still less black marking, or none at all. But, to my great disappointment, no *punctidactyla* were bred from any of these three cages, not even from the first, of which I had great hopes! Unluckily, 16 of the 21 *punctidactyla* bred that season were collected as pupæ, so only 5 larvæ were included in these experiments. I was still more unfortunate in 1904, for, from some 1500 larvæ and pupæ found that year in South Devon, only 3 *punctidactyla* were bred among 758 *cosmodactyla*, and all three were met with as pupæ. But the immense numbers of *cosmodactyla* larvæ, then kept under constant observation, showed the same extraordinary amount of variation, as did those collected in 1892, in the colour of the head, as well as in that of the body, and the conspicuousness, or the reverse, of the white subdorsal lines. It must, of course, be borne in mind that, in *cosmodactyla*, and probably in its ally, the head is black until the last larval moult, and that the larva, no matter what its previous colour has been, becomes, for protection, quite green when it is full-fed, and is just about to pupate. Perhaps the individual larvæ, belonging to any one family of either species, often show only a somewhat limited amount of variation in the colour of the head, etc., and this may account for Mr. Porritt having been led by the larvæ, received from me, to believe that the differences he noticed were reliable. In this connection it is worthy of mention that whereas, referring to larvæ of *cosmodactyla*, presumably resulting from females I sent him, Dr. Chapman wrote (*in litt.*, September 29th, 1904): 'I see little or no variation in the colour and markings of the head,' I was, at that very time, collecting wild larvæ of this species which showed considerable differences in the colour of the head, and infinite variation in the amount of the black markings thereon, some having the head entirely black, or nearly so, whilst in others this colour was altogether absent, except in the ocelli. Both the purple and green forms of the larva are without doubt protective."

FOODPLANTS.—Almost polyphagous, especially affecting the blossoms of leguminous, labiate and composite plants—*Stachys sylvatica* (Frey), *S. recta* (Hofmann), *S. palustris* (Rössler), *S. speciosa*, *S. coccinea* (Richter), *S. officinalis* (*teste* Sorhagen), *Salvia glutinosa*, *S. pratensis* (von Hornig and Hofmann), *Euphrasia lutea* (Schmid), *E. officinalis* (*teste* Sorhagen), *Bartsia odontites* (Button), *Calamintha nepeta* (Schmid).

C. clinopodium (*Clinopodium vulgare*), *Mentha* sp. (Jeffrey), *Jurinia* (*Serratula*) *pollichii* (von Heyden), *Vaccinium oxycoccus* (Hering), *Mimulus cardinalis* (McIntyre), *Galeopsis tetrahit* (Harwood), *Ononis spinosa*, *O. repens* (Frey), *O. arvensis* (Stollwerck), *Erica tetralix* (Freer), *Calluna vulgaris* (Rössler), cultivated pelargoniums (Zeller), *Geranium rotundifolium* (Sich), *Carlina* (*teste* Sorhagen). Bankes writes: "I have found the larvæ of this species plentifully on flower-spikes of *Stachys sylvatica*, and not uncommonly on those of *S. palustris*, and have also taken the imago in some spots where there could be no reasonable doubt that the larvæ had fed on *Ononis repens*, and in others where it had probably fed on *Erica tetralix*, or one of its near allies." McIntyre notes that he discovered larvæ eating the contents of the seed-pods of *Mimulus cardinalis*, at Leytonstone; D'Orville, that Zeller found larvæ, on July 20th, 1846, on a garden pelargonium, boring into the buds, but that some he found at Alphington ate also the leaves, petals, and tips of the flower-buds; South found them feeding on restharrow, and on the flowers and unripe seeds of *Stachys sylvatica*, at Ventnor; N. C. Rothschild, on restharrow, broom and geranium. Hofmann says that, although flowers are the usual food, the larvæ also eat the underside of young leaves of several of the foodplants. (See *Ent. Rec.*, xvii., p. 48.)

Parasites.—Bankes writes (*in litt.*): "Probably at least 50 per cent. of all the larvæ that I have collected in Devon and Dorset have been infested with the larva of a parasitic fly, identified by Mr. Claude Morley as *Apanteles fuliginosus*, Wesm., which also occurs in Belgium, Holland, and Germany, and has been bred from four species of *Tineina*. The infested larva can, when moderately grown, be readily recognised by its sickly yellowish colour, and finally, instead of its pupating, the Braconid larva comes forth from inside its host, and immediately spins its neat, elliptical, straw-coloured, silken cocoon, usually on the flower-spike of the foodplant." Riding says (*in litt.*): "The larvæ are always very much ichneumoned, and, in 1898, I think I did not breed 10 imagines, out of more than 60 larvæ taken, owing to this cause, and this has generally been the case in other years." (See *Ent. Rec.*, xvii., p. 47.)

Puparium.—The larva spins a pad of white silk, usually on the flowering-stem of the foodplant, to which it attaches itself before undergoing pupation. The pupa is fixed by its cremaster thereto, and, when situated among the calyces of *Stachys*, is somewhat difficult of detection. Barrett says that it attaches itself by the tailhooks to the flower-spikes, between two of the whorls of flowers, looking wonderfully like a withered blossom itself. Bankes writes (*in litt.*): "Careful observations made on an immense number of pupæ found in nature on *Stachys sylvatica* prove that, as a general rule, they are attached, by the anal armature only, to a long slight pad of white silk, spun on the stem of the flower-spike, and hang head downwards along the portion of stem between two of the whorls of calyces, but exceptions are not rare, and pupæ have been met with in the following positions: (1) horizontal; pupa attached to either the upper *or* underside of a whorl, and with head pointing inwards, *or*, more rarely, outwards; (2) horizontal; pupa attached, on either the upper *or* underside of a leaf or leaflet, to either the midrib, *or* the margin, *or* the intervening surface, and with the head pointing directly, *or* else obliquely, either inwards *or* outwards; (3) perpendicular; pupa attached to the stem of the flower-spike, and standing erect along it with the head pointing upwards, thus exactly reversing the usual position; (4) perpendicular; pupa attached to upperside of a whorl of calyces, and standing quite erect, head upwards, away from the stem, and with no support of any kind except at, and close to, the anal extremity. I have only, as yet, met with a solitary pupa in this very remarkable attitude. The precise method of attachment is as follows: At 1mm. from the actual anal extremity, the pupa has, ventrally, a cluster of stiff bristles with hooked ends, which, together with the armature of the anal extremity itself, are firmly fixed into the long silken pad spun by the larva. The pupa has thus the power of maintaining any position, quite independently of any support except that afforded it by the silken pad; if, for instance, it is attached to the underside of a horizontal leaf, it maintains a horizontal position equally with the leaf itself. Shortly before the moth emerges, the pupa assumes a somewhat semicircular attitude, raising itself anteriorly, and curling itself back over its posterior segments, probably to allow to the lengthy legs the free play which would be impossible if the normal position were maintained throughout." Chapman says that, in several instances, in confinement, he has observed that the larval skin is entangled amongst the dorsal spines (columns) on the back of the abdominal segments of the pupa, either those on the 3rd abdominal or those behind. This may be normal, accidental, or a mark of debility, but which, he has no grounds for deciding, but he is not quite sure that it is not due to a few threads of silk spun about the larva by other larvæ searching for a pupating-place. He further remarks that it is to be noted that the larva prefers to pupate on a slope with the head down, but will apparently approve the underside of a horizontal surface, but appears to be rarely fixed with its head upwards. This seems, he says, to be a feature with many "plume" larvæ.

Pupa.—The length of the pupa is 8mm.-9mm. The colour is, in all cases, varied by markings, chiefly of olive, pink, or reddish-brown, on a green ground; in a few the ground-colour so predominates that the pupa may be called green; in the majority it is so largely overlaid by olive and brown as to be little in evidence, and again, in a few cases, the pupa may be called reddish or brown, whilst, in one or two, it is rather terra-cotta, with reddish to black markings. The parts of the pupa where the different colours predominate are very various; thus, one specimen has the appendages and greater part of the dorsum of thorax, and 1st and 2nd abdominal segments, green, with the rest brownish-red. Another has wings and appendages beautifully tinted with pink, with abdomen (especially beneath) green. As the markings that are practically always present, one may note those found in the greenest (palest) pupa. (1) This pupa is quite green throughout, except the markings. The dorsal column on the 3rd abdominal segment is most conspicuous, almost black, with a pale tip; from this a brownish shade runs forward a little way along the dorsal flange, and also downwards and forwards to the anal angle of wing, the nearest point of the wing to column, continuing to, and gradually fading out at, centre of wing, making an oblique downwards and forwards stripe; parallel with this, in front, is a similar stripe from the middle of the 2nd abdominal at the flange, where the beginning is nearly black; the rest of the band across the wing, nearly to antenna, is dark olive-green, as, indeed, is the wing-portion of the other. This forward one is, in reality, more pronounced than the posterior one, but looks less so as it wants the high spine, which exists on the 3rd, but not on the 2nd, abdominal segment. The beak, antenna-bases (where they contribute to dorsal flange), and dorsal flange in front of the mesothorax, are whitish, almost porcellanous. The remainder of the flange is tinted with brownish-pink, as are the dorsal spines of the 4th, 5th, and 6th abdominal segments ; the tip of the appendage-case is fuscous. The lateral abdominal flange is whitish, and the abdomen looks white above spiracles, but between the oblique lines is more bright. There is a darker green dorsal line, and oblique (downwards and backwards, as in larva) green lines pass through this, or rather from the dorsal abdominal spines. The 8th, 9th, and 10th abdominal segments are faintly brownish. (2) To take now a very dark example, the colours are terra-cotta, pink, and black, the last, in places, as if it were thinly laid on, so as to be dark fuscous. Green is still present on the 4th, 5th, and 6th abdominal segments, but is really (as it looks) the green interior seen through the pinkish cuticle. White is present along the edge of flange in front of mesothorax, and on the tips of spines and hair-points, except the large spine of the 3rd abdominal segment, where the tip is brown. These amounts of white and green are too small to produce any effect on the general appearance of the pupa, except, perhaps, to give it a little brilliance. Pink is the prevailing ground colour, but with an underlying olive, and with abundant, dark, nearly black, markings. The dark marks, running obliquely forward on the 2nd and 3rd abdominal segments, are very large, and practically absorb all the wing-surface, which, however, has some olive lines between the veins, towards the hindmargin ; the olive tint of the appendages is overlaid with fuscous, and shows darker bands at intervals ; the 4th, 5th, and 6th abdominal segments have markings that are also apparently present in front, but are obscured by flange, spine, and appendages; a dark dorsal line, a dark supraspiracular line, and another between these, somewhat interrupted; below iv and v are two broad dark bands, meeting somewhat in the middle of each segment, so as almost to form one very broad band. Ventrally, there is another dark band on either side. Except subdorsally and ventrally, the ground colour is wanting on the 8th, 9th, and 10th abdominal segments. The most striking feature of this pupa (as in that of *Marasmarcha lunaedactyla*) is the great spine on the 3rd abdominal segment. This may be described as the base of tubercle i of that segment. The pupa is here about 1·5mm. thick, and the spine stands up about 0·7mm. The double dorsal flange of the front segments runs down the 3rd abdominal segment directly to the spine, which has the appearance of being its culmination. The ridge of the flange forms a curve along the front of the spine until its extremity is directed forwards as a sharp hook. This hook is not the tubercle ; at least, the hair of tubercle i stands on the front margin of the spine, about two-fifths of its length from the base. The spine is very flattened from side to side, and has an irregular flange-like extension on its posterior margin ; tubercle ii is not on this spine, but on a conical offset from its posterior base. It might be said that ii emulates i, and, without quite securing a separate base, forms a pointed cone, directed a little backwards, and only about one-sixth the length of i. The hair of ii arises from quite the base of this cone behind. The 4th, 5th, 6th, 7th, and 8th abdominal segments have precisely similar structures, but on a very small scale, and without the dark colouring, so that they are quite inconspicuous; the 6th abdominal segment has the largest, the 5th the next largest, then come the 4th, 7th, and 8th. The hairs are—i from half way up the front, ii from the base behind; i and ii, on these spines, might be described as arising from the same base, or, as on separate bases, and having the bases connected by a ridge or flange; the 1st and 2nd abdominals might be described as having the same structures, but so reduced as to amount to merely slight irregularities on the flanges on which they occur. These flanges are also marked features of the pupa; they are raised ridges, or crests, running from the anterior margin of the mesothorax to the spine of the 3rd abdominal segment. At the spine of the 3rd abdominal segment they cease, there being no trace of them on the 3rd abdominal segment behind the spine, or on the following segments, either before or behind. On the highest point of the mesothorax they rather suddenly approximate, and form a high double crest, with a somewhat abrupt slope in front. As the transverse ridges of the segments (subsegmentation ?) pass over them, they produce a finely-crenulated margin. The general form of the pupa has little of the large thoracic swelling, characteristic of many "plumes," but has some appearance of it, owing to this mesothoracic portion of the ridge, which materially raises the dorsum here, on a lateral view. Apart from the spine on the 3rd abdominal segment, this is about the thickest part of the pupa, and, for the two or three following segments, it is nearly as thick, rapidly dwindling from the 6th abdominal segment to the apex, much like a neatly-sharpened pencil. The wing-cases extend to the end of the 3rd abdominal segment, attached to the segments; beyond this, the pointed apex extends nearly to the end of the 4th abdominal segment (but free from it), when the pupa is contracted. In the empty pupa-case, with the intersegmental membranes expanded, the apex is at the anterior margin of the 4th abdominal segment. The apices of the wings and appendages, in the living pupa, thus form a sort of sheath from the front of the 4th abdominal segment. When the pupa bends back, the 4th abdominal, of course, is separated from this sheath, and stands back at an angle. The rest of the appendage-case, containing the 2nd and 3rd pairs of legs, and maxillæ, extends further as a straight baton, to the middle of the 7th abdominal segment, having basally, at each side, the pointed extension of the wing-apex (beyond Poulton's line) as a strut or support; its length is about half a segment. Below the spiracles (on the 3rd, 4th, 5th, 6th, 7th, and 8th abdominal segments) is a lateral flange, which might be described as the longitudinally expanded base of iv + v, which are on its ridge, and bear two fine hairs pointing forwards. In some specimens, iv and v look as if on a similar base to the spines supporting i and ii. Above the spiracle, iii also points forwards, from a very slightly-raised whitish base. The spiracles (2nd to 7th abdominal) are easily seen as pale raised dots, with a minute, central, black point (in specimen examined, but the colours may vary). The head-sculpturing is a little complex. There is a blunt, rounded beak in front of the clypeal region, then the antenna presents a raised crest, which, at the beginning, is in line with the dorsal crests, but does not join them, and passes outwards along the antenna as far as front spiracle, divided into two parts by the joint of the flagellum. On the front end of the pupa (head, prothorax, and front of mesothorax) are a number of hairs of some length (0·3mm., and 0·4mm.) and stiffness.

of these, 5 pairs are on dorsal ridges and flanges, *viz.*, 1 on end of beak (which here ranges with flanges), 1 on antenna-base, 1 on prothorax, and 2 on mesothorax. Outside these are four pairs, 2 on prothorax, and 2 on mesothorax. The two waves of antennal flanges are continued by the basal ridges of the wing as two more waves, completing the margin of the front of the pupa. There are 2 pairs of hairs on metathorax. On the abdominal segments (the 3rd and onwards) at wing-bases, as well as the two minute ones on flanges, there are a dozen or more (some hid under segment in front) fine transverse ridges (subsegments?, hardly, as they anastomose a little); of these, about 6 are crossed by the bases of the dorsal spines; these are the posterior 6; the spine-bases reaching to posterior border of segment (apart from intersegmentations) (Chapman, October 4th, 1904). In this, as in many other "plume" pupæ, in which I have not mentioned the point in my descriptions, probably as being too familiar, the 1st and 2nd legs at their upper ends abut against the antenna, which makes its outward sweep rather long to accommodate them; the result is that the 1st leg can hardly be said to come up to the eye, as is usual in most pupæ, but comes up past it, the eye being not in front of the leg, but beside its inner border. In examining a dehisced pupa, various points may be noted, not easily seen in the living pupa. The spiracle-cover of the mesothorax is a short domed structure covered with fine ridges and abundant spinelets, though these look as if soft rather than hard. The dorsal head-piece is practically absent, and it fails very often to carry the eye-piece, which very frequently remains more or less attached to the head-piece. The ridges on the abdominal segments appear to be 16 or 17 in number, but are difficult to count, not because invisible, but from not being persistent for any length; they are sharp and narrow, and with fluted sides. The minute sculpture shows the whole surface to be formed of rounded nodules, and the ridges consist of certain of these raised in irregular rows. The cremaster consists of a forward portion on the bosses beneath the 9th abdominal segment, each of which carries about 32 hooks, about 0·2mm. long, and terminating in a fish-hook point. The posterior portion is beneath the extremity of the cremastral spine, and is almost confined to the ventral surface, hardly any hooks being on the margins, as is so regular a feature in *Platyptilia*. There are 50 to 60 hooks on either side of this portion. On the 4th, 5th, and 6th abdominal (the 3rd is covered and soft) segments, the scars of the prolegs are very conspicuous, oval, brown ridges, paler within, as if hollow. The hindwing passes down to just beyond spiracle on the 2nd abdominal segment (Chapman, February 14th, 1906). Hübner figured the pupa of this species (*Raupen*, etc., ix., Aluc. i., pl. C., figs. *c-d*) and reference is made thereto by Stainton (*Ent. Ann.*, 1856, p. 59).

Colour variation in pupa.—Among the many intermediate varieties, some of which are so decidedly olive in hue, that they look as though they must be going to yield *punctidactyla*, Haw. (*acanthadactyla*, Hb.), between the strongly-green and the strongly-purple pupæ of *cosmodactyla*, Hb., the most striking that I have seen has the ground-colour pure cream-buff, with the ordinary oblique dark markings, and this form itself includes various minor varieties, some individuals being distinctly tinged with green, or with one of the other colours towards which the pupa has a known tendency. The pupa becomes very dark in colour before the escape of the imago (Bankes). See also *anteà*, p. 289.

Similarity of coloration of larvæ and pupæ of Amblyptilia cosmodactyla and A. punctidactyla.—In the Clee Hill district of Shropshire, the larvæ of *A. punctidactyla* were found feeding on *Stachys sylvatica*, and the pupa remained suspended to the spike on which the larva had fed; subsequently, at Croxton, in Norfolk, larvæ that appeared precisely similar, were found feeding on the same plant, and eventually suspended themselves in the same way, yet these turned out, without exception, to be *cosmodactyla*, Hb. The larvæ and pupæ were so similar that the characteristic differences must be very slight; both were green, with a slight purplish tint in some; both slightly hairy. Larvæ since taken and reared by a friend from the same plant, in Dorsetshire, produced *A. punctidactyla*. From this it is assumed that *A. punctidactyla* is often overlooked, and the larvæ and pupæ mistaken for those of *A. cosmodactyla* (Williams). Bankes, however, considers this assumption erroneous, urging that an insect so rare as *A. punctidactyla* has been proved to be, by his extensive experience in the very same district of Dorset as yielded the larvæ alluded to by Williams, and elsewhere, cannot be "often" overlooked, in any stage, as *A. cosmodactyla*, Hb.

Time of appearance.—The species is to be found in early March, at sallow bloom, and on until June, the specimens observed during this period having probably hybernated; throughout the greater part of July and early August newly-emerged imagines are to be obtained, followed by another brood in September and October, the individuals of which hybernate and reappear in the spring. Early specimens have been recorded in the south of Europe, *e.g.*, in Portugal, on May 8th, in Morocco in April, and by Mann, at Brussa, in May, but whether hybernated, or freshly-emerged, is not determinable. The insect has also been recorded for May and July in Scandinavia. In central Europe, it occurs much as in Britain; in the Auvergne district, Sand notes it as occurring in July and October, hybernating and reappearing in March; in the Dauphiny Alps we found the first brood in early August, 1896, at nearly 5000ft. elevation, and also in the Piedmontese Alps, at Bobbie, in early August, 1901. In Germany, at Stettin, it is noted only in late autumn and spring (after hybernation) (Büttner), but at Hamburg, from June to September (no distinction being made in the broods) (Sauber); in the Oberharz, it has been found in October (Hoffmann); near Wiesbaden, in August, and at the end of October, the latter brood hybernating (Rössler), and also at Frankfort-on-Main (Koch); from Brandenburg, it is reported in June, August, and end of October (when it hybernates) (Sorhagen); whilst in Silesia, it is only noted in late August-September, and in the spring (Möschler), and, at Regensburg, in September and October, and in the spring (Schmid); in Württemberg it is recorded in May, and August to October (Steudel and Hofmann); and in Baden, in July and early August, and September, hybernating and reappearing in spring (Meess and Spuler). In Switzerland, Frey records it as double-brooded, July (end)-August, and again in late August-September, the individuals of the latter brood hybernating. Luff observes that, in the Channel Islands, in Guernsey, it appeared in August and September, 1898. Ash says that the "Selby" moorland examples certainly hybernate, for he takes a few specimens every spring, and they are abundant in August. Barrett says that "the species is on the wing in June and

July, possibly after hybernation, and apparently, as another generation, in August and throughout the autumn, even emerging in October and November, but whether as a third generation, or only a second, or even a deferred emergence, is not clearly ascertained." Bankes notes: "Imagines, that presumably have hybernated, are occasionally met with from about the middle of May till the middle of July, and during the latter part of July, at any rate, in the south of England, young larvæ may generally be found already feeding on flower-spikes of *Stachys sylvatica*, etc. There must be at least two broods in the south, for, throughout the whole of August and September, and the earlier part of October, larvæ can be collected, and they are therefore obtainable, without any intermission, over a period of nearly three months, during the greater part of which time pupæ are also procurable on the flower- or seed-spikes of the foodplants. The moths of the first brood begin to emerge about the middle of August." Reid notes it as occurring in June and August in Aberdeenshire, and Henderson observes that newly-emerged specimens are to be found at the end of July, whilst hybernated examples are not infrequent in May and early June, at Garelochhead, in Dumbartonshire. Porritt notes hybernated examples occurring in Yorkshire in June, newly-emerged ones in August. Although such a well-known species, continental lepidopterists give but little detailed account of it, and the exact records of its appearance abroad are comparatively few. We have collected the following:—CONTINENTAL RECORDS.—May 23rd, 1846, at Syracuse, June 28th, 1846, in Catania (Zeller); May 17th, 1862, near Pichtendahl (Nolcken); April 22nd, 1870, at Marshen, in northwest Morocco (Blackmore); May 8th, 1880, on the hill, south-west of Almodovar (Ragonot); May 17th, 1892, at Hvalöerne; July 12th-17th, 1892, at Sireosen (Strand); August 12th, 1896, in the Combe de Malaval, about 3 miles below La Grave; July 27th-31st, 1898, at Bourg St. Maurice; August 9th-18th, 1901, at Bobbie (Tutt); July 21st, 1901, at Nasenica, in Bosnia (Rebel); July 10th, 1903, at Etivaz (Blachier). BRITISH RECORDS.—Emerged October 14th-16th, 1863, from pupæ found on geranium at Wandsworth (Tuely); September 22nd, 1865, at Teignmouth (Jordan); bred October 1st, 1865, from pupæ found attached by tail-end to flower-stalks of a garden geranium, at Alphington (D'Orville); June 9th, 1867, at Guestling (Bloomfield); end of August, 1867, at Herne Bay (Buckmaster); July, 1868, in Rossshire (White); July 16th-17th, 1869, at Witherslack (Gregson); July 7th-8th, 1870, on the Bolt Head (Mathew); bred throughout October, 1871, from larvæ collected in September, in the Gravesend district (Button); July, 1879, at Dutton (Hodgkinson); August 5th, 1879, at Folkestone (Sang); abundant at Croydon, in August, 1879 (Gill); September 3rd, 1879, near Witham (Cansdale); July 7th-9th, 1883, common at Dover (Coverdale); August, 1883, at Sandwich (Shepherd); August 17th-19th, 1884, imagines bred from larvæ taken by Bankes at Corfe Castle (Porritt); October, 1884, at Aberayron (Richardson); imagines bred August 30th-September 21st, 1886, from larvæ collected in the Isle of Purbeck, August 5th-25th, 1886 (Bankes); imagines bred September 21st, 1886, and following days, from larvæ collected by W. H. B. Fletcher, September 7th, 1886, at Worthing (Porritt); bred October 7th, 1886, from Sanderstead larvæ (Sheldon); July 10th, 1887, at Ham Ponds, August 8th, 1888, at Kingsdown (Tutt); June 6th, 1888, at Chickerell; ♀, probably hybernated, captured June 17th, 1888, at Llangennech, in Cardiganshire, eggs laid same day, produced, in due course, imagines, August 10th, 1888, etc.; others bred from Portland larvæ, October 27th, 1888 (Richardson); June 14th, 1888, in the Isle of Purbeck; June 20th, 1888, in the Isle of Portland (Bankes); August 26th, 1888, at Greenhithe; August 30th, 1888, at Bexley (Bower); early- and mid-August, 1890, at Deal (Tutt); September 23rd, 1891, at Luss (Dalglish); May 21st, 1892, at Newcastle, Co. Down (Watts); May 25th-27th, July 18th, and August 19th, in the Isle of Purbeck (Bankes); June 5th, 1892, at Cathcart (Dalglish); July 10th-27th, 1892, at Aldeburgh (Cruttwell); September 13th, 1892, at Panton (Raynor); September 22nd, 1892, imago at Lee; imagines bred October 5th-November 8th, 1892, from larvæ found at Lee and Mottingham; two imagines, October 7th, 1892, at Chislehurst (Bower); imago bred, August 20th, 1892, from pupa forwarded from Folkestone on *Ononis*; imagines bred August 20th, 1892, from larvæ collected in August, in the Isle of Purbeck; also imagines bred September 19th-November 29th, 1892, from larvæ collected August 15th-October 5th, in the Isle of Purbeck (Bankes); August 3rd-15th, 1893, at Lochgoilhead; August 10th, 1893, on Ben Donich and August 18th, at Stronachlochar (Tutt); mid-August, 1893, near Aberdeen (Reid); imagines bred September 25th, 1894, onwards, from pupæ collected September 20th-26th, in the Isle of Purbeck (Bankes); May 30th, 1895, near Wemyss (Evans); June 20th, 1895, in the Isle of Purbeck (Bankes); August 22nd, 1895, at Keswick (Beadle); a single specimen, August 20th, 1896, at Great Ayton (Lofthouse); August 18th, 1897, at Lynmouth (T. H. Briggs); August 24th, 1897, at Oxton, Devon (Studd); June 6th, 1898, at Perry Wood (Edwards); June 8th-22nd, 1898, at Camghouran (Porritt); July 11th-August 16th, 1898, at Oxton, Devon (Studd); imagines bred August 3rd-5th, and September 10th, 1898, from larvæ found at Buckerell; imagines captured, somewhat worn, October 24th, 26th, 28th, 1898, at Buckerell (Riding); August 12th, 1898, two imagines on Dartford Heath; October 20th, 1898, an imago at Lee (Bower); imago captured August 21st, 1898, at Leytonstone, eggs laid in confinement, imagines bred therefrom September 29th-October 14th, 1898 (McIntyre); imago on October 22nd, 1898, at Hesleden Dene (J. Gardner); October 26th, 1898, at Lynmouth (T. H. Briggs); early August, 1899, near Honiton; bred imagines, August 24th, 1899, from larvæ from Harpford Wood (Riding); July 31st, 1900, at Deal; August 1st-3rd, 1900, at St. Margaret's Bay (James); August 2nd, 1900, at Cofton; August 9th, 1900, at Oxton, Devon (Studd); August 14th, 1900, at Dartmouth (Bankes); June 21st, 1902, at Oxton, Devon; August 19th, 1902, at Dawlish (Studd); imagines captured August 29th, 1902, in the Isle of Purbeck; imagines bred October 2nd-25th, 1902, from larvæ and pupæ collected September 25th-October 1st, at Dartmouth; imagines captured August 23rd, 1904, at Wareham; also August 24th-29th, and October 22nd, 1904, in the Isle of Purbeck; bred September 5th-October 22nd, 1904, from larvæ and pupæ collected at Dartmouth, September 3rd-October 3rd; also imagines captured at same place from early September to October 10th (see *Ent. Rec.*, xvii., pp. 47-48); October 4th, 1904, at Lynmouth (T. H. Briggs); March 19th, 1905, on sallow blossom, at Hazeleigh (Raynor).

Habits.—This species hides during the morning, but, in the afternoon and late evening, haunts flowers in its neighbourhood, the nectar of which it devours greedily. In the early spring it comes to sallow-bloom, and in the late autumn to ivy blossom. The various flowers said to be attractive to it are—*Calluna vulgaris* on the slopes of Ben Donich and at Stronachlochar (Tutt), Cannock Chase (Freer), and at Chislehurst (Bower); *Ononis arvensis* in Dawlish Warren, so abundant that as many as 50 were observed in a single afternoon (Jordan), also in Epping Forest (Machin), at Leominster (Hutchinson), near Sheerness (J. J. Walker), and at Tenby (Fox); *Thymus serpyllum* at Deal (Tutt); and *Linaria vulgaris* at Teignmouth (Jordan). We noticed it very commonly flying about *Salvia* plants at Bobbie, in afternoon and early evening, and Hudd says it is not scarce at flowers (including ivy-bloom) in the Bristol district, during autumn. There are also noted—several captured in garden, hovering over flowers, in Guernsey, at dusk (Luff), flying at dusk at Greenhithe, and among garden geraniums at Lee (Bower), many found on ivy bloom in October, near Sheerness (J. J. Walker). It occasionally, as may be supposed from its love of flowers, comes to sugar, *e.g.*, at Hesleden Dene (J. Gardner), etc.; and is specially attracted by light, *e.g.*, at Dutton (Hodgkinson), at Oxton, Devon (Studd); at Lee (Bower), etc. Barrett says: "The moth hides among herbage during the day, very often, in the summer, among restharrow or heather, later in the year in hedges and bushes, and is of somewhat perplexing habits. On the coast, and in sandy districts, it is thus often common, hiding in the beds of restharrow, and keeping quite close to that plant, but, in autumn, seems to have forsaken these spots for the lanes and hedges, and in them it may be found till winter. It is supposed by some that the late autumn specimens hybernate, and reappear early in June, but this even seems to be mainly a surmise; the June specimens are not worn, yet no larvæ have been apparently observed in the spring. In autumn it will come, at night, to ivy-bloom and heather blossom, and to sugar and light." One can, however, hardly doubt that this species really does hybernate (see *anteà*, p. 293). In the daytime it is sometimes to be found resting on fences, *e.g.*, Dartford Heath fence, etc. (Bower); at other times among the herbage of a hedge-side, *e.g.*, at Oxton, Devon (Studd); or among the heather on a moor, *e.g.*, at Haslemere (Barrett). Bankes notes that the moth usually flies during the evening, and continues on the wing certainly until nightfall, and probably for some time after it, and says that, on October 22nd, 1904, he took three males on the wing during bright sunshine, in the latter part of the afternoon (*circ.* 3.15 p m.-4.15 p.m.), but, at so late a date, one would naturally expect them to come on flight earlier than during the longer days. He adds that "the moths appear to emerge, indifferently, at any time of day, either morning, afternoon, or evening, but few, if any, left the pupa during the hours of night."

Habitats.—The places where this species may be met are exceedingly varied. We have taken it on the chalk-cliffs at Dover and in the Isle of Wight, on the sandhills of Deal, in the lanes near Strood, on the downs at Cuxton, on the heaths clothing the sides of the mountains above Lochgoilhead and Garelochhead; at an elevation of 3000ft.-4000ft. in the Pellice Valley, in Piedmont, and at an elevation of 5000ft. in the Dauphiny Alps, near La Grave. In Essex it occurs in gardens (Raynor); also at Lee, among geraniums (Bower); in Devonshire, at Buckerell, it prefers woods, copses, lanes, and hedges by the sides of fields (Riding), but in grassy lanes at Oxton, Devon (Studd). It is found in woods having an undergrowth of ling, in the Huddersfield district (Porritt); common on all heaths, especially in the spring, in Aberdeen and Kincardine, also at Forres (Reid); on an open heath, surrounded by young spruce trees, at Wemyss (Evans); high up on the heathery fells around Keswick (Beadle); on heaths at Haslemere (Barrett), and at Chislehurst (Bower). It is abundant in Dawlish Warren among *Ononis* (Jordan); also common among *Ononis* in Epping Forest (Machin); and near Leominster also among *Ononis* (Hutchinson); it is common on the crest of the coast sandhills at Aldeburgh (Cruttwell); and in wet places on Cannock Chase (Freer). Barrett considers it to be most attached to coast districts in Britain, but this is hardly borne out by our list of localities. Bankes observes that "the species seems pretty generally distributed in Dorset, and parts, at any rate, of south Devon, and, whilst usually more or less common, is abundant in some seasons. It is, thanks to its being polyphagous, able to make itself equally at home either on the coast-line, or inland, where it is found, both in the more sheltered parts of the open heaths, and also along the hedgerows in the arable and grassy districts." The locality it haunted, above Bobbie, was a very rough, steep, flower-covered slope, in the Pellice Valley, where "plumes" were very abundant, and where the species was chiefly disturbed from amongst a giant *Salvia* that grows there. At La Grave it was found on the steep slopes by the side of the road some little distance down the valley, as well as on the lower pastures above the village. In Germany the localities appear to be much as in Britain—hedgesides and woods where *Stachys* abounds; sloping downs and fields, among various species of *Ononis;* heaths, among *Calluna;* and gardens, among cultivated pelargoniums, *Stachys*, etc. It is found, not only in the lowland districts, but reaches up into the mountains to an elevation of some 3000ft. or 4000ft., for example, in the Austrian Tyrol, the Hartz mountains, etc.

British localities.—Generally distributed throughout England, Ireland and Scotland. Aberdeen: very local—Ben-na-chie (Reid). Antrim: Belfast district, generally distributed (Watts). Argyll: Lochgoilhead, Ben Donich (Tutt), Dunoon (Chapman). Berwick (*teste* Barrett). Bute: Arran (Morton), Brodick (Sharpin). Cambridge: Cambridge (Stainton). Cardigan: Llangennech (Richardson). Carmarthen: Aberayron (Richardson). Cheshire: Bidston, Tranmere (*teste* Leech). Cork: Glengariff (Tutt coll.), Glandore, Timoleague, Courtmacsherry (Donovan). Cumberland: Keswick (Beadle), Lake district (Stainton). Derby: Willington (Garneys), Burton (G. Baker). Devon: Bolt Head (Mathew), Teignmouth (Jordan), Dartmouth (Bankes), Oxton, near Exeter, Cofton, Dawlish (Studd), Harpford Woods, near Honiton, Buckerell (Riding), Alphington (D'Orville), Plymouth (Reading), Lynmouth (T. H. Briggs). Dorset: Isle of Purbeck, Wareham, Portland (Bankes), Weymouth (Richardson), Swanage (Fox), Bloxworth, fairly common (Cambridge). Down: Newcastle (Watts). Dumbarton: local, Gareloch-head (Henderson), Luss (Dalglish). Durham: Hesleden Dene (J. Gardner). Elgin: Forres (Reid). Essex: Witham, Ravenhall (Cansdale), Saffron Walden (Jeffrey), Leytonstone (McIntyre), Epping Forest (Machin), Hazeleigh (Raynor), Leigh (Vaughan), Colchester (Harwood). Fermanagh (*teste* Barrett). Fife: near Wemyss (Evans). Gloucester: near Clifton, Westbury-on-Trym, Almondsbury (Hudd), Bristol (Stainton), Wotton-under-Edge (Perkins). Hants: Bournemouth (Ashdown), Isle of Wight—Ventnor (South), Portsea (Button), New Forest (Stephens). Hereford: Leominster (Hutchinson), Tarrington (J. H. Wood). Hertford: Cheshunt (Boyd). Kent: Gravesend (Button), Sandwich, Deal, St. Margaret's Bay (Tutt), Greenhithe, Bexley, Lee, Mottingham, Chislehurst, Dartford Heath (Bower), Folkestone (Sequeira), Dover (Coverdale), near Sheerness (J. J. Walker), Alkham, Pembury, Farnham (Stainton), Herne Bay (Buckmaster).

Kerry (*teste* Barrett). Kincardine: common (Reid). Lanark: common, Cleghorn (Morton). Lancashire: throughout (Sharp), Dutton (Hodgkinson). Lincoln: Panton (Raynor). Middlesex: Chiswick (Sich), Kingsbury (Bond). Norfolk: Croxton, St. Faith's (H. Williams), King's Lynn (Atmore), Tuddenham (Waters), Norwich, Aldeby, Cawston, Cromer (Barrett). Pembroke: Tenby (Fox), Pembroke (Barrett). Perth: Camghouran (Porritt), the Trossachs, Stronachlochar (Tutt). Renfrew: Gourock (Dunsmore), Cathcart (Dalglish). Ross (White). Roxburgh: Hawick district—near Cowbyres (Guthrie). Shropshire: Clee Hill district (H. Williams). Sligo: near Sligo (Russ). Somerset: Leigh (Hudd). Stafford: Cannock Chase (Freer). Suffolk: Aldeburgh (Cruttwell), Tuddenham (Waters), Leiston (Walsingham), Lowestoft (Boyd). Surrey: Wandsworth (Tuely), Battersea Park (Canning), Sanderstead (Sheldon), Box Hill (Machin), Croydon (Gill), Haslemere (Barrett). Sussex: generally distributed—Hastings district, not uncommon, Guestling (Bloomfield), Worthing, Bramber, between Shoreham and Coombe (W. H. B. Fletcher), Eastbourne (R. Adkin), Bognor (Lloyd). Sutherland (Salvage). Westmorland: Witherslack (Gregson). Wicklow: Wicklow, Woodenbridge (Hart). Worcester: Perry Wood (Edwards), Comer Gardens (J. E. Fletcher). York: Great Ayton (Lofthouse), Huddersfield, rare, Edlington, Doncaster (Porritt), Everingham, common (Sumner), Skipwith, Selby, common (Ash), Richmond (Sang), Scarborough (Stainton), York (Prest).

Distribution.—Probably throughout the Palæarctic, and part of the Nearctic, region. Recorded from Armenia, Syria, Mauretania, Madeira, Canaries, outside Europe, also from New York State, etc., in North America. Africa: [South Africa (*teste* Fernald),] north-west Morocco—Marshen (Blackmore); Madeira—Funchal (Baker). America: New York—West Farms (Angus), California, Oregon (Dyar). Asia: Asia Minor—Patara (Loew *teste* Zeller), near Brussa (Mann), Persia—Hadschyabad (Staudinger). Austro-Hungary: Bohemia (Nickerl), Lower Austria—Vienna district, the Prater, Tivoli, Mauer (Mann), Gutenstein (Kollar), Hernstein, distributed in the foot-hills (Rogenhofer), Tyrol—Glockner district, near Bozen, Trient, the Dolomite district, Schluderbach (Mann), near Tratzberg, Taufers, Knutten (Weiler), Carniola—near Oberfeld (Mann), Dalmatia—Fiume (Mann), Hungary — Nagyág (Aigner), Transsylvania (Rebel). Belgium: rare, Fôret de Soigne, Brussels (Crombrugghe). Bosnia and Hercegovina: Trebevic (Apfelbeck), Nasenica (Rebel), Jablanica (Hilf). Bulgaria and East Roumelia: near Slivno (Haberhauer). Channel Isles: Guernsey — Burnt Lane (Luff). Denmark: very rare—Fyven, Odense (Bang-Haas). France: Aube (Jourdheuille, Cher—St. Florent, Indre—Nohant (Sand), around Paris, not rare—Fontainebleau, Montmorency, Bois de Boulogne, Forêt de Bondy (Begrand), Dauphiny Alps—Combe de Malaval, Savoy Alps — Bourg St. Maurice (Tutt), Saône-et-Loire (Constant), Doubs—Maison Rouge (Bruand). Germany: east and west Prussia, somewhat rare—near Neuhäuser, Königsberg (Speiser), Pomerania, very rare—near Stettin, Carolinenhorst, Vogelsang (Büttner), Mecklenburg—near Neustrelitz (Messing), Hamburg, rare, Höpen (Sauber), Hanover—Hanover (Glitz), Oberharz (Hoffmann), Göttingen (Frey), Rhine Provinces—near Crefeld, rare, Friemersheimer Damm, near Trier, Aachen, near Uerdingen, rare (Stollwerck), Hesse—near Wiesbaden (Rössler), near Frankfurt-on-Main (Koch), Waldeck—Rhoden, Arolsen (Speyer), Nassau (Rössler), Thuringia—near Sömmerda, in the Schmücker (Knapp), near Erfurt, rare (Keferstein and Werneburg), Province of Saxony—near Halle (Stange), near Dessau (Richter), Brandenburg—Frankfurt-on-Oder (Metzner), Silesia—on the Seefelder, near Reinerz (Standfuss), Upper Lusatia—Nisky, Särichen (Möschler), Lichtenau—Lauban, Siegersdorf (Sommer), Kingdom of Saxony—Saxon Upper Lusatia (Schütze), Bavaria — near Regensburg, Winzerberge (Schmid), Württemberg—Kochendorf (Steudel and Hofmann), Baden, near Constance, Meersburg, Freiburg, Karlsruhe (Reutti), near Ueberlingen, Hüfingen, Lahr, Speyer (Meess and Spuler), Alsace—(Peyerimhoff), Palatinate (Meess and Spuler). Greece (Rebel). Italy: Piedmontese valleys—Bobbie, etc. (Tutt), Sicily—Sferracavallo, Madonie (Mina-Palumbo), Syracuse, Catania (Zeller), Lombardy—Algate (Turati). Portugal: southwest of Almodovar (Ragonot). Roumania (Caradja). Russia: Baltic Provinces—Riga, near Lips, Pichtendahl (Nolcken), Volga district—Casan (Eversmann). Scandinavia: Swedish Lapland—Umensis, very rare (Zetterstedt), Barsele (Dahlbom), Scania, Blekinge, north Bothnia (Wallengren), Norway—Smaalen district, Hvalöerne, near Bölingshaon, Lister district—Sireosen, Aal (Strand), Saltdalen (Sparre-Schneider). Spain: Tragacete (Chapman), Barcelona district, abundant—Belen, San Genis, Otoño

(Martorell). SWITZERLAND: rare—Zürich (Frey), Bremgarten (Boll), the Berneck, near St. Gallen (Täschler), Degersheim (Müller), Étivaz (Blachier).

AMBLYPTILIA PUNCTIDACTYLA, Haworth.

SYNONYMY.—Species: **Punctidactyla**, Haw., "Lep. Brit.," pt. 3, p. 479 (1811); Williams, "Ent. Mo. Mag.," xviii., pp. 212-213 (1882); Tutt, "Ent. Rec.," i., p. 93 (1890); "Brit. Nat.," i., p. 42 (1891); "Pter. Brit.," p. 57 (1895). **Acanthadactyla**, Hb., "Eur. Schmett.," Aluc. figs. 23-24 (*post* 1811). **Tesseradactyla**, Haw., "Lep. Brit.," p. 479 (1811). **Punctidactylus**, Sam., "Ent. Usef. Comp.," p. 409 (1819); Curt., "Brit. Ent.," fo. 161 (1827); Stphs., "Illus. Haust.," iv., p. 376 (1834); Wood, "Ind. Ent.," 1st ed., p. 237, pl. li., fig. 1648 (1839); Sta., "Man.," ii., p. 441 (1859); Porritt, "Buck. Larvæ," ix., p. 352, pl. 163, fig. 6 (1901); Barr., "Lep. Brit. Isles," ix., p. 360, pl. 414, figs. 5-5*a* (1904). **Acanthodactyla,** "Verz.," p. 430 (1825); Stphs., "Illus. Haust.," iv., app. p. 424 (1834); South, "Ent.," xxii., p. 32, var. *c* (1889); Tutt, "Ent. Rec.," xi., p. 238 (1899); Riding, "Ent. Rec.," xi., p. 289 (1899). **Tesseradactylus,** Curt., "Brit. Ent.," fo. 161 (1827); Stphs., "Ill. Haust.," iv., p. 376 (1834); Wood, "Ind. Ent.," 1st ed., p. 237, pl. li., fig. 1647 (1839). **Cosmodactyla,** Tr., "Die Schmett.," ix., pt. 2, p. 235 (1833); Staud. and Wocke, "Cat.," 2nd ed., p. 342 (in part) (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 788 (1877); Zell., "Stett. Ent. Ztg.," p. 163 (1878); Frey, "Lep. Schweiz," p. 429 (1880); Jord., "Ent. Mo. Mag.," xviii., p. 117 (1881); Barr., "Ent. Mo. Mag.," xviii., p. 177 (1882); Leech, "Brit. Pyr.," p. 56, pl. xvi., fig. 10 (1885); Meyr., "Trans. Ent. Soc. Lond.," p. 486 (1890); Hofm., "Deutsch. Pter.," p. 65 (1895); Meyr., "Handbk.," p. 433 (1895); Fern., "Pter. Nth. Amer.," p. 24; revd. ed., p. 25 (1898); Riding, "Ent. Rec.," x., p. 263 (1898); Staud. and Reb., "Cat.," 3rd ed., p. 73 (1901); Dyar, "List Nth. Am. Lep.," p. 442 (1902); "Proc. Un. Sta. Nat. Mus.," xxv., p. 399 (1902); xxvii., p. 922 (1904). **Acanthodactylus,** vars. *c*, *d*, *e*, Zell., "Isis," p. 785 (1841); "Linn. Ent.," vi., p. 338, vars. *c*, *d*, *e* (1852). **Cosmodactylus,** H.-Sch., "Sys. Bearb.," v., p. 369 (1855); pl. i., fig. 4 (1853); Frey, "Tin. Pter. Schweiz," p. 406 (1856); "Mitt. Schw. Ent. Gesell.," i., p. 335 (1865); iii., p. 293 (1870); Jord., "Ent. Mo. Mag.," vi., p. 121 (1869); xviii., p. 117 (1881); Nolck., "Lep. Fn. Estl.," p. 802 (1871); Walsm., "Pter. Cal. Ore.," p. 23, pl. ii., figs. 2-4 (1880); Porritt, "Ent. Mo. Mag.," xxii., p. 149 (1885); Tutt, "Young Nat.," x., p. 164 (1889). **Ulodactyla,** Zett., "Ins. Lapp.," p. 1012 (1840). **Ulodactylus,** Dup., "Cat. Meth.," p. 383 (1844).

ORIGINAL DESCRIPTION.—*Alucita* (The brindled plume) alis anticis virescenti-cinereis albido nebulosis, punctis costalibus numerosis, strigaque postica obsoleta, albis. Habitat apud nos rarissime. Expansio alarum 9½ lin. Alæ anticæ bifidæ, posticæ tripartitæ atræ (*Lepidoptera Britannica*, p. 479). [In adding *acanthadactyla*, Hb., as a synonym of this species, we think it advisable to add here descriptions of the figures of *Alucita acanthadactyla* in the copy of Hübner's "Samm. Eur. Schmett.," that belonged to Prof. Zeller, and made at our request by Mr. Bankes. (N.B. —Where the colourist has failed to make the wings quite symmetrical in colour or markings, the one showing the clearest detail has been relied on.) The descriptions read: Fig. 23, "*acanthadactyla*." *Exp. al.*, 20mm. Forewing, in length 9·5mm.; in breadth 1mm. in middle; 3mm. at tornus; costa straight; apex pointed and produced; tornus produced; termen decidedly concave; fissure *circ.* 1mm. long; colour tawny-brown, speckled and irregularly marked with black, and much clouded with it near termen. A series of four costal dots begins about middle of costa, followed by a spot, and, at 1mm. from apex, by an oblique fascia; all these, together with a dot on termen of each lobe, and the sparingly black-spotted cilia, are primrose-coloured. Dorsal cilia with a small, oblique, projecting, black scale-tooth at about, and a larger one somewhat beyond, the middle, followed by a blackish spot and another at tornus. Hindwings dull brown; upper fissure extending almost to middle, lower one nearly to base; cilia white, blackish at apex of third plumule, which has a long, projecting, perpendicular, blackish, dorsal scale-tooth, rather beyond middle. Abdomen (suggestive of ♂) tawny-brown, marked with black, paler posteriorly. Fig. 24, "*acanthadactyla*" (abdomen suggestive of ♀; *exp. al.*, 20·5mm.) differs from fig. 23 in the following chief points: (1) forewing not dark speckled; dark markings dusky-brown, more decided in shape and size, consisting, anteriorly, of a mainly-dark basal area, with one or two oblique bars from near middle of costa; (2) the four costal dots are placed, three before, and one after, the primrose costal spot; lower lobe with two terminal dots instead of one; all these dots are white; (3) cilia of hindwings dull brown instead of white; (4) abdomen black-marked, white anteriorly, tawny-brown posteriorly.]

Imago.—20mm.-21mm. Forewings narrow, divided into two lobes; falcate at apex; the outer margin wide and indented; colour, pale olivaceous-ochreous; the costal margin darker olivaceous-brown, conspicuously marked with white dots from the base to the costal triangular blotch; the latter inconspicuous, only a slightly darker shade than ground colour; the lobal area similarly rather darker, both lobes crossed by a pale ochreous-white transverse line, almost medially; a large ochreous-white costal mark above end of fissure on the outer edge of the costal blotch; the inner margin of the wing of the darker tint (similar to the costa); the median area rather paler; a fine white longitudinal line from end of fissure halfway to base, a short dark longitudinal discal mark; a series of fine white lines crossing the wing from costa to inner margin, giving the wing a very reticulated or mottled appearance; the fringes of the outer margin white, externally shaded with grey; at the anal angle a black patch; on the inner margin also whitish, very narrow, chequered with single black scales and small patches. The hindwings blackish-brown, finely mottled with minute paler scales; the fringes of plumules 1 and 2 dark grey-brown; of plumule 3 also dark grey-brown, but with paler bases, with a large median scale-patch, a small black patch near apex, and a row of scattered black scales from median scale-patch to base.

Variation.—Bankes writes (*in litt.*) that, "as a rule, in British specimens, the variation in colour seems confined within rather narrow limits, and of about 30 specimens bred from Dorset and Devon larvæ and pupæ, all have the ground-colour of the forewings olive-grey, though in some this is of a much lighter tint than in others. One specimen, probably hybernated, taken in the Isle of Purbeck on July 17th, 1884, is of a browner hue than any others I have seen, and made one wonder whether it could possibly be a worn *cosmodactyla*, Hb., but this is certainly not the case. The only extreme form known to me is

ab. *albida*, n. ab.—Forewings white, irregularly mottled with fuscous, and with the usual dark markings only faintly expressed. Hindwings fuscous-grey.

My only example came to me, without data, from the "Machin" collection, and I have seen another, both being British. Haworth's representative of the *Alucita tesseradactyla* of his *Lep. Brit.*, p. 479 (1812), bearing his own MS. label "*tesseradactyla*," and agreeing with the description there given, has recently come into my hands. It is totally unlike the true *tesseradactyla*, L., both in size and shape, and rather dissimilar in colour, and is certainly a pale example of *punctidactyla*, Haw., with the ground colour of the forewings ivory-white, very faintly mottled with fuscous, and with the usual dark markings strongly pronounced and clearly defined. Differing markedly from the still paler ab. *albida*, I would propose that it should be known as ab. *ossea*, n. ab., since the name *tesseradactyla* is not available for it. The species seems fairly constant in size, nor have I seen any strikingly large, or strikingly small, individuals." Haworth's original description of *tesseradactyla* (*Lep. Brit.*, p. 479) reads as follows: "Alucita (The marbled plume) alis patentibus fissis cinereo nebulosis, posticis fusco nebulosis," a mere copy of the Fabrician description under this name. The American examples vary in size from 18mm.-23mm., and also in the intensity of the markings, so much so that, at first, Walsingham had doubts whether the examples (50) he captured might not be separated into at least two species; but "a careful comparison of these with a series of the European form, as well as the perfectly regular and gentle gradations of size and colour by which they are distinguished, tend to prove that they all belong to the same species. Zeller, in his abstract of Wallengren's "Scandinaviens Fjädermott" (*Stett. Ent. Ztg.*, 1867), treats *cosmodactyla*, Hb., as identical with *ulodactyla*, Zett., and *acanthadactyla*, Hb., and I am indebted to him for specimens of what he understands by the first and last of these three names. The two forms which he has so kindly sent me are certainly included in my American series, of which three varieties are here figured (*Pteroph. Calif. Oreg.*, pl. ii., figs. 2, 3, 4) to facilitate identification." There can be no doubt that the examples figured by Walsingham are of this species, but of forms hardly known in Britain. The first example (fig. 2) is one tinged with flesh-colour or light brownish = ab. *approximata*, n. ab., giving one a suspicion of the colour of the disc of the forewing of pale *cosmodactyla*. The second (fig. 3) is possibly the same as, or at least very near, ab. *albida*, Bankes; whilst the third (fig. 4) is ashy-grey, and possibly represents a very extreme ab. of the form described as *ulodactyla*, Zett., and which we name below ab. *extrema*, n. ab. The series in the "Frey" collection is something in the nature of a revelation to those who collect only British examples. Here one finds, under the name of var. *stachydalis* (evidently the bred types, with their pupa-cases) two specially ochreous-green examples from Zürich. The first two examples in the series of what were evidently considered, by Frey, typical "*cosmodactyla*," are not unlike ordinary British *punctidactyla*, Haworth, an ochreous-grey, or slightly-greenish grey, tint pervading the wings, and the markings not at all darkly or clearly marked; moderately typical examples. Then come 10 dark strongly-marked specimens, such as we rarely, if ever, get in Britain. (The nearest approach to this form among British examples comes from Oxton, Devon.) In these, there is practically no tinge of green, the ground colour is ashy or grey, in which, occasionally, a little brown is mixed, the whole strongly speckled with black scaling, which, in the darkest examples, practically blots out the ground colour, leaving us with an almost blackish insect, finely crossed transversely with delicate white lines; the triangular costal blotch black-brown, the outer part of the two lobes also black, with a whitish transverse line crossing the dark area, and with a few, scattered, white scales thereon; the pale lunular mark, outside the triangular costal blotch, conspicuous. The hindwings are correspondingly dark. The paler forms of this Zürich race, in which the ashy colour is predominant over the brown-black or fuscous-black markings, comprise, no doubt, the *ulodactyla* of Zetterstedt. There is little doubt also, that this is the var. *d* of Zeller (*Isis*, 1841, p. 785), described as "alis anterioribus cinerascentibus parum nebulosis, punctis albis in laciniarum margine postico obsoletis," of which he had one ♂ from Fischer von Röslerstamm's collection. An example of the brown-tinged form, just noted, is evidently figured by Herrich-Schäffer (*Sys. Bearb.*, pl. i., fig. 4), and this we would call ab. *dubia*, n. ab. The dark forms of this race we call *freyi*, n. ab. This is probably Zeller's var. *e* (*op. cit.*), described as "major; alis anterioribus paulo latioribus, obscuris cano subreticulatis = *spilodactyla*, Kaden, *in litt.*" The most extreme form of this race in the opposite (pale) direction is labelled "*cosmodactyla*, aberr., Zürich." This specimen has the whole of the wings of an ashy-grey colour, only relieved by faintly-darker grey longitudinal shadings, a narrowly fuscous-spotted costa, a dark fuscous-black triangular costal blotch, and a dark irregular band crossing the lobes, filling up the anal angle of the lower lobe. Walsingham's fig. 4 (*Pter. Cal. Oreg.*, pl. ii) might nearly be drawn from this specimen. We call it ab. *extrema*, n. ab. We have a specimen approaching this, bred by Studd, from a larva found at Oxton. Of this variable and interesting species, therefore, there appear to be only three previously named forms, *viz.*:—

Ashy, shaded with fuscous, a white striga parallel with hind margin = var. *ulodactyla*, Zett.

Ashy-green, clouded with white, with many white costal spots, and obsolete striga at hind-margin = *punctidactyla*, Haw.

Greenish-fuscous, with darker costal spot, and white costal points = *cosmodactyla*, Tr. = var. (et ab.) *stachydalis*, Frey.

a. var. *stachydalis*, Frey, "Mitt. Schw. Ent. Gesell.," iii., p. 290 (1870); "Stett. Ent. Ztg.," 1871, p. 125 (1871); "Lep. der Schweiz," p. 429 (1880); Sta., "Ent. Mo. Mag.," xviii., p. 213 (1882); Hofm., "Pter. Deutsch.," p. 65 (1895).—From the seed-capsules of *Aquilegia*, I have bred, during several years, about 100 examples of *cosmodactyla*, among which appeared a single specimen which was coloured exactly the same as those regularly produced when reared on *Stachys*. I propose the name var. *stachydalis* for this striking form (Frey). The young larva of the var. *stachydalis*, 7mm.-8mm. long, is brown-red, with two white lateral lines on the back (subdorsal), and a broken white line above the spiracles (supraspiracular) and whitish lateral flange. Tubercles white on the meso- and metathorax, with two white hairs each, on the dorsum of the remaining segments, each with *one* white hair, on the lateral flange, again, each with two divergent hairs. Besides this, the whole body is thickly beset with small, very short, black bristles. Head shining black, or also yellow-brown with black spots; thoracic shield black-brown, divided by a fine pale median line, anteriorly whitish margined, beset with white bristles. Anal flap black-brown with white bristles. Spiracles on white elevations. Thoracic feet black, terminal joint brown. Ventral and anal claspers like the venter, whitish-grey. In the fullgrown larva, the brown-red colour gradually vanishes, and gives place to green; the dorsal stripe, and the 2nd and 3rd abdominal segments retain the brown-red longest; at last, the red colour dies away here, and the dorsal stripe becomes dark green; the thoracic shield and anal flap become green as well; the rest of the markings remain unchanged. Described from larvæ found plentifully at the end of July and beginning of August on the flowers of *Stachys silvatica* and *Salvia glutinosa* (Hofmann).

The remarkable statement of Frey (*suprà*), involving as it does no description whatever, either of the normal *Aquilegia* form, or the *Stachys* form, which one example from *Aquilegia* resembled, and which is here named *stachydalis*, gives no clue as to what *stachydalis* is, but, the year following, Frey noted (*Stett. Ent. Ztg.*, 1871, p. 121) that he met with *cosmodactyla*, Tr. (*punctidactyla*) at Zürich, in June, and that Boll, at Bremgarten, had called his attention to a "plume" larva feeding on the flowers of *Stachys sylvatica*, which, at first, he was inclined to consider was that of *acanthodactyla*, Tr., but which produced *cosmodactyla*, Tr., of strikingly bright olive-brown hue, 18 exactly similar examples being reared altogether, and which he considered, could be nothing but a variety of this species. He further noted that, in the course of the year, he had reared a hundred *cosmodactyla*, Tr., from the seed-capsules of *Aquilegia*, among which was a single specimen identical with those reared from *Stachys sylvatica*. It is to be assumed, therefore, that the olive-brown form is Frey's *stachydalis*, an assumption borne out by the types in his own collection at the British Museum. It is the nearest of all the forms to our ordinary British *punctidactyla*, and, except for being, perhaps, a little yellower and brighter-tinted, would fall within the bounds of *punctidactyla*, Haw., very well. Boll, himself, records breeding pale olive-brown specimens at Bremgarten. Stainton quoted Frey's remarks (*Ent. Mo. Mag.*, xviii., p. 213); and Hofmann observes (*Pter. Deutsch.*, p. 66) that "the var. *stachydalis* varies from the type, principally in the unusually rich yellowish-white and greenish-yellow scaling, which makes this particular form look very much lighter, sometimes yellowish-white; the markings, however, being the same as "the type." It is impossible to accept South's *acanthodactyla* var. *a* (see *Ent.*, xxii., pp. 31-32) as this form, although it has been referred hereto, its ground colour of "ochreous-grey, with a rosy tinge," not satisfying Frey's description of "bright olive-brown" (see *anteà*, p. 176). Treitschke's *cosmodactyla* is perhaps *stachydalis*, Frey, Treitschke's insect being described as "*Alucita*, alis anticis olivaceo-fuscis, macula triangulari obscuriore, punctis costalibus albis." The specimens described by Treitschke came from Schmidt, and were taken at Laybach; he further adds that "the Hübnerian *cosmodactyla* accords exactly with it." We can only suppose that there must be great difference in the Hübnerian figures, certainly those we have seen show no trace of olive in them (see *anteà*, pp. 274-5). Peyerimhoff notes the capture of two examples of var. *stachydalis* at Saverne, in Alsace.

β. var. *ulodactyla*, Zett., "Ins. Lapp.," p. 1012 (1840).—Alis anticis cinereo-fuscoque variegatis, postice macula costali parva strigaque intramarginali albis; apice emarginato-dentatis. ♂. Long. al. exp. fere $\frac{7}{8}$ poll. Hab. in Lapponia Suecica Umensi rariss.; ad Barrsele d. 1 Jul. a D. Dahlbom inventa. Lappon. meridional., Suecia inferior rariss. ♂. Similis videtur *Aluc acanthodactylae*, Treits., seu *odontodactylae*, Charp., sed maculis alarum nigricantibus distinctioribus deficientibus dignota. Tota cinereo-fuscoque variegata. Alæ anticæ margine apicali emarginato-dentato, quasi eroso l. crispo. Ante marginem striga cum margine parallela alba, interne fuscedine inducta. Fasciculi pilorum nigrorum duo in margine interiori adsunt (Zetterstedt).

This, we suspect, to be the ordinary continental form of the species. Judging by the "Frey" collection, the Zürich specimens are almost entirely of this form, in extremely varying examples. Specimens from Regensburg are also in the British Museum collection. The only British examples of this race that we have seen were bred by Studd, from larvæ taken at Oxton.

Comparison of Amblyptilia punctidactyla and A. cosmodactyla.—*Amblyptilia punctidactyla* is a somewhat stouter form with broader wings than its near ally; the forewings are very richly dusted with yellow and white, or sometimes with greenish-yellow on a blackish ground, so that they appear as if marbled. The white spots of the costa are larger than in *A. cosmodactyla*. The underside of the forewings uniform black, with deep black costa set with large white spots, while the costa in *A. cosmodactyla* is always brown. The underside of the 1st and 3rd plumules of the hindwings black (in *A. cosmodactyla* brown), richly sprinkled with white scales. The scale-tuft of the 3rd plumule is (like the very weak indication of the anal angle) placed beyond the middle, more towards the apex of the plumule; it is nearly as long as broad, and, in this direction, varies only very seldom, in any case much less than in *A. cosmodactyla*; on the sides of the tuft, the inner marginal fringes are white at the base for some distance (Hofmann). I cannot see that, in Britain, *punctidactyla* averages at all broader in the wing than its ally (Bankes). I should note our Devon *punctidactyla* as dark green, mixed with greyish-ochreous (losing some of this colour after a time, and getting sometimes a somewhat redder tinge); much more mottled than *cosmodactyla*; with a very large and conspicuous black scale-tooth on both fore- and hindwings, especially that on the 3rd plumule of hindwing; much more prolonged apex of the upper lobe of the fore-wing, beyond cleft, beak-like; a white costal spot immediately before apex (both these latter characters absent in *cosmodactyla*). The latter is reddish-brown, with a greenish hue in a good many specimens when bred; smoother, neater, more unicolorous, and with a more regular pattern than in *punctidactyla* (Riding). [See also *anteà*, p. 279.]

Habits of larva.—The fact that the larvæ of *punctidactyla* are so very similar to those of *cosmodactyla*, and feed on the same foodplants, has led to very little that is reliable being written about them. In late July and early August, Riding finds the larvæ of both insects apparently together on *Stachys sylvatica*, at Buckerell. He notes (*in litt.*): "They are very uncertain in appearance, in some years abundant, in others, as in 1904, not one to be found." He says (*Ent. Rec.*, xi., p. 289) that, in early August, 1899, he spent many hours in woods, and beside hedges and ditches, hunting for the larvæ of the *Stachys* "plume," or "plumes," and he rarely obtained more than three or four per hour. Both red and green larvæ were to be obtained, the former generally the smaller, and to be met with before the purplish-red corolla has fallen off, the latter larger and on plants that were seeding, the colour being evidently protective. From the few kept, two large olive-green imagines with black and white markings (*punctidactyla*), and a small and reddish-brown (*cosmodactyla*) one, were bred. He further notes (*op. cit.*, x., p. 263) that a large percentage of the larvæ is ichneumoned; in 1898, he places it at 85 per cent. Among the imagines reared, specimens of both *punctidactyla* and *cosmodactyla* appeared. In 1899, the larvæ were found feeding on the unripe buds, as well as the other parts of the flower, the most advanced dipping into the seed at the bottom of the cup, just like a Dianthœciid larva in the capsules of its own food. He further observes (*in litt.*) that he only knew one locality in which he could rely on getting larvæ of *A. punctidactyla*, without discriminating the larvæ, *viz.*, in Harpford Woods, between Buckerell and Sidmouth. In the lanes and hedges, where the larvæ were abundant on *Stachys sylvatica*, one or two would turn out to be *A. punctidactyla*, but the majority *A. cosmodactyla*. He adds, "I generally searched for the larvæ of *punctidactyla* in Harpford Woods, the first and second weeks in August, when I sometimes found them nearly fullfed, but the best time to look for them would be, however, the second, third, and fourth weeks of July; I never discriminated the larvæ of the two species, and only observed that (1) some larvæ were dull reddish-purple in colour (the hue of the flowers of *Stachys*), with darker dorsal vessel, and whitish subdorsal and spiracular bands, whilst (2) others were yellowish-brown, with darker dorsal vessel, and a band of reddish-purple, partly, or all, along the dorsum; (3) others darker green, with no red colour. I noted that the larvæ seemed to adapt themselves very readily to environment, and that the purplish-red larvæ were found mostly on the flowers, or reddish parts of the stem, and the green larvæ on the green parts. Hofmann notes that "the larva lives in July on the unripe seed-capsules of *Aquilegia vulgaris*, boring into the capsule through a roundish hole, and penetrating therein as far as the first part of the body." Zeller observes that he found the larvæ also on *Geranium pratense*, devouring the blossoms and seeds, as well as on *Erodium cicutarium* (*Stett. Ent. Zeitg.*, 1878, p. 163). Frey records the larvæ, in June, on *Stachys sylvatica*, then, four or six weeks later, on the seeds of *Aquilegia vulgaris*. Boll notes the finding of larvæ in the bloom of *Stachys sylvatica* at Bremgarten. Bankes observes that the larvæ feed on the flowers and unripe seeds of *Stachys sylvatica* in the Isle of Purbeck. In Pomerania, the larvæ are found eating the seeds of *Aquilegia* (Paul and Plötz), and in the Hamburg district, flowers of *Stachys sylvatica* (Sauber), also in Silesia, although they feed as well on the flowers of *Aquilegia vulgaris* (Wocke); in the kingdom of Saxony, the larvæ are found on *Euphrasia officinalis* and *Stachys palustris*, as well as *S. sylvatica* (Schütze); in Bavaria, they are to be taken at the beginning of July, usually in some numbers, when present at all, clearing out the contents of the green seed-vessels of *Aquilegia vulgaris*, and going to others when these are emptied; the larvæ will also eat the green pupæ if they meet with them (Schmid); in Würtemberg, the larvæ are to be found in July and in the autumn, feeding on the seeds of *Aquilegia* and the flowers of *Stachys sylvatica*, in a delicate web (Steudel and Hofmann). Dyar records (*Proc. Unit. Sta. Nat. Mus.*, xxvii., p. 922) that, at Kaslo, in British Columbia, he found larvæ in the red bracts of the high bush-honeysuckle (*Lonicera involucrata*), eating holes in the young fruit through the bracts, and destroying the fruit. Frey says that the larvæ occur in July, in Switzerland. Barrett, in August and September, at Haslemere. Other records of the capture of larvæ are—August 6th, 1884; July 20th-August 8th, 1885; August 15th-September 16th, 1892, in the Isle of Purbeck (Bankes); July 29th-30th, *circ.* 1883, in the Isle of Purbeck (Digby, *teste* Bankes); and August 5th and 9th, 1899, in the neighbourhood of Buckerell (Riding).

Larva.*—*Penultimate instar:* Head bilobed, shining black. Cervical shield quadrate, black; thoracic feet, and anal plate, black; tubercles brown, angularly-plated, i and ii with a pale hair and very short black one separate, i dorsad to ii; tubercle iii also with multiple hairs; two secondary hairs, very short, black, below tubercle i; tubercle iiia present; iv+v with a secondary hair closely adjoining; vi single. Skin with sparse, dark, secondary granules. Dorsum broadly whitish, with dorsal reddish line; sides dull reddish; stigmatal region whitish (Dyar. From specimen taken in British Columbia). *Final instar:* Head round, vertically bilobed posteriorly, pale testaceous. Body cylindrical, normal, green; a dull crimson dorsal line, with a small oblique subdorsal dash on joint 6, and a dash on joints 5 to 12; a white subdorsal line, from joint 2, posteriorly, to 13, anteriorly, and a broken subdorsal one, the larger anterior part on each segment being oblique. Tubercles small, hairs single, i and ii separate, iv and v approximate, v anterior and dorsal to iv; on thorax i*a*+i*b*, ii*a*+ii*b*, iv+v, numerous

* For description of young larva, see *antea*, p. 302, under var. *stachydalis*.

fine, short, secondary hairs, shorter than, and easily differentiated from, the primary ones, bulbous-tipped. Hairs all white, not long, inconspicuous (Dyar. From specimen taken in Colorado). *Final instar* (fullgrown): Length about ·5in.; of the usual stumpy form when at rest. Head small, and narrower than the 2nd segment; it has the lobes rounded, and is highly polished; body cylindrical, attenuated a little posteriorly, each segment plump and distinct, making the divisions clearly defined; skin soft, and sparingly clothed with short hairs (see p. 307) (Porritt). The fullgrown larva is 11mm. long, slightly attenuated towards both ends of the body, with weakly-developed lateral flange bright green; the dorsal vessel shows through dark green; two white subdorsal lines run on both sides of this; below these runs a supraspiracular line, interrupted at each segmental division, consisting of white diagonal dashes sloping from the anterior downwards to the posterior. Spiracles ringed with light brown; lateral flange white. Head yellowish-green, with pale brown spots, or also simply green, with dark brown mouth-parts. Prothorax and anal flap green. All the prolegs pale green; thoracic legs with brown claws. The tubercles are small, of the colour of the body, and single-haired; only those on the lateral flange bear two hairs. The body is, besides, especially on the back, rather thickly beset with short, fine, white, not knobbed, hairs (only distinctly visible with a lens). (Described from the living larva) (Hofmann). [I have a preserved larva that was taken at Guarda (Lower Engadine) on July 27th, 1900, that is certainly an *Amblyptilia*, and certainly not *cosmodactyla*, and must, therefore, with the highest probability, be *punctidactyla*. It was feeding on geranium; there were one or two others, but I reared none; I think the others proved to be stung. It is fairly certain that this larva is *punctidactyla*, as it agrees with that larva in the very clear points that are described by Hofmann as distinguishing *punctidactyla* from that of *cosmodactyla*. Indeed, the chief use of this specimen is to enable me to follow what Hofmann says. His description has the great advantage that it is absolute, and enables both species (*cosmodactyla* and *punctidactyla*) to be distinguished, whilst Porritt's (very able for the time it was written) is of little use, except to anyone who has the two larvæ before him for comparison, the more so since the most definite distinguishing character of the two species, which he found in his specimens, the colouring of the head (see p. 307), does not appear to hold good generally, either according to Hofmann, to Mr. Bankes' observations (*anteà*, p. 286), or in my own more limited experience.] The most notable difference is in the secondary hairs. In *A. punctidactyla* these are more numerous, more generally distributed, and rather shorter. They are less various in length; the great majority of them are about 0·08mm. long. In *A. cosmodactyla* there are few as short as this, the majority being about 0·12mm. In both there are longer ones, but these are rarer in *A. punctidactyla*, and only occur near the tubercles. The form of these hairs is very distinctive, in *A. cosmodactyla* they taper very little, and then swell out at the ends, to be nearly as thick there as they are at their bases, with bifid or multispiculate ends. In *A. punctidactyla* they have, at first glance, all the appearance of ordinary hairs, regularly tapering, and with sharp points. It is only on close examination, with a good deal of magnification, that it is seen that they are more or less blunt, and perhaps bifid. The primary hairs are also shorter. On the 1st abdominal segment their comparative lengths are :—

TUBERCLES.	IN COSMODACTYLA.	IN PUNCTIDACTYLA.
i	0·66	0·64
ii	0·48	0·48
iii	0·70	0·60
iv	0·54	0·38
v	0·51	0·42

This difference, it will be seen, is most pronounced in the lateral, and hardly occurs in the dorsal, hairs. In *A. punctidactyla*, they also taper more rapidly, and so seem to have also sharper points, and are more slender. My specimen does not quite agree with Hofmann's statement that there are no secondary tubercular hairs. These are present, but are less obvious and pronounced than in *A. cosmodactyla*, and might properly be described as absent in i and ii, but iii, especially, has a fairly-developed secondary hair, and the postspiracular secondary tubercles are represented by some, decidedly stronger, secondary hairs, but less strong than in *A. cosmodactyla.* In Lord Walsingham's collection are two larvæ from Mr. Porritt labelled "*punctidactylus*," and these also agree with Hofmann's description. The secondary hairs, instead of being of varying sizes and with very thickened ends as in *A. cosmodactyla*, are of uniform small size, and the ends, though thickened, are only slightly so, and exactly the same on all hairs. There is one larger secondary hair in the position of the lower postspiracular accessory. Certain of the secondary hairs are attached to the bases of the tubercles, but, differing in no way from the others, though they are probably secondary tubercular essentially, quite justify Hofmann's statement that such hairs are absent, as they may be equally regarded as skin-hairs only. The heads of these two specimens are pale, but have some dark markings of exactly the same pattern as those of *A. cosmodactyla* (Chapman).

Variation of larva.—There are two very distinct varieties of the larva of this species :—

1. The ground-colour of a clear purplish-pink; head very dark sienna-brown, almost black; the smoke-coloured dorsal vessel shows through as the dorsal stripe; subdorsal stripes clear white, and very conspicuous; below them is a narrow and interrupted white line, and another about the same width, but which, being tinged with pink, is not so pale, along the spiracles; hairs white. Ventral surface semitranslucent, yellowish-grey, prolegs purplish-pink on the outside; anterior legs of the dark sienna-brown of the head, but with paler rings.

2. The ground-colour bright pale green; the markings the same as in var. 1, except that the white stripes are scarcely so conspicuous; in some specimens the smoky mediodorsal vessel is tinged with pink, and the ventral surface and prolegs are of the same bright green as the dorsal area (Porritt).

Buckler figured (*Larvae*, etc., pl. clxiii., figs. 6 and 6*a*) two larvæ, after their final moult, on September 1st, 1877, showing considerable difference in their markings; they were feeding on the seeding flower-spikes of *Stachys sylvatica*, and the moths emerged September 15th, 1877.

Foodplants.—Seeds of *Aquilegia vulgaris* (Frey), flowers and unripe seeds of *Stachys sylvatica* (Bankes), *S. palustris*, *Euphrasia officinalis* (Schütze), *Salvia glutinosa* (Hofmann), flowers and young fruit of

Lonicera involucrata (Dyar), *Geranium pratense, Erodium cicutarium* (Zeller), *Arthocarpus* sp. (Walsingham).

Pupation.—The larva attaches itself to the spike of *Stachys sylvatica*, on the flowers of which it has fed, in order to undergo pupation (Williams). The pupa is attached to the foodplant by the tail, and two somewhat curved pointed protuberances, which spring from the back, give it a curious appearance (Porritt). Attached by the anal hooks to the foodplant, hanging like a little slender butterfly pupa (Barrett). All the pupæ that I have collected have been found on the stems of *Stachys sylvatica*. Their ordinary position is identical with that of *A. cosmodactyla*, Hb., *viz.*, suspended head downwards along the portion of the stem between two of the whorls of the calyces of the foodplant, and the method by which the pupa is attached to the stem is precisely similar (Bankes). In almost all cases that I have noted, the pupa has been suspended lengthwise along the stem (Riding). The fullfed larva usually leaves the flowers of *Stachys sylvatica* on which it has been feeding, and crawls somewhat lower down the stem, before spinning its pad of silk, to which it attaches itself for pupation (Wocke). The pupa hangs free on the flower-stalk, or on a seed-capsule of *Aquilegia*, the pupal stage lasting from 14 to 21 days (Kaltenbach).

Variation of pupa.—As in the larvæ, there are two distinct varieties—(1) purple, (2) green; but both forms have oblique dark markings (Porritt).

Pupa.—The pupa of this species is substantially the same as that of *A. cosmodactyla*. The latter varies considerably in just those points in which the pupa of *A. punctidactyla* differs from it, and very probably the last-named does the same, but my specimens are too few to say whether this be so or not. Four or five points may be noted: (1) The great halbert-shaped process of the 3rd abdominal is, in *cosmodactyla*, rough, nodulated, and angulated in outline; in *punctidactyla*, the posterior border is a smooth, regular, curve, and the front margin is less deeply notched. A good many specimens, however, of *cosmodactyla* are very close to *punctidactyla* in this respect. (2) The small process of this spine, which carries ii, is rather smaller in *punctidactyla*, and is less a mere process on the large spine, and nearly, but not quite, separate. (3) The remaining processes on the 4th-8th abdominal segments, carrying tubercles i and ii, are larger in *cosmodactyla* than in *punctidactyla*, and, although it is the fact, in both species, that the two processes (one carrying i, and the other carrying ii) are fused together as one process, they sometimes have the appearance, in *punctidactyla*, of being really two separate processes. (4) In *punctidactyla*, the posterior portion of this process (carrying ii) is very distinctly smaller than in *cosmodactyla*. (5) The hairs of ii, iii, iv, v, and vi, are very much shorter in *punctidactyla* than in *cosmodactyla*, in the former, being of a length about equal to the diameter of the spiracle, and, in *cosmodactyla*, several times that length, nearly, in fact, half the width of a segment. I have examined something like 200 pupæ of *cosmodactyla*, a few of my own breeding, but the mass sent me by Mr. E. R. Bankes. Amongst these, there is much variation in all these points of difference, but, though, in many instances, one or other of these characters approaches very closely to the form belonging to *punctidactyla*, so closely that one would be inclined to say that, in that character, the pupa was more like *punctidactyla* than *cosmodactyla*, still, it does not quite reach the *punctidactyla* form. This is especially the case in the most marked of these characters, *viz.*, the shortness of hairs on *punctidactyla*, which do not vary in my specimens of that species, though some *cosmodactyla* approach them so closely that, if a large number of *punctidactyla* afforded some varieties, the interval would no doubt be bridged. With regard to this variation, there is one point about my material to be noted. Amongst some 200 undoubted *cosmodactyla* pupæ, none approach *very* closely to *punctidactyla*, but a number (50 or so) sent me some years ago by Mr. Bankes, as *cosmodactyla*, afforded five pupæ that I take to be *punctidactyla*, and four that make a very close approach to them, but are, I think, *cosmodactyla*. In reply to my enquiries respecting them, Mr. Bankes says: "I certainly cannot warrant them as including no *punctidactyla*, for I never could satisfactorily separate the larvæ, even with the published distinctions before me, when sorting them out. Probably the shells you have were the result of my searches for larvæ in 1892, when I bred, with a host of the parasite, *Apanteles fuliginosus*, Wesm., 443 *cosmodactyla* and 21 *punctidactyla*, every cage that produced the latter species yielding the former also." Those selected from these shells as *punctidactyla* are, then, almost certainly that species, but what of the intermediates? They are not typical *punctidactyla*, but are nearer to them than any among the 200 (odd) undoubted *cosmodactyla* are (Chapman). The pupa is green, bright yellow-brown to dark brown (then reddish on the back), with dark longitudinal lines on the abdomen and between the veins on the wing-cases, also with two blackish diagonal streaks on the sides of the thorax, of which the posterior arises from the sickle-shaped humps of the 4th abdominal segment; the latter exhibit, on the anterior side (or slope), no such deep indentation as those of *A. punctidactyla*; neither is the apex so sharp or high. Of the bifurcated thorns on the back of the 4th to the 8th abdominal segments, the posterior point, directed downwards, is much smaller than the anterior point which stands upright, through which a further difference from the pupa of *A. cosmodactyla* is exhibited, in which these thorns, especially the posterior point, are significantly larger (Hofmann).

Time of appearance.—Hybernated examples are to be met with from March until June. The imagines of the year commence to emerge at the end of July, and continue throughout August and September, and may be taken during any spell of mild weather during the late autumn*. They are rarely seen from December to February when their hybernation seems more complete. Bankes writes (*in litt.*): "The imago seems clearly to hybernate as such. Mr. J. C. Dale took one on March 30th, and three in April (in two different years), and I have captured a specimen on May 29th, and another, which, from its condition, appeared to have unquestionably hybernated, on July 17th. There are probably two broods, at any rate, in the south of England, for larvæ may be found from about the middle of July to the middle of September, and very likely till later, and moths may be bred from about the middle of August until, at least, the beginning of October." In Switzerland, the imagines are found at the end of July and in

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* Barrett says: "On the wing in June and the beginning of July, then again in September, but whether as two generations, or hybernating and reappearing in the following summer, is not clearly ascertained."

August, and reappear in the spring after hybernation (Frey). Hofmann says that, in Germany, the moth emerges at the end of July; those taken in spring have probably all hybernated, though Zeller found a perfectly fresh specimen on June 1st. It is reported as occurring in Pomerania, in July (Paul and Plötz); in the Hamburg district it appears in August, from July larvæ (Sauber); from the end of August until June of the following year in the mountains of Silesia (Wocke), but in July in the lowlands (Möschler); in August, in Saxon Upper Lusatia (Schütze); in Bavaria, it appears towards the latter end of July, and good examples are to be found in the spring after hybernation (Schmid); it occurs in July and August to October in Württemberg (Steudel and Hofmann), and in Baden at the end of July and August, reappearing again in the spring after hybernation, the species being probably double-brooded in the south of the duchy (Meess and Spuler). In Austria it is recorded as occurring, in the Vienna district, in September and again in May (Mann); a ♀ was captured on May 26th near Flitsch (Zeller), and specimens also on June 22nd and 26th at Bozen (Meess). Imagines are recorded as follows:—Continental records: In June, 1869, at Zürich (Frey); May 24th, August 16th, at Lechts (Huene); May 22nd, 1870, at Pichtendahl; between May 10th and 24th, near the Jägellake; June 8th, at Lips; July 19th, at Rotsiküll (Nolcken); captured ♂ June 1st, 1871, bred a ♀ August 30th, 1871, from Tuors-Pensch, in the Oberalbula district (Zeller); June 9th, 1879, at Saltdalen, in Arctic Norway (Storjord *teste* Schoyen). In America, some 50 specimens between May 16th, 1871, in California (at San Francisco), and the end of August, 1871 (on Mount Shasta); also taken again in April, 1872, in the north of Oregon; and bred from larvæ found, in June of the same year, in the neighbourhood of Rouge River, in southern Oregon; the species must be at least doublebrooded (Walsingham); June 21st, 1902, at Kaslo, British Columbia (Cockle); July 11th-19th, 1903, also at Kaslo (Dyar). British records: April 5th, 21st, 1816, March 30th, 1817, July 4th, 1820, October 4th, 1825, April 4th, 1831, at Glanvilles Wootton (J. C. Dale); May 26th, 1865, at Glanvilles Wootton (E. R. Dale); September 6th, 1876, at Glanvilles Wootton (C. W. Dale); newly-emerged, July and August (Stainton); scarce in July and August, near Bristol, etc. (Hudd); September, 1864, at Haslemere (Barrett); imago bred October 1st, 1883, from larva found in the Isle of Purbeck (Bankes); [August 16th, 1884, at Glasgow (Mackay);] imago captured July 17th, 1884, in the Isle of Purbeck; imagines reared August 22nd-September 5th, 1884, from larvæ collected in the Isle of Purbeck, August 6th, 1884 (Bankes); imagines mid-September, and early October, 1884, at Aberayron (Richardson); imagines bred September 6th, 1885, and following days (Porritt), from larvæ collected from July 20th-August 8th, in the Isle of Purbeck (Bankes); imagines bred September 16th-29th, 1892, from larvæ found August 15th-September 16th, in the Isle of Purbeck; imago caught May 29th, 1893, in the Isle of Purbeck (Bankes); imagines end of September, 1892, at Buckerell; imagines end of September, 1893, at Buckerell (Riding); June 27th-July 16th, 1894, at Painswick (Farn); October 4th, 1894, one off oak, at Pease Dean (Evans); July 11th, 1898, at Oxton, Devon (Studd); bred August 21st, September 14th, 23rd, 31st, 1898, from larvæ found at Harpford Wood (Riding); October 14th, 1898, near St. Andrews (Rothschild); November, 1898, at Enfield (Edelsten); bred August 25th and 27th, 1899, from larvæ found at Harpford Wood (Riding); imagines caught September 3rd, 1904, at Dartmouth; others bred September 7th-11th, 1904, from pupæ found September 3rd, 1904, also at Dartmouth (Bankes).

Habits.—The moth appears to hide successfully in the autumn, being rather infrequently seen, although, occasionally, it is attracted by the nectar of the ivy-blossom in October and November; after hybernation, it is also occasionally noticed with the early spring moths at sallow blossom. The over-wintering examples seem to be on the wing until June, when they lay their eggs, the egglaying being apparently spread over a considerable period. Newly-emerged examples are to be found throughout August and September, and are particularly fond of flowers, having been found feeding on those of *Scabiosa succisa*, *Stachys sylvatica*, *Senecio jacobaea*, etc. Barrett says that the moth is rather secret in its habits, hiding in dense hedges, or among thick herbage, in the daytime, but not easily disturbed, nor very often seen; he notes it as flying in a lane at Haslemere in September, 1867, and further observes that it flies at night, and will come to flowers of ragwort. Richardson says that the ♀ is to be taken regularly at Aberayron, in Cardiganshire, in the autumn, by beating furze bushes, in which, presumably, they hybernate, depositing their ova in spring or early summer; whilst Porritt notes that he kept two ♀s in confinement in a covered pot of growing *Stachys*, and various dried leaves, that they lived well into the winter, but by February both had died. Barrett has beaten it from thatch, at Haslemere, in the winter. Bankes observes (*in litt.*) that he has never taken the moth on the wing of its own accord, but he has "no doubt that its actual flight begins in the evening and lasts until after nightfall. A specimen kept in confinement for many weeks, used, in mild weather, to regale herself towards dusk, and in the early part of the night, on the ivy-bloom supplied to her, but to sit quite motionless at other times. He further notes that of the only three imagines bred of recent years, one emerged at 12.35 p.m., one at 3.10 am., and one between 9.45 p.m. and 7.30 a.m." [Mackay records it as occurring at light at Glasgow.] Schmid says that imagines in good condition are sometimes taken at Ratisbon after hybernation, but observes that they are rarely noted in nature because they conceal themselves so completely during the day, and are very sluggish and quiet.

Habitat.—In Britain, hedgesides and the outskirts of woods seem to be its most frequent habitats. In south Germany it appears to be widely distributed, and occurs in Upper Bavaria, especially in the lower mountain districts; in Silesia it occurs in the mountain valleys (Wocke), but in Saxon Upper Lusatia, it frequents heaths as well as the mountain-woods (Schütze). In the Baltic Provinces, it is noted as occurring on dry meadow-land near Lechts, and in the forest-meadow near Pichtendahl (Nolcken). In Austria it occurs in the woods of the Vienna district, and in Bohemia; whilst in Switzerland it goes up to a height of 5700ft. (at St. Moritz). Bankes writes (*in litt.*): "This species is extremely local, and generally rare, both in Dorset and South Devon, and even in the best years for it, the larvæ have only been collected very sparingly. In my experience, they only occur along hedgerows, and seem to prefer plants growing in sheltered and shady situations, but they are certainly found on various different geological formations. Having always been unable to distinguish the larvæ from those of *cosmodactyla*, Hb. (*acanthodactyla*, Tr. *nec* Hb.), the precise spots where some of my larvæ and pupæ have been collected are unknown to me, but the cases where these are known for certain show that, in each instance, the larvæ or pupæ have all been collected in some one particular spot where one has had the good fortune to chance upon a brood. This is the explanation of the fact that, from some two dozen larvæ that I collected in 1884, all but two or three of which were forwarded to Mr. Porritt as the common *acanthodactyla*, Tr. (*nec* Hb.), the whole number of resulting moths, with only four exceptions, were *punctidactyla*, Haw. But one may often closely search a district where *A. punctidactyla* occurs, and collect many hundreds of larvæ of *A. cosmodactyla*, and yet have no success, as far as the capture of *A. punctidactyla* is concerned." In Herefordshire and Kent it comes to the sallow-bloom in woods in spring, and Jordan notes it as occurring in woods at Koppang, in Scandinavia. In the western parts of America it occurs in the high mountains, and is recorded from the western United States to Alaska; in New Mexico it has been taken at the top of the Las Vegas, between the Pecos and Sapello rivers, at an elevation of 11000ft. (Cockerell); in Colorado, at Platte Cañon, at 7000ft. (Dyar). Walsingham says that he has at least fifty American specimens of this insect, taken at different times and places, ranging from San Francisco to Mount Shasta and the north of Oregon.

British localities.—Widely distributed, but generally rare or very local. Aberdeen: Braemar (Reid). Argyll: very rare, Dunoon (Chapman). Berwick: Pease Dean (Evans). Cardigan: Aberayron (Richardson). Carmarthen: Llangennech (Richardson). Cheshire: Bidston, Tranmere, Claughton (Ellis), Birkenhead (Stainton). Devon: between Sidmouth and Buckerell, Harpford Wood, Honiton, Tipton (Riding), Oxton (Studd), Lynmouth, Exeter (Leech), Dartmouth (Bankes). Dorset: [Portland (Baker),] Bloxworth, very rare (Cambridge), Isle of Purbeck, scarce (Bankes), Glanvilles Wootton, rare (Dale). Fife: near St. Andrews (Rothschild). Gloucester: near Bristol, scarce, Redland, Almondsbury (Hudd), Coxhorne (Robertson), Painswick district (Farn). Hereford: Leominster (Hutchinson), Tarrington (J. H. Wood). Kent: Strood (Tutt), Alkham, Pembury, Charlton (Stainton). Kerry: [Killarney (Birchall), probably *cosmodactyla* (Kane).] [Lanark: Glasgow (Mackay).] Lancashire (Barrett). Merioneth: Barmouth (Horton). Middlesex: Enfield (Edelsten). Perth (Barrett). Shropshire: Clee Hill district (H. Williams). Somerset (Barrett). Surrey: Mickleham, Farnham (Stainton), Haslemere, Witley (Barrett). Sussex: Lewes (Stainton), Brighton, Falmer Downs, Shoreham (Vine). Westmorland: Lake district (Stainton). Worcester (Barrett). [Yorks: Scarborough (Stainton).]

Distribution.—Apparently throughout the Palæarctic and western Nearctic regions. In north America, the western district from California to Alaska (Cockerell); throughout central Europe, northwest Russia, southeastern Scandinavia, Sicily and Dalmatia (Rebel). America: British Columbia—Kaslo (Dyar); U.S.A.—New Mexico, top of the Las Vegas Range, between the Pecos and Sapello rivers, at an elevation of 11000ft. (Cockerell); Colorado—Pine Grove, Platte Cañon, at about 7000ft. (Dyar), California—San Francisco, Oregon (Walsingham). Asia: Asia Minor, near Brussa (Mann). Austro-Hungary: Bohemia (Nickerl), Lower Austria—Vienna district—Kahlengebirge (Kollar), near Tivoli, on the Laaerberg, Bisamberg, the Prater (Mann), Tyrol—North Tyrol (Wocke), Innsbrück, Taufers Valley, Sternbach-Moos, near Uttenheim (Weiler), Bozen (Meess), Upper Carinthia—Flitsch (Zeller), Dalmatia (Mann). Denmark (Bang-Haas). France: Auvergne district—Cantal, Murat (Sand). Germany: east and west Prussia (Siebold), Pomerania—Greifswald, Zarrentin (Paul and Plötz), Mecklenburg—near Neustrelitz (Messing), Hamburg—Sachsenwald, near Reinbeck, Niendorf (Sauber), Hanover—Hanover (Reinhold), Thuringia—in the valleys (Knapp), Mühlhausen (*teste* Jordan), Silesia, confined to the mountains—near Salzbrunn, Charlottenbrunn, Pitschenberg, Schreiberhau, Grunewald-Thal near Reinerz, valleys of the Gl. Schneeberg and Altvater (Wocke), Lichtenau, Lauban (Möschler), Württemberg—Eisenbach (Steudel and Hofmann), Saxony—Saxon Upper Lusatia (Schütze), Bavaria — Regensburg, near Maria Ort — Schelmengraben, Alling, Kelheim (Schmid), near Munich, Isarauen, Schäftlarn, Tegernsee, Oberaudorf (Hartmann), at the Walchensee, in the Allgau, Immenstadt, Eisenstein (Hofmann), Baden — Thalmühle, near Engen Unterhölzer, Donaueschingen, Waldshut (Meess and Spuler), Alsace—Saverne (Peyerimhoff). ITALY: Lombardy—Milan, Brianza (Turati), Sicily—Catania (Zeller). RUSSIA: northwest and southwest Russia (Rebel), Moscow district—Prochorowo (Albrecht), Volga district—Casan, Orenburg (Eversmann), Baltic Provinces—Pehrse (Leinig), Grösen (Rosenberger), Lechts, very rare (Huene), Lips, Rotsiküll, Pichtendahl, Wänma (Nolcken). SCANDINAVIA: Lapland (Wallengren), Norway—Koppang (Jordan), Saltdalen (Sparre-Schneider), Odnaes (Strand). SWITZERLAND: Ober-Albula — Tuors Pensch, Bergün, St. Moritz, up to 5700ft. (Zeller), Winterthür, Zürich (Frey), Bremgarten (Boll), Riffelberg (Jordan), Upper Engadine—near St. Moritz (von Heyden), near Lenzburg (Wüllschlegel).

Subfamily: STENOPTILIINÆ.

Tribe: STENOPTILIIDI.

This subfamily and tribe obtain their name from Hübner's coitus *Stenoptiliae* of the family Cuspides (*Verz.*, p. 430). In this coitus, he unites our Stenoptiliids and Leioptilids, whilst, in the other coitus, *Aciptiliae*, of this family, he places the rest of our Alucitines. Zeller, in 1841 and 1847, failed to separate the Stenoptiliids from the Leioptilids and other allied groups, but Herrich-Schäffer came nearer to making the necessary division, his section i of *Pterophorus*, containing the Stenoptiliids, being described as follows:—

Genus IV: PTEROPHORUS, Zell.

1. Fasciculus frontalis conicus—*miantodactylus*, F.v.R.
2. Frons squamis appressis*, subquadrata.
    - i. Palpi squamis compressis* triangulares, alæ anteriores apice acuto, puncto ante fissuram pallidius ciliatam simplici aut gemino nigro; punctis limbi loborum amborum nonnullis.
        - A. Cilia basi alba, punctis nigris, uno (duobus in *P. loewii*) in angulo anali anterioris, duobus versus apicem interioris.
            - *a*. Lobus anterior innotatus.
                - α. Cilia costalia lobi anter. alba—*fuscus*, Retz., *loewii*, Zell., *mannii*, Zell., *stigmatodactylus*, Zell.
                - β. Cilia costalia lobi anter. alarum anter. non alba—*aridus*, Zell., *serotinus*, Zell.
            - *b*. Lobus anterior lineola longitudinali nigra.
                - α. Margo anterior innotatus—*mictodactylus*, W.V., *plagiodactylus*, F.v.R., *lutescens*, H.-Sch.
                - β. Margo anterior lineola alba ad ⅔—*coprodactylus*, Zell.
        - B. Cilia dimidio basali acute fusca—*graphodactylus*, Tr.

In 1862, under the generic name *Mimaeseoptilus*, the Stenoptiliids were treated as a separate division, which was then diagnosed by Wallengren (*Skandinaviens Fjädermott*, p. 18) as follows:—

Antennæ of the ♂ fringed with very short hairs. The frontal tuft raised into a blunt cone. Palpi longer than the head, compressed laterally, the middle joint thickened above with hairs, the last joint short, blunt, scarcely to be distinguished from the preceding. The posterior tibiæ slender, not thickened. The first pair of spines in the posterior tibiæ equal, the second pair slightly unequal. The anterior wings cleft to a third part of their length, the segments more slender, the upper one with a distinct posterior angle, the posterior lanceolate, with the posterior angle not well-defined. The segments of the posterior wings slender, the middle segment

* These words have been transposed in printing, *anteà*, p. 84.

dilated so as to be somewhat spoon-shaped, the third, or posterior, division without any black scales in its short fringe. The anterior wings not perfectly flat, their anterior margin being very slightly deflexed, their inner margin without a tooth, and, when at rest, slightly deflexed, so as to embrace the posterior wings. The veins of the anterior wings ten in number; the 1st and 2nd separate from the base, the 3rd from the posterior margin of the cell, and the 4th and 5th together from the posterior angle of the cell, all running into the posterior segment; the 6th rises from the little transverse vein near the anterior angle of the cell, and the 7th, which is two-branched, rises from the angle itself; these run into the anterior segment; the 8th and 9th arise from anterior margin of the cell, and run into the anterior margin of the wing; the 10th arises from the base of the wing, and runs along into its anterior margin. The cell is distinct, closed, with a very slender spurious transverse veinlet, moderately curved, with the convexity turning towards the base of the wing. The veins of the inferior wings are four in number, the 1st two-branched, ending in the 1st segment; the 2nd two-branched, ending, as well as the simple 3rd vein, in the 2nd segment (this 3rd vein generally joins with the 2nd at the base), and the 4th vein simple, ending in the 3rd segment. No cell.

This tribe appears to be in some respects one of the most generalised of those belonging to the Platyptiliids. To some extent, larvally, the Stenoptiliines are very near the Platyptiliines, but the alliance is much more marked pupally. The ♂ genital appendages, however, mark them off as a very special and homogeneous group, standing as well separated and defined in this particular, as they do in wing-structure, etc. Bacot notes that, on pupal characters, our three British species are very close, but, as larvæ, are much more divergent, *Stenoptilia pterodactyla*, in particular, being much further advanced in its wart development than the Adkinias. It may be here noted that larval characters appear to be remarkably modified in accordance with the feeding habits throughout the superfamily. The egg is inclined to be cylindrical in outline, somewhat full, and approaching more nearly than any others to those of the Agdistids.

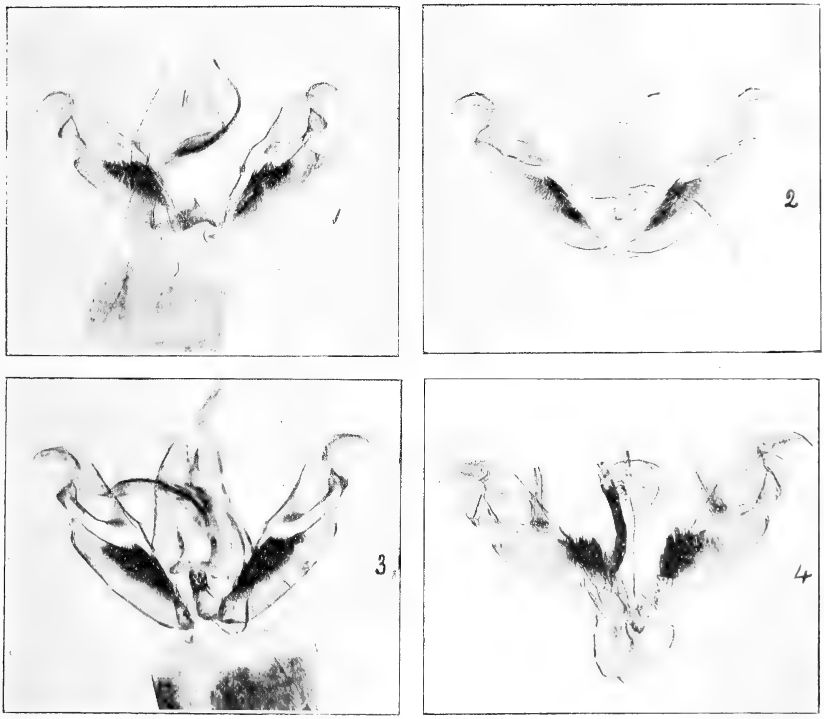
The Stenoptiliine larva is a miner in the 1st and 2nd stadia, and afterwards may hide in a burrow (not mining), but usually feeds somewhat in the open. A structural description of the larva practically covers also *Marasmarcha* and *Amblyptilia* (Chapman). In form, the larva is somewhat cylindrical, the secondary skin-hairs are present, and the tubercles comparatively generalised in position; the warts ill-developed; the hairs minute, clubbed, and baton-like as in the Agdistid larva. The tubercles, however, are much more complicated than those of the Platyptiliids (*sens. rest.*), but much less so than the highly specialised Alucitines. Both these forms, however, the more simple, single-haired, tubercles of the Platyptiliines, and the complicated warts of the Alucitines, are very possibly developments in different directions from an intermediate form of wart, resembling, probably, the warts of the Stenoptiliines. Structurally, the prothoracic plate has a central suture, and a dark-coloured hollow towards each outer extremity. The tubercles always have the primary hairs distinguishable, but are usually accompanied by secondary hairs that sometimes run them rather close. The secondary skin-hairs are generally distributed, and vary in length in different species. *Adkinia zophodactylus* and *A. bipunctidactyla* are without post-spiracular accessory tubercles, which are well-developed in *Stenoptilia pterodactyla*, and are indicated in *Marasmarcha lunaedactyla* and *Amblyptilia cosmosdactyla*. The prolegs have a similar structure in all, tall, with a tubular chitinous sheath, the crochets few, large, and dark. In *A. cosmodactyla*, the number is 4 or 5, in

M. lunaedactyla 5-6, in *S. pterodactyla* 6-8, in *A. bipuntidactyla* 6-7, and in *A. zophodactylus* not only are there 9, but they are distinctly smaller and paler, and the white colour is feebly more delicate.

The Stenopliliine pupa is rather long, slender, and generally highly tinted with pink or green shades. It differs in outline from the Agdistid pupa, in being rather more swollen in the thoracic region; the pupal skin is extremely delicate and filmy; the surface apparently very smooth, but a lens exhibits numerous fine transverse ribs on the abdominal segments. The tubercles are single-haired, the setæ retaining the baton-like character. Really, the tubercles are represented by minute knobs, very prominent as to i and ii, almost like little beads stuck on, the lower ones are eminences, only they carry minute, transparent, clubbed hairs, not on their summits, but in depressions on one side, i on the anterior, and ii on the posterior, aspect, and so on; the hairs are thus nearly parallel with the pupal surface. The relative position of i and ii varies in the different species, and must here be a specific, and not a generic, character. In *S. graphodactyla* (giant form), from Larche, the two beads are almost conjoined. In *S.* var. *pneumonanthes* (from Montreux), they are apart, about 3 of their own diameters. In *S. pterodactyla*, they are about the same, or a little closer, varying somewhat in different specimens. In *A. bipunctidactyla*, they are closer, nearly the same as in *S. graphodactyla*. In *A. zophodactylus*, they are more widely apart, perhaps 4 diameters of bead, which in this species is not much more pronounced than in the lower tubercles; yet in all the species they are on the 4th and 2nd of the small transverse ribs. All have the dorsal flange (on the prothorax to 3rd abdominal) fairly well marked; it reasserts itself also on the last three segments. The free appendages are the 2nd and 3rd legs and maxillæ, which extend as far as the end of the 5th abdominal segment, supported by a pointed wing extension to nearly the posterior margin of the 4th abdominal (Chapman).

The Stenoptiliine imago presents the usual Platyptiliid characters, *e.g.*, it has a single spina in the ♀ frenulum; the general form of the Platyptiliid forewing, although the squared-shape of both lobes, *i.e.*, exhibiting a costal and anal angle, is somewhat obsolete; nervure II of the forewing having 5 branches; the same character of the divisions of the hindwing, etc. The hindwings, however, have not the tuft of black scales on the third plumule, which is a constant character of the true Platyptiliine and Oxyptilid imagines. Of the superficial wing-markings, Hofmann gives (*Die deutsch. Pteroph.*, pp. 68 *et seq.*) the following description: "The dot on the inner margin is mostly either absent or indistinct, the discal spot, as a rule, present, though sometimes only very weakly indicated, or even quite absent. The dots at the fissure are always present, though the upper one is often very small and indistinct. They lie sometimes close to the fissure, and sometimes about 1mm. in front of it. A pale transverse line on the lobes of the forewings is sometimes fairly distinct on both segments, though usually only on the upper one, but sometimes only more or less indicated, or even quite absent. The narrower inner marginal portion of the forewing is, as a rule, paler in colour than the broader costal portion. There is sometimes a thick blackish streak in the upper segment, while, in the lower segment, there are two, one above the other. These streaks are, however, by no means constant, but vary much in distinctness and strength, often being quite absent. In addition, on the forewings, especially on the fold, in front of the fissural dots, and along the costa, are longitudinal rows of black and white scales. The outer marginal fringes usually have a whitish, or, at any rate, a pale, basal line, in which, at the anal angle of the upper segment, there lies usually one, more rarely two, black or dark brown dots. There are mostly, in this pale basal line of the lower segment, three dark dots, one at the apex, a second a little below this, and a third at the anal angle, which is, however, sometimes wanting. The fringe dots are sometimes narrow, and sharply marked, sometimes paler and more suffused, and then show a tendency to combine, which also happens in exceptional cases. In a smaller section, the species have a dark brown basal line in the outer marginal fringes of both segments, which, however, is occasionally once or twice divided by paler colour. The hindwings are always without markings. On the underside, the apices of the segments, and the first and the third feathers are more or less strongly dusted with white. The white transverse line of the upper segment sometimes shows through on the underside. The head always has the same colour as the costal portion of the forewing; the eye is margined above by a fine white line, which is continued on both sides of the frontal protuberance along the upper ridge of the palpi to their tips. The first, and sometimes also the second, joint of the palpi, has a similar narrow white line on its lower edge; the antennæ are brown, but white beneath at the base. The pro- and mesothorax have also the same coloration as the costal portion of the forewing, while the metathorax shows the coloration of the inner margin. Sometimes these different colours are divided by a narrow whitish transverse line. The first and second segments of the abdomen have the same colour as the metathorax, and are bordered laterally by two, broad, white, longitudinal streaks; the following segments of the abdomen, in general coloured as the forewings, are ornamented, especially distinctly below, with white, often interrupted, longitudinal lines, and with groups of black scales on the posterior margins. The legs have about the same coloration as the body and forewings, and are similarly marked in all the species. The middle coxæ exhibit, on the outer side, a broad, silver white band; the femora are finely edged with white on both sides beneath, the front and middle tibiæ are dark above, white beneath, the hind tibiæ similar above and below, mostly dark, the front and middle tarsi dark above, white below, with perhaps the exception of the extreme apices, the hind tarsi with the first joint dark, and the following whitish. The spurs outwardly dark, inwardly white, black at the apex. The markings of the head, thorax, abdomen, and legs, are the same in all the species." Hofmann gives (*Die deutsch. Pteroph.*, pp. 68 *et seq.*), under the name *Stenoptilia*, the following summary of the structure of the Stenoptiliids :—

Head: Crown flatly-scaled. Forehead extended in a conical flat-scaled protuberance, with the anterior margin straight, or very obtusely-angled. Antennæ of the ♂ very weakly ciliated. Palpi laterally compressed, longer than the frontal prominence, the second joint rough-scaled above, nearly triangular, the third joint very small, cylindrical, not reaching beyond apex of second joint. *Legs* slender. Hind tibiæ without especial characteristics. *Abdomen* long and slender, 2nd and 3rd segments much longer than the rest, widened posteriorly in ♀. *Forewings* cleft to one-third, the segments narrow, with very oblique margin, both with more or less distinct anal angle. Feathers of hindwing dissimilar, the first the



Prepared by T. A. Chapman.] [*Photo. A. E. Tonge.*

Ancillary appendages of Adkinia zophodactylus, A. pneumonanthes, A. coprodactylus, and Stenophila pterodactyla × 28.

Natural History of the British Lepidoptera, 1906.

[For explanation see back.]

PLATE II.

[*To be bound facing p.* 317.]

ANCILLARY APPENDAGES OF ADKINIA ZOPHODADTYLUS, A. PNEUMONANTHES, A. COPRODACTYLUS, AND STENOPTILIA PTERODACTYLA × 28.

Fig. 1.—*Adkinia zophodactylus:* Paler, more delicately chitinised than others shown. The interior rod of ædœagus partially exserted (this rarely happens in these preparations). The terminal rounded lobe with delicate membranous extension.

Fig. 2.—*Adkinia pneumonanthes:* Shows well the relative form of the tegumen when compared with fig. 1; the terminal lobe more rounded than in *A. zophodactylus*.

Fig. 3.—*Adkinia coprodactylus:* One tip of the tegumen is blemished in plate (that to right). The terminal rounded lobes showing delicate membrane extending beyond scaled portion as in fig. 1. The interior rod very obvious within the ædœagus.

Fig. 4.—*Stenoptilia pterodactyla:* Larger, stronger, sickles or cusps of clasps longer, more pointed. The terminal lobes of tegumen very rounded, with scarcely any sulcus between them.

[The black areas on the clasps are due to unremoved hairs, and the difference between photos in this respect are not due to any differences of structure, but to completeness or otherwise of this removal.]

N.B.—The ancillary appendages in all are very similar. The clasps complex, delicate, definitely different only in size, and possible slight differences in length and sharpness of terminal sickle. The ædœagus similar throughout; the slender chitinous rod within which is part of eversible membrane. The most obvious differences are in the varying completeness of the removal of scales and hairs. The uncus rises (see Plate III) from the ventral surface of the terminal rounded lobe. The uncus is characteristically different as shown in the four forms.—T. A. CHAPMAN.

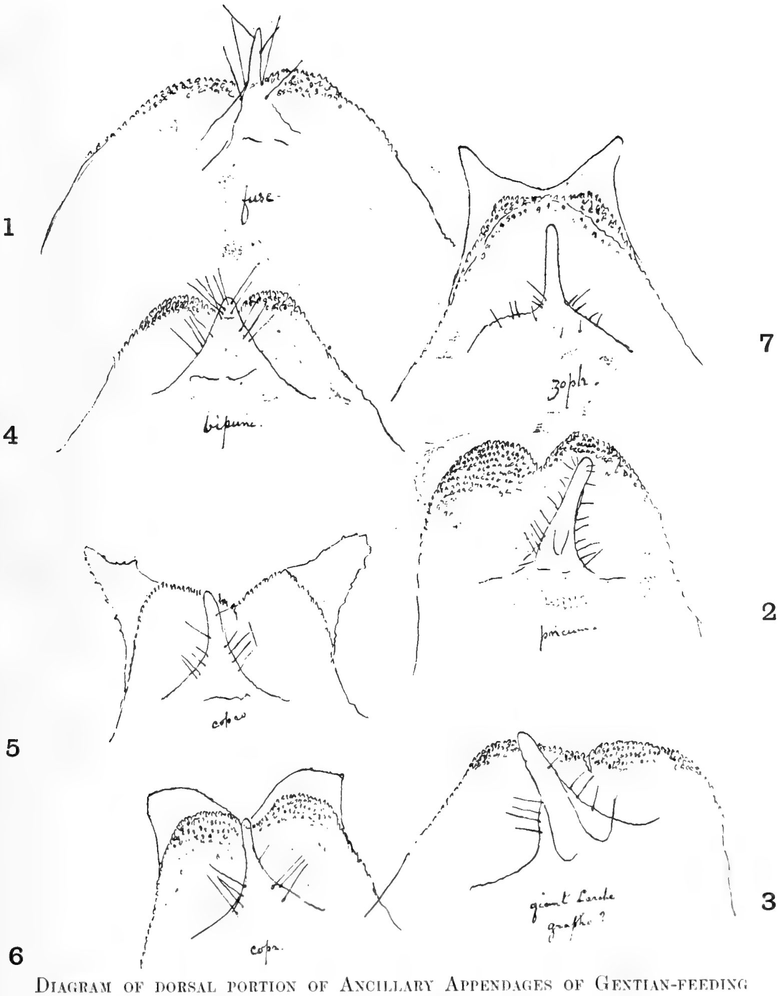


DIAGRAM OF DORSAL PORTION OF ANCILLARY APPENDAGES OF GENTIAN-FEEDING STENOPTILIAS AND OF OUR TWO OTHER BRITISH SPECIES × 80.
(From camera sketches by T. A. CHAPMAN.)

Natural History of the British Lepidoptera, 1906.

[For explanation see back.]

PLATE III.

[To be bound facing p. 317.]

DIAGRAMMATIC REPRESENTATION OF DORSAL PORTION OF ANCILLARY APPENDAGES OF THE GENTIAN-FEEDING STENOPTILIAS, AND OF THE OTHER TWO BRITISH SPECIES × 80.

Fig. 1.—Tegumen of *S. pterodactyla*, with terminal lobes full and round, short (*i.e.*, with less marked sulcus), uncus broad-based, terminal part baton-like, hairs distributed, strong.

Fig. 2.—*A. pneumonanthes*, terminal lobes full and round, with well marked sulcus. The uncus thicker, more robust, tapering regularly, the basal half with complicated folds, clothed with short sensory hairs almost throughout.

Fig. 3.—*A. grandis*, n. sp., terminal lobes full and round, with well marked sulcus. The uncus as in *pneumonanthes*.

Fig. 4.—*A. bipunctidactyla*, with terminal lobes narrower and shorter, uncus broad-based and triangular.

Figs. 5-6.—*A. coprodactylus*, showing variable, rounded, irregular membrane extending beyond scaled portion; uncus broad-based, terminal part baton-like; hairs grouped at base.

Fig. 7.—*A. zophodactylus*, delicate structure, showing triangular, pointed membrane extending beyond scaled portion; uncus with flattened base, the process smooth, slender and baton-like, hairs on base.

N.B.—Except the median process and the clear extensions in *A. zophodactylus* and *A. coprodactylus*, the whole area is scale-covered; this scaling is only diagrammatically indicated in the figures.—T. A. CHAPMAN.

broadest, with very oblique margin and indicated anal angle; the second narrower, with elongated apex; the third linear, without dark scales on inner margin. *Neuration:* Perfect, and shows no essential difference from that of the genera, *Eucnemidophorus*, *Platyptilia*, and *Amblyptilia*. *Genital organs:* The male organs of copulation differ from those hitherto noticed, chiefly because there is no uncus attached to the 9th dorsal plate, which is deeply emarginated, but only a fine thin pencil-like projection protrudes from the posterior margin (10th dorsal segment ?). The claspers are deeply hollowed, boat-shaped, and terminate posteriorly in two somewhat triangular-pointed delicate lobes, and a strong downwardly-curved bristly hook, which springs from a broad base on the upper margin, and extends far beyond the two lobes. At the origin of the hook stands a thick pencil of stiff bristles, situated on a chitinous plate projecting towards the inner hollow of the clasper. The outer side of the clasper is also thickly beset with bristles. The 9th ventral plate is very small, oval, or bluntly triangular. The arcuate downwardly-curved penis is very long, and has, close to the base, a long prominence directed downwards (tab. iii., fig. 6). In the different species examined I found only unessential differences, for example, in the greater or less arching of the 9th dorsal plate, in the form of the terminal lobes of the claspers, etc.

Hofmann says (*Die deutsch. Pterophorinen*, p. 72): "The species of the genus *Stenoptilia* are very near to one another, and are, at the same time, in coloration, and in certain elemental markings, very variable, so that the determination is often very difficult. At the most, only the position of the dark dots before the cleft appears to be constant. By this character the species may be divided into two groups:—

I. The dots on the cleft, or at least one of them, the lower, are placed immediately on the cleft.
    A. The dots of the cleft are large, one directly above the other, in very close vicinity, often united or blended into a thick transverse streak.
        1. A thick black longitudinal streak in the upper lobe more or less surrounded by white scales, especially on the hind and upper margins ... ... *pelidnodactyla*, Stein.
        2. A black longitudinal streak in the upper lobe only very slender, or only indicated by black scales; a very oblique white transverse line of the upper lobe runs into the costal fringe (or is, together with the longitudinal streak, entirely wanting) ... *serotina*, Zell. (and var. *plagiodactyla*, Zell.) (non St.).
    B. The dots of the cleft small, the upper somewhat distant from the lower, and removed further in towards the base, or quite absent. The costal fringes of the upper lobe white.
        1. With one black dot in the fringes of the anal angle of the upper lobe ... ... *stigmatodactyla*, Zell.
        2. With two black dots in the same ... *zophodactylus*, Dup.

II. The dots of the cleft are separated by a small, often brightly coloured, interval (about 1mm.) from the cleft.
    1. The costal fringes of the upper lobe white. Forewings lighter, or darker, cinnamon-brown...*fusca*, Zell. (and var. *paludicola*, Wallgrn.).
    2. The costal fringes of the upper lobe at most, for a short distance, just beyond the cleft, and at the apex white, otherwise dark.
        a. The outer marginal fringes of the upper and lower lobes white, only towards the anal angle brown, with a connected black brown basal line.
            α. The space between the dots of the cleft and the cleft bright brownish-yellow, often dusted with white; at the commencement of the upper lobe a bleached yellow undefined spot ... ... *graphodactyla*, Tr.
            β. Without the characteristics given for *α*, on the contrary, with very distinctly expressed oblique white line on the upper lobe, which is mostly continued as two small white spotlets on the lower lobe, var. *pneumonanthes*, Schleich.
        b. The outer marginal fringes of the upper and lower lobes brownish, with a white basal line, in which one black dot lies at the

anal angle of the upper lobe, while three (sometimes only two) lie on the lower lobe ... *coprodactylus,** Zell.

The resting-habit of the Stenoptiliids is somewhat different from the species of any other group; they usually hang loosely from a grass culm or plant stem, among the herbage that is generally to be found in their haunts, the wings not stretched out at full length, as in the Platyptiliines, but drawn partly back, so that they are at an angle of about 45° with the body, and at about a right angle with each other. They are held horizontally, the hindwings beneath the forewings, the inner margin of the latter bent under so as to hide the former.

Genus: Adkinia, Tutt.

Synonymy.—Genus: **Adkinia,** Tutt, "Ent. Rec.," xvii., p. 97 (1905). **Phalaena,** Scop., "Ent. Carn.," p. 257 (1762). **Alucita,** Vill., "Linn. Ent. Fn. Suec.," ii., p. 535 (1789); Hb., "Schmett. Eur.," Aluc., pl. i., fig. 3 (*ante* 1811); Haw., "Lep. Brit.," p. 476 (1811); Treits., "Die Schmett.," ix., p. 240 (1833). **Pterophorus,** Sam., "Ent. Usef. Comp.," p. 409 (1819); Curt., "Brit. Ent.," fo. 161 (1827); Dup., "Hist. Nat.," xi., pp. 661, 668 (1838); Wood, "Ind. End.," p. 235, pl. li., fig. 1629 (1829); Zell., "Isis," p. 837 (1841); Dup., "Cat. Méth.," p. 382 (1844); Zell., "Isis," pp. 38, 904 (1847); "Linn. Ent.," vi., pp. 361, 364 (1852); H.-Sch., "Sys. Bearb.," v., pp. 375, 376 (1855); Frey, "Die Tin.," etc., p. 411 (1856); Sta., "Man.," p. 442 (1859); Schmid, "Berl. Ent. Zeits.," viii., p. 65 (1864); Gregs., "Ent.," iii., p. 186 (1866); Nolck., "Lep. Fn. Estl.," p. 807 (1871); Porritt, "Ent. Mo. Mag.," xxi., p. 208 (1885); "Buckler's Larvæ," etc., pp. 358, 359, pl. 163, fig. 9 (1901). **Stenoptilia,** Hb., "Verz.," p. 430 (1825); Stphs., "Illus.," p. 372 (1834); Meyr., "Trans. Ent. Soc. Lond.," p. 487 (1890); Hofm., "Deutsch. Pteroph.," pp. 75, 81 (1895); Meyr., "Handbk.," etc., pp. 440, 441 (1895); Staud. and Reb., "Cat.," 3rd ed., p. 76 (1901). **Mimaeseoptilus,** Wallgrn., "Skand. Fjäder.," p. 18 (1859); Jord., "Ent. Mo. Mag.," vi., p. 123 (1859); Staud., "Cat.," 2nd ed., p. 343 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, pp. 794, 795 (1877); Frey, "Lep. Schweiz," p. 430 (1880); Barr., "Ent. Mo. Mag.," p. 178 (1882); Gregs., "Ent.," xviii., p. 150 (1885); South, "Ent.," xviii., pp. 98, 274-275 (1885); Sorh., "Kleinsch. Brandbg.," p. 5 (1886); Tutt, "Young Nat.," x., pp. 164, 165 (1889); South, "Ent.," xxii., p. 34 (1889); "Brit. Nat.," ii., 61, 107, 111, 159 (1892); "Pter. Brit.," pp. 85, 93 (1895); Barr., "Lep. Br. Isles," ix., pl. 415, fig. 5*b* (1904).

The genus was constituted (*Ent. Record*, xvii., p. 37) in order to separate *bipunctidactyla*, and other allied species, from *Stenoptilia*, as represented by *pterodactyla* (*fuscus*). As has already been shown (*anteà*, p. 317), Hofmann separated (*Die deutsch. Pteroph.*, p. 72) the two groups on imaginal grounds, and they form sect. I and sect. II respectively, of his genus *Stenoptilia*. But there are also distinct larval characters, of which the much weaker (almost absent) development of the lower accessory postspiracular tubercle, the less wart-like growth of the primary and subprimary tubercles, the weaker development of the skin-spicules, etc., in *Adkinia*, when compared with

* In exceptional cases in *S.* var. *pneumonanthes*, the dark basal line of the outer marginal fringes of the upper and lower lobes is more than once, mostly twice, intersected with pale, or, especially in wasted specimens, is here and there much bleached, while in *S. coprodactyla*, in equally exceptional cases, the dark dots of the outer marginal fringes of the lower lobe unite into a more or less distinct line. In such cases, besides the other characteristics mentioned more particularly in the description, the arrangement of the outer marginal fringes of the upper lobe is the chief distinguishing character; in the white basal line in *S. coprodactyla* there is to be found, at the anal angle, only one black dot, and very rarely, also, a second above it, while in *S. graphodactyla* and var. *pneumonanthes*, a distinct brown basal line, even if interrupted here and there with paler, is always recognisable Hofmann .

Stenoptilia, may be mentioned. These details (for which we are indebted to Chapman and Bacot) may be summarised as follows :—

Ovum.—The ovum of *Stenoptilia* (as illustrated by *pterodactyla*) is much more Agdistid-like than that of *Adkinia* (as illustrated by *bipunctidactyla*), the longitudinal ribs are more marked in *Adkinia*. Larva.—In the larva of *Stenoptilia* (*pterodactyla*), the posterior accessory dorsal warts on thoracic segments are represented by strong hairs; these tubercles are almost entirely, or totally, absent in *Adkinia* (*zophodactylus* and *bipuntidactyla*). In *Stenoptilia*, the accessory tubercles = iiia and iiib (Dyar) are developed, the upper strongly; in *Adkinia*, they are practically undeveloped (in *A. zophodactylus* no trace). In *Stenoptilia*, the warts representing primary tubercles are well-developed, with primary and numerous secondary setæ, on fairly well-developed raised skin areas; in *Adkinia*, these warts are only incipient, with primary hair, and no, or very few, ill-developed, secondary hairs. Pupa.—The pupal structures are practically identical. Imago.—The spotting of the forewings is at the fissure in *Adkinia*, some distance therefrom in *Stenoptilia*.

We are not at all certain that *bipunctidactyla* and *zophodactylus* are not themselves characteristic of separate little natural groups, but our ignorance of the early stages of the allied Palæarctic species forbids us going into further subdivision, and inclines us to leave, provisionally, *zophodactylus* in the same genus as *bipunctidactyla*. As to the larval differences exhibited by *Adkinia bipunctidactyla* and *A. zophodactylus*, Bacot observes that the latter has far fewer secondary hairs than the former, whilst in this the incipient wart development is also less distinctly marked. He suspects that the internal-feeding habit, maintained in the 2nd brood of *A. zophodactylus*, has kept the development of hairs, warts, &c., usually connected with an external-feeding habit, markedly in check, the greater development of hairs being useless in internal-feeding larvæ.

Adkinia zophodactylus, Duponchel.

Synonymy.—Species: **Zophodactylus,** Dup., "Hist. Nat.," xi., p. 668, pl. 314, fig. 4 (1838); "Cat. Méth.," p. 382 (1844); Gregs., "Ent.," iv., p. 350 (1869); Staud. and Wocke, "Cat.," 2nd ed., p. 343 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 795 (1877); Frey, "Lep. der Schweiz," p. 430 (1880); Barrt., "Ent. Mo. Mag.," xviii., p. 180 (1882); Porr., "Ent. Mo. Mag.," xx., p. 228 (1884); South, "Ent.," xxii., p. 35 (1889); Tutt, "Ent.," xxii., p. 104 (1889); "Young Nat.," x., p. 165 (1889); "Brit. Nat.," ii., pp. 111, 157 (1892); "Pter. Brit.," p. 93 (1895); Barr., "Lep. Brit. Isl.," ix., p. 377, pl. 416, fig. 1*a* (1904). **Loewii,** Zell., "Isis," pp. 38, 904 (1847); "Linn. Ent.," vi., p. 364 (1852); H.-Sch., "Sys. Bearb.," v., p. 375 (1855); Sta., "Ent. Ann.," p. 98 (1858); "Man.," ii., p. 442 (1859); "Ent. Ann.," p. 143 (1860); Schmid, "Berl. Ent. Zeits.," viii., p. 65 (1864); Jord., "Ent. Mo. Mag.," vi., p. 123 (1869); Porritt, "Buckler's Larvæ," etc., ix., p. 358 (1901); Staud. and Reb., "Cat.," 3rd ed., p. 76 (1901). **Zophodactyla,** Meyr., "Trans. Ent. Soc. Lond.," p. 487 (1890); "Handbook," etc., p. 440 (1895); Hofmn., "Deutsch. Pteroph.," p. 81 (1895); Lamb., "Rev. Mens. Soc. Ent. Nam.," 1904, pp. 50 *et seq.* (1904).

Original description. — Pterophore zophodactyle [*Pterophorus zophodactylus*, mihi (pl. 314, fig. 4).] Envergure 9 lignes. Les quatre ailes sont entièrement d'un brun-noirâtre obscur des deux côtés, avec un point noirâtre oblong à l'origine de la fente qui divise les premières ailes en deux parties. Cette fente est assez large, et s'étend jusqu'au tiers de la longueur desdites ailes. Des trois divisions dont se composent les secondes ailes, les deux premières sont spatuliformes et la troisième linéaire. La frange des premières ailes est blanchâtre, et celle des secondes brunâtre. La tête, les antennes et le corps sont de la couleur des ailes, ainsi que les pattes, à l'exception des tarses, qui sont blanchâtres. Pyrénées-orientales (M. Méret) (Duponchel, *Hist. Nat.*, xi., p. 668).

Imago.—18mm.-20mm. in expanse. Forewings dark grey or whitish-grey with a slight violet tinge in fresh examples, the costal half somewhat darker; the median and apical areas paler; the inner marginal area sometimes tinged with brownish; speckled with white scales between the nervures, also a few scattered black scales; the basal half of costa sometimes faintly dotted with white, the outer half of costa with a strongly developed white edging, especially distinct towards apex; a faint brownish dot near centre of disc (sometimes absent), another near the lower extremity of fissure, inconspicuous, scarcely darker than ground colour; two, tiny, black, outer-marginal, dots towards anal angle of upper lobe, and two on outer margin of lower lobe towards apex; fringes dark grey, whitish in cleft. Hindwings dark, glossy, golden-brown in tint; fringes just a little paler than the ground colour of the wings, very glossy towards apex of plumules.

Sexual dimorphism.—The ♀ noticeably larger than the ♂, of a deeper tone in all its parts, but above all in hindwings, which are nearly black (Lambillion).

Variation.—In the more typical British form there is considerable minor variation, especially in the amount of black and white scaling on the forewings, the depth of the ground colour along the costa, and the presence of brown shading along the inner margin, particularly towards the base. In some, the black and white scales, running along and between the nervures, give a distinct suggestion of delicate longitudinal striation, and, in the palest examples, the white scaling is continued from the base, through the middle of the wing to the apex, the latter sometimes being particularly white. There is also considerable variation in the depth of the tint of, and size of, the discal and fissural spots, as well as the shade above the latter, all these markings being in some quite distinct, in others practically obsolete; the presence or absence of a tiny, dark, longitudinal mark in the upper lobe of forewings reminds one also of the similar mark in *A. bipunctidactyla*, whilst the black dots on the outer margin of the same lobe towards the base, occasionally have the normal two, extended into a series of three or four, the extra ones very faint, whilst those on the outer margin, towards the apex of the lower lobe, also vary much in distinctness. Compared with a long series from Canterbury, of distinctly purplish hue, with a tendency to brownish on the inner margin, the examples from Cuxton are particularly whitish, so much so that the forewings could be described as whitish, with the costal area narrowly fuscous-tinted, the discal and fissural spots faintly fuscous, the front lobe of forewings also faintly fuscous, with a white oblique line crossing it at some little distance from the outer margin; the characteristic sprinkling of darker scales almost entirely absent; the fringes pale grey, inclined to whitish basally; the hindwings pale brownish in tint, with grey fringes = var. *pallida*, n. var. We should be inclined to call the dark Duponchelian type rare in Britain. We have an example, bred by Whittle from Shoeburyness larvæ, in which the inner-marginal half of the forewing is particularly brown, and the costa and the lobes of the forewings particularly blackish, with very little white scaling in the median area, and practically none in the lobes, where, however, there is a distinct sprinkling of black scales, only the extreme apex of the front lobe being somewhat paler. Another example from there is strongly marked with scattered white scales, throughout the median and lobal areas, the inner margin somewhat browned. The race has a more robust appearance than the Canterbury examples, which are also somewhat browned on the inner margin, as well as the paler Cuxton specimens. Barrett says that the species is hardly variable, except that often the markings are hardly visible; but in the most strongly marked specimens two black dots are sometimes visible in the cilia of the anterior lobes of the forewings. Bankes writes (*in litt.*): "Somewhat variable, the brown colour of the forewing ranging from light brown to deep fuscous, with the whitish scaling in excess in the former, and rather deficient in the latter, case; the tone of the hind-varies with that of the forewing, and there is every intermediate form between the two extremes. In my lengthy series, both the palest and the darkest specimens hail from the same spot in Purbeck, though some Essex examples are hardly less pale than the former. As regards size, the largest individual therein expands 19·5mm., while the smallest measures only 16·5mm." In the Frey collection, the specimens from Frankfurt are strongly sprinkled with white scales; the two dots at the end of the fissure are developed into well-marked streaks, whilst the discal dot is also in the form of a streak; the inner margin is very little tinged with brown. The Zürich specimens in the same collection are rather large, also much sprinkled with white scales, but the dots all ill-developed and the inner marginal area not tinted with brown. The Regensburg specimen is particularly noticeable for the development of the transverse line in the upper lobe of the forewing. Two Kelheim specimens, bred from gentian, are very like some British examples, in which the upper of the fissural dots is modified into a shade stretching towards the costa. The different forms group themselves as follows:—

1. Whitish; the costal area greyish, with ill-developed fissural and discal dots = ab. *pallida-obsoleta*, n. ab.

1*a*. As in 1, but with well-developed fissural and discal dots – ab. *pallida*, n. ab.

2. Slaty-grey, sprinkled thinly with white scales medially; with ill-developed fissural and discal spots = ab. *ardoisea-obsoleta*, n. ab.

2*a*. As in 2, but with well-developed fissural and discal dots = ab. *ardoisea*, n. ab.

2*b*. As in 2 or 2*a*, but with the inner margin brownish = ab. *ardoisea-fusca*, n. ab.

2*c*. As in 2*a* or 2*b*, but with the median area strongly sprinkled with white scales medially from base to apex = ab. *ardoisea-variegata*, n. ab.

3. Dark slaty-grey, sprinkled thinly with white scales medially; with ill-developed fissural and discal spots = ab. *obscura-obsoleta*, n. ab.

3*a*. As in 3, but with well-developed fissural and discal dots = ab. *obscura*, n. ab.

3*b*. As in 3 or 3*a*, but with the inner margin brownish = ab. *obscura-fusca* n. ab.

3*c*. As in 3*a* or 3*b*, but with the median area strongly sprinkled with white scales medially from base to apex = ab. *obscura-variegata*, n. ab.

4. Costal area blackish-grey; inner margin brown; with well-developed fissural and discal spots = *zophodactylus**, Dup.

The reference of *hodgkinsoni*, Gregs., to this species, as a variety, by Barrett (*Ent. Mo. Mag.*, xviii., p. 180) and ourselves (*Pter. Brit.*, p. 95), proves to be quite erroneous; Bankes says (*in litt.*) that the

* Duponchel's description, "entirely dark brown-blackish," etc., is very poor; his published figure little better. Our diagnosis here is taken from both.

examples in Hodgkinson's collection under this name, and captured by him, are simply worn *A. bipunctidactyla*.

Comparison of Adkinia zophodactylus and A. bipunctidactyla.—The former is nearly allied to *bipunctidactyla* and *plagiodactyla*, but recognised at a glance by the costal cilia from the middle of the wing to the apex being white. The ground colour of the anterior wings is more of a slaty-grey tint than in *bipunctidactyla*, only the inner margin having a brownish tinge (Stainton). Hofmann says (*Die Deutsch. Pteroph.*, p. 81) that, "at the anal angle of the front lobe of the forewing, there are two distinct black dots, one above the other, by which *A. zophodactylus* may easily be separated from all the allied species, whilst at the apex of the hind lobe the two typical dots are to be found." Although the white edging along the outer half of the costa is usually a clear indication of *A. zophodactylus*, yet we have British specimens that do not clearly show this character; but, in such doubtful specimens, the presence of the two tiny black dots at the anal angle of the upper lobe of the forewing appears to be an unfailing indication. It is also markedly characteristic that the white scales in *A. zophodactylus*, are much more irregularly and generally sprinkled than in *A. bipunctidactyla;* whilst the tendency of the discal and fissural dots to form weak lineolæ of a grey-brown rather than a black tint, and for the upper of the fissural dots in addition, to fade off into a weak shade towards the costa are sufficiently striking on close examination of *A. zophodactylus;* the apex of the upper lobe appears also to be usually rather more hooked in *A. zophodactylus* than in *A. bipunctidactyla*.

Egglaying.—Eggs were laid during the last ten days of July, 1904, on the green seed-vessels just below the flowers of *Erythraea centaurium* (Bankes); eggs laid on the bases of the flowers in some numbers, sometimes on one another (Bacot). Some eggs were laid on, or about, July 25th, 1904, by a captured ♀, also others on, or about, the same date by a bred ♀. Although this bred ♀ laid fertile ova, and must, therefore, have paired with a bred ♂, and the other, captured in the pink of condition, may perhaps have paired in confinement, the moths were never observed *in cop.*, although they were looked at, daily, at frequent intervals between 7 a.m. and 11 p.m. They probably paired late at night, but cannot have remained together for many hours (Bankes).

Ovum.—When first laid, greenish-white (Bankes); of a transparent pale yellow colour, when far advanced in development the larval embryo faintly seen within the eggshell, the ocelli showing up as a dark spot on the head. The surface is smooth and glistening; there is some wide and rather coarse, but poorly marked, surface sculpturing, and this appears to be very similar to that on the egg of *A. bipunctidactyla*—longitudinal corrugations on the sides, and irregular cell-pattern on the shoulders and micropylar end. The egg is roughly oval with flattened sides, but is somewhat irregular in shape. The nadir is narrower and more rounded than the micropylar end, and appears somewhat pointed in contrast with it, the tapering to base occurring on both sides and edges. Length ·4mm. (two eggs) to ·36mm. (one egg); width ·23mm.; thickness ·18mm.-·2mm. (Bacot, July 28th, 1904).

Habits of larva.—Practically nothing is known of the early life of the larva of this species in the spring, although we have a note stating that, until the second moult, the young larvæ mine the leaves of the food-plant (W. H. B. Fletcher). In the earliest days of July, when the flower-buds of *Erythraea centaurium* are commencing to unfold, the larvæ are to be found, and continue from this time onwards, almost without break, until the end of September. Bankes says (*in litt.*) that, when quite young, the larvæ are most difficult to find, living concealed, at this time, inside the very small flower-buds, and feeding on the internal parts of the bud, and of the young seed-vessel below it; they move readily from one flower-bud to another, entering the fresh one by means of an inconspicuous hole bored through its side. The affected bud generally shows some yellowish discoloration at the tip. The larvæ of medium size feed inside the pink (*i.e.*, the larger) flower-buds, their entrance holes being more noticeable than before, but, when too large to dwell comfortably therein any longer, they live externally, feeding either upon the flowers, or upon the unripe seeds, which are reached by boring holes through the sides of the seed-vessels. These, upon which the larvæ are fond of resting, have, by this time, together with the stalks and leaves, already turned rather yellow. This is the case, where he finds the larva, even in the beginning of July; the larvæ, whose colour admirably matches theirs, being thereby rendered very inconspicuous upon them. Bacot says (*in litt.*) that the newly-hatched larva of the second brood eats a minute hole through the thin, papery, outer covering of the seed-capsule, and may eat a little beneath this before progressing further, but, in most cases, it bores directly into the seed-capsule, leaving so slight a sign of its entrance, that very careful search is needed to discover it. It does not appear to attack the seeds at first; at any rate, the youngest found was engaged in mining vertically up the suture, or seam, that divides the central partition of the seed-case, but it evidently starts on the seeds before the first moult. By the end of July, and in early August, 1904, young larvæ were already well advanced, and, by August 8th, the seed-heads of centaury, on which eggs had been laid in mid-July, contained larvæ, some in their 1st, others in their 2nd, instar, and yet others more than half-grown (probably in their 4th instar), whilst the seed-pods showed no signs of feeding larvæ unless held against a strong light. At this date well-grown larvæ were found on *Erythraea* heads, collected July 30th, at Broxbourne, ten larvæ being then detected as the result of careful examination. [On the same date, Whittle writes that he had two larvæ spun up for pupation on the heads of the foodplant, picked three days previously, and that he had failed to find larvæ earlier.] From this time the larvæ fed up at a great pace; several of the larvæ emerged from the seed-heads when from 5mm. to 7mm. in length, and fed exposed, spinning a slight silken web, that drew together several florets round themselves, for the purpose of moulting. They appear to rest among the buds, or on the stem directly beneath. The larva is particularly quiet under examination, and, if not about to moult, rests with its head partly retracted and turned downwards, so that it is difficult to observe, and in this position bears a strong general resemblance to the larva of *Adactylus bennetii*. The largest of these larvæ began to spin up for pupation on August 12th and the following days, and the first pupated apparently on the 17th; by the 20th many had spun up, and the first moth appeared on August 27th, the last about September 20th (Bacot).

Lambillion notes (*Rev. Mens. Soc. Ent. Namur*, 1904, pp. 50-51) that the larva rests lengthwise on the branches of the foodplant, its head raised. It appears sluggish, its movements are very slow, and, at the least touch, it falls to the ground; when it wishes to feed, it crawls into the angles of the floral stems, attacks a capsule, generally from below, eating with rapidity; sometimes, after its meal, it rests near the attacked capsule, but more often goes back to the stem. He says that its colour, size, and form make it astonishingly like the stems and flowers of the foodplant, and it wants a keen eye to discover it; so difficult is this, that, after having carefully examined the stems of a bunch of flowers with a lens, and failed to find larvæ, they may be found some days afterwards, when almost adult. One suspects, however, that this is due less to the protective resemblance exhibited than to the fact that, by this time, they have left the inside of the capsules, and have become external in their habits. Schmid observes (*Berl. Ent. Zeits.*, viii., p. 65) that the larva lives from the end of July till September, commonly, in many places, on *Erythraea centaurium*, usually in the green seed-capsules, which it empties; the light-brown frass that is thrown out revealing the presence of the larva. He says that it is possible, by selecting the affected plants, for one to collect comparatively few plants, and obtain daily a number of larvæ which are about to leave the capsules for pupation, and that, even after the earliest imagines have emerged, and pupæ of various ages are obtainable, larvæ still continue to come out of the capsules. This was probably the origin of Kaltenbach's note, that the larvæ feed in the green seed-capsules, eating the contents, and keeping well concealed, but protruding yellowish-brown frass. Schmid, however, in 1887, records (*Lep. Faun. Regensb.*, p. 202) that he discovered the larvæ feeding, not only on the flowers and green capsules of *Erythraea centaurium*, but that he found many more later, on *Gentiana germanica*. Rössler also notes it as feeding, in Nassau, on the flowers and seeds of *Erythraea centaurium*, and refers to Schmid having also bred it from the green capsules of *Gentiana germanica*. Sorhagen records that, in Brandenburg, it feeds in the seed-capsules of *Erythraea littoralis* as well as *E. centaurium*. Steudel and Hofmann observe that, in Württemberg, the larvæ live very much concealed, eating out the green capsules of *E. centaurium* till they are quite empty, the ejected excrement betraying their presence. Hofmann notes (*Die Deutsch. Pteroph.*, p. 82) that "the larvæ live in July and in September, in the blossoms of *Erythraea centaurium* and *Gentiana germanica*." The time, at which larvæ may be found, appears to depend on the season, and, in different seasons, may extend from late June until the end of September or beginning of October. Until the flowering shoots of *Erythraea centaurium* are well formed, and the larvæ of the early brood fairly well-grown, nothing whatever is known of the habits of the larva, except the statement of Fletcher, already noted, that, until the second moult, the young larvæ mine the leaves of the foodplant. The variation in the length of larval life is considerable, and hence the two recognised broods overlap, whilst the possibility of a partial third brood is not at all remote. Jeffrey notes (*Ent. Mo. Mag.*, ii., p. 165) that, near Saffron Walden, towards the end of August, 1865, he found larvæ feeding on seeds of *Erythraea centaurium*, growing in a wood; these, however, were late examples, as imagines were already on the wing.

Gregson says the larvæ are to be found in July, August, and September, the time of their being full-fed varying much in different seasons. As to the variation of the dates of finding larvæ we note: Larvæ taken August, 1859, in the capsules of *Chlora perfoliata*, pupated September 2nd, etc., imagines appeared a few days later (Henslow); August 8th, 1868, at Wallasey (Ragonot); fullgrown larvæ and pupæ mid-August, 1883, at Cattistock (Parmiter); August 11th, 1884, in the Isle of Purbeck, imagines bred September 2nd-14th (Bankes); two larvæ September 2nd, 1887, at Ventnor (South); larvæ August 1st, 1892, in Tilgate Forest, also in July, 1893, over a hundred larvæ being found in a bag of foodplant obtained in Addington Park (Sheldon); fullfed larvæ preparing for pupation, noticed among collected foodplant on July 27th, 1901, the *Erythraea* collected at Shoeburyness a few days earlier (Whittle); larvæ of various sizes obtained in the Isle of Purbeck, July 4th-5th, 1904, pupated in a few days, and imagines appeared from July 17th-25th; these (and captured ♀ at same time) laid eggs, larvæ from which were fullfed and pupated August 17th onwards, imagines appeared August 27th-September 20th (Bankes). In Hesse, at Mombach, larvæ were taken in July (Rössler); in Brandenburg they are to be found from the end of July to September (Sorhagen); in Bavaria, larvæ occur in August (Schmid), and, in Württemberg, in July and again in September (Steudel and Hofmann). An account of the habits of this species is given by de Vries, in Sepp's *Ned. Ins.*, vi., p. 177, pl. xlv., figs. 1-8.

Larva.—*First instar:* Very small larva, about to moult for the first time; skin pale, whitish, glistening, no spicules; segments with well-marked incisions, but subsegments poorly marked; the body tapering somewhat posteriorly; the prothorax rather long; the head small, polished, smoky-black in tint; scutellum and anal plates paler. Under $\frac{1}{4}$ in. objective, the hairs appear short, bristle-like, pale in colour, without thorns, slightly knobbed at apex; although no spicules are present, a granular spotting appears beneath the skin, probably the spicules of the next instar showing through. Spiracles raised, black-rimmed, not very tall, but showing up conspicuously. The tubercles form small chitinous plates, with raised buttons as hair-bases; on the meso- and metathorax, i and ii are on the same basal plate, as also are iii and iv; in these pairs of hairs the inner i and upper iv are much the smaller; v bears a single long hair. On the abdominal segments, the setæ of i and ii are set trapezoidally, i, the smaller, being some distance in front of, and inner to, ii; iii is close above the spiracle, iv and v on the same plate beneath spiracle, v being the smaller, and upper, hair. The hairs on the head are small and pointed, not knobbed, but there are two large ones towards the crown that are slightly knobbed. The faintly marked subsegments appear to be two on the thoracic, and three on the abdominal, segments (August 6th, 1904). *Second instar:* There is now a well-developed coat of coarse black spicules. *Penultimate instar* (ready to moult): 7mm.-9mm. in length. A rather slender, cylindrical, larva, with the usual long prolegs, and, when at rest, its body well above the resting-surface. The body tapers gradually, and markedly, backwards from the 2nd abdominal segment. The segments are well-marked, with fairly deep incisions, especially ventrally, but the segments are not noticeably swollen dorsally or laterally; the spiracles are placed well up on the sides at about, or rather above, the middle. The head is small, rounded, polished, pale brown in colour, slightly mottled with darker on the cheeks; it bears a few scattered, and rather weak, tapering, hairs; the ocelli situated on a dark patch. The prothorax is small, and the first pair of legs appears somewhat weak in comparison with the others; the scutellar plate is not conspicuously coloured, but carries some black spotting on its posterior dorsal half, bordering the median line; it has also a noticeable feature in the two depressed dark-coloured spots, situated about midway between the mediodorsal line and the spiracles. The spiracles are not highly raised, but form a somewhat conspicuous feature, as they are rimmed with black. The skin is wrinkled, but the subsegmentation is only poorly marked; there are three subsegments on the meso- and metathorax, and four on the abdominal segments, but only one of these is strongly marked dorsally, and this is the one that is normally present between tubercles i and ii. The skin bears a thickly-set coat of rather coarse skin-points, or short, stout, spicules, but, as these are not distinctively coloured, they are not conspicuous. There is some variation as regards coloration among the larvæ, possibly due to age, the larger ones being of a more vivid green. They have a dark mediodorsal line, the dorsal area on either side being pale olive-brown; there is a dark subdorsal line, not, however, so heavy as the mediodorsal, and this is bordered faintly above, and more strongly beneath, with dull white; the sublateral and ventral areas are paler and brighter green. In the older (better-grown), larvæ, the back is pale and brighter green, the dorsal stripe is paler and more transparent-looking, whilst the upper white border to the subdorsal stripe is much stronger, but, below, becomes a narrower and irregular broken line; there is also a narrow, white, lateral line, which I cannot trace in the younger larvæ. When the larva is feeding, and in positions of stress, the muscular band beneath the spiracles is rendered conspicuous, suggesting a lateral flange, which disappears when at rest. The tubercles are small, low, skin-elevations, hardly warts (and can only be so termed in a very loose sense); they are, however, distinctly removed from the single-haired primitive stage, the allowance being one additional hair for i, ii, and iii, but not for iv and v. There may also be another very small dark-coloured bristle-like hair associated with i and ii, but not with iii. In addition to these, there are a few scattered skin-surface hairs, and these are dark-coloured, and very short and bristle-like, with knobbed tips, the greater number arranged in proximity to the mediodorsal line. The primary hairs are stout, tapering, curved, and slightly knobbed at the tips, and minutely thorned or serrated. On the meso- and metathorax, i and ii are conjoined at the base, the lower group, iii and iv, being two hairs on a conjoined base; the subprimary is a single hair, and v and vi a double-haired tubercle posterior to it, with another double hair, vii, beneath. On the abdominals, i and ii are widely separated, but nearly in line with one another, iii well down towards the spiracle, iv and v with bases on the same raised skin-area, but with actual hair-bases apart, perhaps rather further so than is normal. Although there is no postspiracular accessory tubercle present, there appear to me to be indications that the lower, and perhaps also the upper, will be developed in the next skin (Bacot, July 7th, 1904). *Final instar* (fullgrown): Of a sickly yellowish-green colour, with a red dorsal line or rather band. In form cylindrical, tapering rapidly at each end, from mesothorax forwards, and from 7th abdominal backwards. Each segment has a feature, common in "plume" larvæ, but decidedly marked in this species, *viz.*, the segment is cylindrical, and ranges with its fellows, but the incisions, even in the smaller larvæ, have little of the appearance of one segment folding over the other, but each is a wedge-shaped groove, rather sharply cut on the general cylindrical outline, which is also slightly affected by the subsegmentation, each segment being divided into a rather large anterior, and a smaller posterior, subsegment, and the latter again subdivided into two by a slightly less marked line. As to colouring, there is a good deal of difference as to the amount of red. There is always the dorsal band, which does not reach so far out as tubercle i. Then there is a broad line, occupying nearly half the space between ii and iii, which is often wanting, especially in older larvæ. There is often also a suffused reddish coloration round the spiracles. I should imagine a wholly red larva a probable variety, but I have not seen one. In a larva in which the subdorsal, normally red, line is of an olive-green, its upper and lower margins are bounded by a yellow line, the lower one being waved, arched up over the spiracle, and downwards on the 2nd of the three subsegments. It has the appearance of resulting from subcutaneous material (fat bodies ?); a little way below iv and v is another pale line, almost white rather than yellow. On the red dorsal band is a diamond-mark on each segment, formed by four yellowish lines; the two front ones are on the latter half of the 1st subsegment, and diverge backwards, the other two, on the posterior subsegments, reverse this arrangement, and fall a little short of the posterior margin of the segment. There is also a curious brown spot, just outside each external angle. The tubercles are, i, with a hair (0·3mm.) directed slightly forwards, and a short posterior hair; it is just behind the middle of the 1st subsegment; ii, on the middle of the 2nd (or 3rd) subsegment, has an upright hair, such as that on i, and one short posterior hair; iii also has one long hair and a posterior shorter one; iv and v are apparently very close together, but not conjoined, the anterior being a little upper, length about 0·3mm.; vi is low down at the posterior margin of the segment, with a backward-directed hair; below this are three hairs above the proleg; one of these does not seem to be one of the usual three in this position, but is rather higher up. To revert to the subsegmentation—the subsegments extend down to below iv and v; the 2nd subsegment curling round under the 1st and 3rd subsegments, preserving its distinctness, however, and all ending in a marked "flange"; below this is another flange, with an anterior and posterior prominence; the anterior has a secondary hair or two, the posterior carries vi. There is again a sulcus below this flange, as well as above, dividing it from the subspiracular (carrying iv and v) flange. The spiracles are hemispherical brown bosses, with the spiracular opening at top. The general skin-surface is finely spiculated. Secondary hairs are variable; they are very short, and either white or brown-black. The latter are always present on the dorsal red line, and sometimes on the lower one; in one larva there is one, and sometimes two, between (or slightly above) tuberces iv and v. One larva has no white secondary hairs; another has a little row along the anterior and posterior borders of each segment. The second hairs of tubercles i, ii, and iii, have the appearance of being rather more strongly developed skin-hairs, as there is no raised boss marking the tubercle of the large hair (Chapman, August 17th, 1904). The larva is well-figured by de Vries in Sepp's *Nederlandsche Insecten*, vol. vi., pl. xlv., figs. 1 and 2. *Adult* (fullgrown): Slightly less than ·5in. in length; of proportionate bulk; head much smaller than the 2nd segment (prothorax), the lobes rounded and polished; body cylindrical and uniform, tapering a little posteriorly; segmental divisions fairly defined, and a tuft of several short hairs springs from each of the indistinct tubercles (Porritt). The small head is blackish-yellow, with two small black spots; the mandibles brown, as also are the legs; the prolegs on the other hand are of the colour of the body. Length when fullgrown 4-5 lines; colour yellow-green with darker dorsal line, and a lateral line of the same colour, but less distinct. The segmental incisions are deep, and short. Scattered, light brown, hairs are visible all over (Schmid).

Variation of larva.—The larvæ are very variable, not only in ground colour, but also in markings; some have a red dorsal stripe, some a pinkish one, others have scarcely any trace of dorsal or other longitudinal markings (Tutt). In colour there are two extreme varieties among the larvæ, which, in the different individuals, vary between these forms. These extremes are:—

1. The ground colour a delicate pale green, strongly tinged indeed with yellow; head pale yellowish-green, the mandibles and ocelli brown; the mediodorsal stripe dark green or purple in different specimens; the subdorsal stripes yellow, and there are two other fine, but very faint, yellow, lines, one above, and the other below, the spiracles; segmental divisions also yellow; spiracles black, very narrowly encircled with white. Ventral surface, legs, and prolegs uniformly pale yellowish-green.

2. The ground colour brownish-yellow; head also brownish-yellow, freckled with brown; mediodorsal stripe broad, bright purple; subdorsal stripes also broad, but of a much less distinct dull pale purple, and having a fine white line running through them; a narrow purple line, edged with white, extends along the spiracular region. Ventral surface, legs, and prolegs uniformly pale yellowish-brown (Porritt).

Jeffrey describes the larva as "dull dark green, and more sparingly clothed with hairs than is usual in plume larvæ." Gregson notes it as "light, yellowish-green, semi-transparent, with a very narrow, claret-coloured, dorsal line, commencing on the mesothorax and dying away as it approaches the anal segment; the subdorsal and spiracular lines not visible in some specimens, in others faintly noticeable as light lines."

Foodplants.—*Erythraea centaurium* (Schmid), *E. pulchella*, *E. littoralis* (Lambillion), *Chlora perfoliata* (Henslow), *Gentiana germanica* (Schmid and Hofmann).

Parasites.—From the few larvæ retained in 1904, one or two parasites were bred. Of a ♂ sent to Morley for report, the latter notes: "The single ♂ *Apanteles* received, and bred from *A. zophodactylus*, appears to be (probably) the undescribed ♂ of *Apanteles contaminatus*, Hal., but I cannot be sure of this in the absence of the ♀, which has been bred in England from an undetermined larva, mining the leaves of *Arctostaphylos uva-ursi*" (Bankes).

Pupation.—The fullfed larva spins a silken pad, generally selecting a stalk of the foodplant to which it attaches itself in the ordinary Alucitid position, and then pupates usually head downwards (Tutt).

The position chosen by the larva for pupation is usually on the stem near the flowers, to the spinning on which it attaches itself by its cremaster, in a position often oblique or semi-vertical, the head turned upwards. Owing to its colour, form, and the position that it occupies on the stem, one can easily mistake it for a withered flower, the corolla of which has fallen; the similarity is absolute (Lambillion). The inverted position is almost invariable. The pupa can throw itself back by bending (dorsad) the free abdominal segments, and when it does so, the head points in precisely the opposite direction to that it has when at rest. This is more movement than the Platyptiliid (*sens. rest.*) pupæ have, and much more than the hairy Alucitid pupæ show. The pupa also has this attitude when the moth has emerged (Chapman). The pupa is well shown as to usual positions and attitudes by Sepp, *loc. cit.*, figs. 3, 4, 5, and 6. Lambillion notes the pupal stage as being from ten to twelve days.

Pupa.—A long, narrow, straight, smooth pupa, variable in colour; a prominent, but not sharp, frontal beak; dorsal flange-ridges running down the first three abdominal segments on either side, beginning with ridges near the middle line on the mesothorax, but so smoothed down as to be easily overlooked. The green specimens have more or less of a pink dorsal line or band, reduced in the greenest specimen to a faint tinge on the thoracic segments and on the final abdominal segments. The actual form of the pupa is that common to the smooth pupæ of the Platyptiliid "plumes," *viz.*, with somewhat swollen thorax, diminishing rather suddenly to the abdomen, thence a very trifling diminution until the final tapering of the 7th to 10th abdominal segments. In some specimens the thoracic thickening is wanting, in others it is best seen laterally, in others dorsally, and in some it is very marked. Each segment, from the 4th abdominal onwards to the 7th and 8th abdominals, has very numerous, transverse, fine wrinkles. On the 1st abdominal segment these are absent, on the 2nd they are faintly indicated, and on the 3rd are quite distinct in a mounted specimen. On the 4th abdominal they may be counted 21 in number just below tubercles iv and v, but as they do not each continue round the whole segment, but fade out here and there, they differ at other parts of the segment, *e.g.*, on this same segment only 16 are reasonably definite at the horizon of tubercle vii. The finer sculpturing is very elaborate. Most of the allied "plume" pupæ have a similar finer sculpturing, of rounded pits, or of spiculæ, but it may be owing to the much greater delicacy of the pupa-case of *A. zophodactylus*, that a good deal more of the detail of which this consists is easily seen in a mounted specimen. Continuing the examination of the 4th abdominal segment, we find the posterior intersegmental portion nearly colourless, except its margin, where it touches the solid portion of the segment; here it is darker even than that, and is probably quite as solid, illustrating how, even in the movable segments, the intersegmental subsegment is capable of solidification, as we find it in the fixed segments of many pupæ. This portion is, as usual, sculptured into cells essentially hexagonal, but so far irregular, and with their transverse (to segment) diameters so elongated, that they might be regarded as spaces between fine ribs running round the segment, and anastomosing at regular short intervals. In the coloured marginal portion, the dark ribs and colourless cells make a marked contrast; on the colourless (movable and flexible) portion the ribs are barely marked, yet it is easy to see that each cell contains a central spot (probably raised as an incipient spicule). Passing in the other direction, *i.e.*, forwards into the solid and ribbed portion of the segment, the surface is seen to be divided, in precisely the same way, by raised lines into cells of the same size and form, as those of the intersegmental membrane, excepting that the cells are more usually hexagonal, and are more often formed by lines between the transverse lines than by simple anastomosis. These cells are dark in tint, *i.e.*, darker than the dividing-lines, and, in the centre of each, there is a large transparent (or pale) spot, giving the appearance of, and probably being, a pit, that is more easily seen than the cell containing it. It occupies almost the whole width of the cell, but leaves its ends unoccupied, the cells being as noted, longer (transversely to segment) than wide. In the centre and forward part of the segment, this is less so, and the hollows occupy so much of the cells, that the unoccupied portion of the cell is not easily distiuguished from the lines dividing the cells. At the anterior margin of the segment, the pits are wanting, and the cells and lines dividing them are a little obscure, but there are present numerous fine points or spicules; these arise, not from the centres of the cells, but from the angles where the lines dividing them meet. Laterally they occupy three or four rows of the larger ribs, ventrally eight or nine, dorsally three or four. The 2nd and 3rd legs, with the proboscis, form a free continuation of the appendages nearly as far as the end of the 5th abdominal segment (all are fixed, as usual, to the end of the 3rd abdominal segment). Though the pupa is so smooth, there are the usual tubercular hairs, minute clubbed batons, those on i and iii directed forwards, on ii backwards, those on the lateral and ventral ones (on exposed surfaces) seem to be all present; length of that on vii about 0·045mm., of the others about 0·04mm. These batons are short and curved (those on vii are rather longer and straighter), thickest at their ends, and colourless; they are of the same character as those on the pupæ of *Agdistis*, *Adactylus*, and *Platyptilia*, indeed, by comparison, the hairs of the pupæ of *Platyptilia*, though short, thick, and blunt-pointed, are ordinary hairs, since they taper equally for their whole length, whilst these are apically distended. Strictly, though *Platyptilia* associates itself with *Stenoptilia* and *Agdistis* in the minuteness of the tubercular hairs of the pupa, it does not do so in the form to more than a very slight degree. The hairs on the pro-, and mesothorax, and on the vertex, are even smaller, but are clubbed in form. The 1st legs end at about the end of the wings (end of 3rd abdominal segment); the proboscis is hidden beneath them towards their tips, and, though exposed beyond them, is not very distinct till towards its extremity, where it is apt to be more tinted. The forward set of cremastral hooks contains about 40 in number on each side, and the terminal set is apparently more numerous, but they are so crowded and obscured by silk, that actual counting appears hopeless. The form of the hooks is a little special. It is as though the end of a needle had been bent back round a fine rod, and the new end then sharpened, but there remains a rounded hollow in the concavity of the bend where the supposed rod was used to bend them round; in a few instances it is a little closed up. Amongst the forward hooks the surface is finely spiculated; their length is about 0·06mm. The hindwing reaches just past the spiracle of the 2nd abdominal segment; the spiracle has the usual appearance of being thrust back. The forewing has the usual long point supporting the free appendages. The cover of the prothoracic spiracle is a raised, little, oval plate, with fine striæ or wrinklings. The pupa is usually so colourless and delicate that, when mounted in "canada balsam," hardly any structure is observable (Chapman, August 30th, 1904). The pupa is slender, and nearly (if not quite) as long as the fullgrown larva; it is of almost uniform width, the last two segments only tapering to the anal point. It is glossy and cylindrical, but there is a depression on the thorax and front abdominal segments; the snout and top of the thorax are prominently and sharply defined; the leg-cases extend a long distance down the front of the abdomen, but, before the end, become detached from it. The ground colour is yellow, but is almost hid with a deep pink, which is suffused all over the surface, and almost forms a stripe from the head through the abdominal segments; wing- and leg-cases dingy olive, tinged with pink (Porritt). The pupa is naked, of a beautiful soft green or reddish tint; blunted anteriorly, and showing, before the lighter vertex, a carmine-red stripe, which is gradually lost towards the anal point (Schmid).

Variation of pupa.—As may be assumed from what has been written in the last paragraph, the pupæ vary almost to the same extent as the larvæ, some are green, others are quite red, and there are many intermediate forms (Tutt). Gregson describes it as "purplish flesh-colour, the wing-cases changing to dark purple-brown about two weeks after pupation." Chapman notes it as "usually of reddish colour; a large proportion, however, green, and no doubt the proportion of each depends on environment, since two or three that have fixed themselves low down are greyish-green, or very dull brownish-red. Some of the greenest pupæ, especially after the eyes take a dark tint as the imago matures, have the head and appendages adjacent, and even the wings, nearly white, especially the beak, reminding one much of some Platyptiliid pupæ, especially that of *Gillmeria pallidactyla* (*bertrami*)." Lambillion says (*Rev. Mens. Soc. Ent. Namur*, 1904, p. 51) that he has observed that before emergence the ♂ pupa scarcely changes colour, whilst that of the ♀ becomes blackish-brown.

Time of appearance.—Early specimens of this species are occasionally taken in Britain, for we have an example in our collection of our own capturing labelled "end of May, 1889: Orpington," and Zeller has recorded an April-caught specimen, as also has Brabant. Besides these, there appear to be two broods of this species in Britain, the imagines of the first appearing from the middle to the end of July (from larvæ coincident with the early flowers of *Erythraea*), the other, from the end of August to October, varying considerably, not only in different seasons, but also in the same, and even in the same brood (the larvæ feeding on the seeds of their food-plant). Little is known of the larvæ of the first brood, the only records we have being the rearing of imagines, July 20th, 1886, and following days, from larvæ collected the first week of July near Dover; imagines taken July 6th, 1893, at Cuxton, fully out and abundant by July 22nd, on the same ground (Tutt); imagines captured August 1st, 1889, July 10th-11th, 1903 (all worn), and July 22nd, 1904 (fresh); others bred July 17th-25th, 1904, from larvæ taken July 4th-5th, in the Isle of Purbeck (Bankes); imagines bred July 27th-August 8th, 1904, from larvæ taken July 19th and following days at Wépion (Lambillion). It appears to be the second brood that is most frequently obtained, and the following records seem to belong to it. Imagines reared from end of September through October, from larvæ found at the end of August and in early September on the sand-dunes of Dunkirk (Brabant); imagines bred about September 12th, 1859, from larvæ pupated September 2nd (Henslow), imagines captured end of August, 1865, near Saffron Walden, larvæ obtained at the same time, pupated on September 4th and the following days, and emerged from about September 18th (Jeffrey); imagines early in August, 1868, from near Southport; in 1869, the earliest emerged on September 19th, when some larvæ were not fullfed; bred between August 23rd and September 1st, 1883, from larvæ obtained at Cattistock (Porritt); imagines bred September 16th, 1882, August 16th, 1883, September 2nd-14th, 1884, the last lot from larvæ taken August 11th, 1884, in the Isle of Purbeck; also imagines captured August 31st and October 2nd, 1886, at Bloxworth (Bankes); imagines bred October 5th, 1887, from larvæ obtained September 2nd at Ventnor (South); imagines caught September 8th, 1890, in the Isle of Purbeck (Bankes); September 10th, 1895, at Hampstead (Watts); August 12th-22nd, 1899, at Shoeburyness; also imagines bred August 6th-18th, 1901, from larvæ found at Shoeburyness, on July 27th (Whittle); imagines caught September 27th, 1902, at Dartmouth, September 1st, 1903, in the Isle of Purbeck, October 10th, 1904 (♂ at sugar), at Dartmouth (Bankes); May 28th, 1904, near Wareham (W. P. Curtis *teste* Bankes); imagines emerged August 27th-September 20th, 1904, at Reigate (Chapman), from eggs laid about July 25th, 1904, by Purbeck-bred and -captured ♀s (Bankes); bred August 19th-September 5th, 1904, from larvæ collected in July; imago caught at Great Wakering, August 13th, 1905 (Whittle). In Germany the records are somewhat similar. Hofmann says that "the perfect insect flies in July, August, and till late in autumn; an especially large and dark ♂ is labelled 'Stuttgart, November 14th'"; as, however, Zeller records capturing the moth in April, it appears as if the species might hybernate (see also *posteà*, p. 333). It is also noted as being bred September 1st near Friedland, in Mecklenburg (Stange); imagines from August to October in the Rhine Provinces (Stollwerck); at end of August and in September, near Frankfort-on-Main (Schmid), and during the same period at Mombach (Rössler); the end of August to October, in Brandenburg (Sorhagen); in October, near Breslau (Wocke); end of August, from larvæ found at commencement of month at Regensburg, in Bavaria (Schmid), and from July to September, in Baden (Meess and Spuler).

Habits.—The moth is very inconspicuous and easily overlooked; its comparatively small size, and pale colour after a very little exposure, add to the difficulty of distinguishing it. It appears, however, to be easily disturbed during the daytime, in fine weather, from among the rough herbage among which its foodplant grows, especially in the late afternoon; in fact, it was flying quite freely on two sunny afternoons between 2 p.m. and 4 p.m., on July 6th and July 22nd, 1893, at Cuxton. At Bourg d'Oisans we found it also flying freely in mid-August, 1896, and it certainly had the same habit at St. Michel-de-Maurienne, in 1897. It also appears to fly voluntarily during the evening, and, perhaps, is most abundant at dusk, though difficult to see. Bankes notes (*in litt.*) that it is to be found on the wing amongst its foodplant, in calm and hot weather, rather before sunset, and continues to fly until dusk, and sometimes later, for it has occurred at sugar after dark (at Dartmouth); it was on flight as early as 7.45 p.m. on July 10th, 1903 (in the Isle of Purbeck). Jeffrey found it flying among the foodplant in the daytime at Saffron Walden, at the end of August, 1865. It would appear that the ♀s of the summer (July) brood lay their eggs almost at once, yet this would not appear to be the case with the ♀s of the autumn brood, for on September 26th, 1904, Chapman notes of some 60 imagines that had been out some days, that some had died (? from keeping them in closed jars), and the ♀s of these were absolutely void of eggs, though containing fat bodies and other tissues. The first 30 or so out (between August 28th and September 5th) were sleeved on a flowering plant about the latter date, and careful examination on September 26th showed nearly all alive, but no trace of an egg; by November, however, all the imagines of this species had died, whilst specimens of *Amblyptilia cosmodactyla*, kept under similar conditions to the *Adkinia zophodactylus*, went on satisfactorily with their hybernation. It is remarkable that we do not yet know how this species hybernates. We have long since suspected that it did so as a young larva hidden within the foodplant,* as is the case with its nearest allies. It has been reported, however, by Lambillion (*Rev. Mens. Soc. Ent. Namur*, 1904, p. 56), that Brabant has found the imago in April, in France, and that Colignon, in January, 1899, found, hybernating in a grotto in the valley of the Meuse, worn imagines, referred by Lambillion to this species.† We ourselves have an example of our own capturing, labelled "Orpington. End of May, 1889," and Bankes states (*in litt.*) that a worn ♂, which, however, he was able to identify with certainty, was taken near Wareham, by Mr. W. P. Curtis, on May 28th, 1904. Hofmann notes the capture of a dark ♂ at Stuttgart, on November 14th, and adds that, on the other hand, Zeller found the imago in April. Still we feel doubt about the imago hybernating.

Habitat. — On the chalk-hills at Cuxton, where *Erythraea centaurium* grows, among and near great patches of tall, rough, chalk-frequenting plants, stunted rose, and blackthorn bushes, *Adkinia zophodactylus* is not uncommon. At the foot of the steep mountain slopes behind the Grand Hotel, at Bourg d'Oisans, a similar overgrown, tangled, wilderness, a slope covered with wild flowers and grass, that had once been a field, but had been allowed to go out of cultivation, produced this species in great abundance, whilst it was also frequent in another wild uncultivated field, where the foodplant, however, grew abundantly, at St. Michel-de-Maurienne. Hudd notes it as occurring on the Leigh downs; on railway-banks near Hartlepool (Gardner); on the slopes of the upper cliff at Ventnor (South); in a field where a great deal of *Erythraea centaurium* grows, at Shoebury-

* It has been objected by various lepidopterists that this is impossible, as *Erythraea centaurium* is an annual. We are quite aware that many authorities state this, but it is not so (see *Ent. Rec.*, xvii., p. 72); the plant is no doubt biennial, and flowering-shoots can be found under favourable conditions well into November in some years.

† Lambillion's statement (*op. cit.*, p. 56) runs: "En janvier, 1899, si nos souvenirs sont exacts, M. Colignon, en visitant une grotte de la vallée de la Meuse, trouva une énorme quantité de Ptérophores, de différentes espèces, hivernant là, collés à la voûte, en compagnie de nombreux diurnes, du genre Vanesse et des noctuelles. Il nous en apporta quelques-uns pour les déterminer; mais ils étaient pour la plupart si défraîchis, qu'il était presqu'impossible de les reconnaître; peu d'espèces furent déterminées. Plus tard, dans le nombre, nous reconnûmes des *S. zophodactylus*." This after all is not very convincing, because of their condition, etc.

ness; no doubt the insect occurs all over this district, but I usually collect it in this old brickfield near Shoeburyness, where centaury is one of the commonest plants (Whittle); at Broxbourne, in a very sheltered spot on the Boulder Clay, surrounded by woodland (Bacot); on very dry sandy wastes on the coast, and inland, where vegetation is scanty, but *Erythraea centaurium* common, in the Isle of Purbeck (Bankes). Schmid notes that in Hesse-Darmstadt it occurs in dry places, where there is, however, plenty of vegetation—near Frankfort-on-Main, the insect occurs on the Babenhäuser highway, and in the Ginheimer Wood, as well as on the Bieberer height, near Offenbach. In Mecklenburg, it occurs in a plantation of young trees, in the Sandhäger pinewood (Stange); in the Rhine Provinces, also it is found in the woods of the Bergheim district (Stollwerck); and in Württemberg, on the Feuerbacher Haide (Steudel and Hofmann), etc.

Localities.—Exceedingly local, but possibly overlooked. Aberdeen: once near Pitscurrie, and once on Ben-na-chie (Reid). Cheshire: occasional (Arkle), Wallasey (Ragonot). Cornwall: Bodmin (Tellam). Devon: Dartmouth (Bankes), Dorset: Isle of Purbeck, very local, not uncommon (Bankes), Wareham district—distributed, Bloxworth, etc. (A. W. P. Cambridge), near Dorchester (Porritt), Cattistock (Parmiter). Dublin: Howth, Portmarnock (Sinclair). Durham: near Hartlepool (Gardner). Essex: Shoeburyness, Great Wakering (Whittle), near Saffron Walden (Jeffrey), Leigh (Vaughan), West Bringholl near Colchester (Harwood). Hants: Bournemouth (Robertson *teste* Bankes), Hayling (W. H. B. Fletcher), Isle of Wight — Ventnor (South). Herts: Broxbourne (Bacot), Sandridge (Griffith). Hereford: Tarrington (J. H. Wood). Kent: Orpington, Cuxton (Tutt), Deal (Vaughan), Dover, Folkestone (Austin), Canterbury (Parry). Lancashire: Southport (Hodgkinson). Middlesex: Hampstead (Watts). Norfolk: Hunstanton (Porritt), Norwich, Merton (Barrett). Pembroke (Barrett). Somerset: Leigh Downs, etc. (Hudd). Suffolk: ?Hitcham (Henslow). Surrey: Addington Park, Croydon (Sheldon), Red Hill, Haslemere (Barrett). Sussex: Tilgate Forest (Sheldon), Hastings district (Bloomfield), Abbott's Wood (Vine), Clapham Wood (W. H. B. Fletcher). Wilts (Barrett). Yorks: Bramham (Smith), Sandburn, York (Prest).

Distribution.—Central and southern Europe (except Balkan peninsula), Asia Minor, and Armenia (Staudinger and Rebel). Asia: Asia Minor—Smyrna (Kruper), Brussa (Mann). Austro-Hungary: near Vienna (Hofmann), Lower Austria—Hernstein (Rogenhofer), near Tivoli, Mauer, near Baden, etc. (Mann), Breitenfurt (Hornig), Bohemia (Nickerl), Budapest district (Aigner). Belgium: Ri de Flandre—Wépion, Fort St. Heribert, common (Lambillion), Brussels, Louvain (Donckier). France: Dauphiny Alps — St. Michel-de-Maurienne, Bourg d'Oisans (Tutt), Pyrénées-Orientales (Méret *teste* Duponchel), Aube (Jourdheuille), Indre—Nohant (Sand), Saône-et-Loire (Constant), Dunkirk (Brabant). Germany: largely confined to south Germany, and here very local (Hofmann), Mecklenburg—Friedland (Stange), Rhine Provinces—Kreise Bergheim, near Quadrath, Schlendorf, Königsdorf, not rare (Stollwerck), Hesse-Nassau—on the Babenhäuser road, and at Ginheim, near Frankfurt-on-Main, the Bieberer height, near Offenbach (Schmid), Mombach, Wiesbaden (Rössler), Thuringia—Jena (Knapp), Province of Saxony and Brandenburg (Sorhagen), Silesia, very rare, near Breslau (Wocke), Bavaria—near Regensburg (Schmid), Württemberg—Feuerbacher Haide (Steudel and Hofmann), Baden—Lahr, Carlsruhe (Reutti), Alsace—St. Pierre-Bois, La Chapelle (Peyerimhoff), Rheinpfalz, rare (Bertram). Italy: Sicily—Messina (Zeller). Netherlands (de Vries). [Russia: ? Caucasus district (*teste* Christoph).] Spain: Moncayo (Chapman). Switzerland: local and rare—near Zürich (Frey). Turkey: Rhodes (Loew).

Adkinia bipunctidactyla, Scopoli.

Synonymy.—Species: **Bipunctidactyla,** Scop., "Ent. Carn.," p. 257 (1762); de Vill., "Linn. Ent. Faun. Suec.," ii., p. 535 (1789); Haw., "Lep. Brit.," p. 476 (1811); South, "Entom.," xviii., p. 98 (1885); Leech, "Brit. Pyr.," pl. xvii., fig. 5 (1886); Tutt, "Brit. Nat.," ii., p. 61 *bis* (1892); "Pter. Brit.," p. 85 (1895); Meyr., "Handbook," etc., p. 441 (1895); Staud. and Reb., "Cat.," 3rd ed., p. 76 (1901). **Mictodactyla,** Hb., "Eur. Schmett.," Aluc. pl. i., fig. 3 (*anteà* 1811); "Verz.," p. 430 (1825); Treits., "Die Schmett.," ix., p. 240 (1833). **Bipunctidactylus,** Sam., "Ent. Usef. Comp.," p. 409 (1819); Curt., "Brit. Ent.," fo. 161

(1827); Stphs., "Illus. Haust.," p. 372 (1834); Wood, "Ind. Ent.," 1st ed., p. 235, pl. li., fig. 1629 (1839); Sta., "Man.," ii., p. 442 (1859); Barr., "Ent. Mo. Mag.," xviii., p. 178 (1882); Porritt, "Ent. Mo. Mag.," xxi., p. 208 (1885); Tutt, "Young Nat.," x., p. 164 (1889); South, "Entom.," xxii., p. 34 (1889); Barr., "Lep. Brit. Isles," ix., p. 375, pl. 415, figs. 5-5c (1904). **Mictodactylus,** Dup., "Hist. Nat.," p. 661, pl. 314, fig. 1 (1838); Zell., "Isis," p. 837 (*in part*, var. *b*) (1841). **Aridus,** [Zell., "Isis," p. 904 (1847); "Stett. Ent. Ztg.," p. 210 (1850); "Linn. Ent.," vi., p. 366 (1852); H.-Sch., "Sys. Bearb.," v., p. 376 (1855);] Gregs., "Ent. Mo. Mag.," vii., p. 88 (1870); Knaggs, "Ent. Ann.," p. 94 (1871); Staud. and Wocke, "Cat.," 2nd ed., p. 343 (1871); Tutt, "Pter. Brit.," p. 88 (1895). **Serotinus,** Zell., "Linn. Ent.," p. 361 (1852); H.-Sch., "Sys. Bearb.," v., p. 376 (1855); Frey, "Die Tin.," etc.," p. 411 (1856); Wallgrn., "Oefvers K. V. A. Förh.," p. 222 (1856); "Skand. Fjad.," p. 18 (1859); Tgstrm., "Anmaerk," etc., p. 200 (1859); Röss., "Wien. Ent. Monats.," p. 201 (1864); Jord., "Ent. Mo. Mag.," p. 123 (1869); Nolck., "Lep. Fn. Estl.," p. 807 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 794 (1877); Frey, "Lep. der Schweiz," p. 430 (1880); Snell., "De Vlind.," ii., 2, p. 1038 (1882); Sorhgn., "Die Kleinschm. Brandbg.," p. 5 (1886). **Plagiodactylus,** Sta., "Sys. Cat.," app. p. 28 (1849); Zell., "Linn. Ent.," vi., p. 368 (1852); H.-Sch., "Sys. Bearb.," v., p. 377 (1855); supp. fig. 22 (1853); Frey, "Die Tin.," p. 412, *in part* (1856); Sta., "Man.," ii., p. 442 (1859); Jord., "Ent. Mo. Mag.," vi., p. 123 (1869); Staud., "Cat.," 2nd ed., p. 343 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 796 (1877); Zell., "Stett. Ent. Zeitg.," p. 164 (1878); Frey, "Lep. der Schweiz," p. 430, *in part* (1880); Barr., "Ent. Mo. Mag.," xviii., p. 178 (1882); Tutt, "Brit. Pter.," pp. 87-89 (1895); Porritt, "Buckler's Larvæ," etc., ix., p. 359, pl. 163, fig. 9 (1901). **Plagiodactyla,** Meyr., "Trans. Ent. Soc. Lond.," p. 487 (1890). **Serotina,** Hoffm., "Deutsch. Pter.," p. 75 (1895).

Original description.*—*Phalaena bipunctidactyla.* Long. lin. 4. Alæ anticæ cinereæ; punctis tribus, nigris, lineaque fusca longitudinali in limbo. In sylvestribus. Alæ superiores bifidæ; incisura lin. 1½ longa, segmentis parallelis, supra pari uno punctorum nigrorum, intervallo lin. 1⅔ ab alæ apice distantium, punctoque alio minore eodem intervallo, a basi aliisque punctis remoto. Alæ posticæ trifidæ, fusco-ferrugineæ nitidæ. Abdomen alis posticis concolor, lineis argenteis dorsalibus binis, lateralibus denuo binis sed ad medium usque non productis, infra iterum binis; præter has, est lineola nigra lateralis ad basim abdominis (Scopoli, *Ent. Carn.*, p. 257).

Imago.—20mm.-23mm. Forewings greyish-brown; the costal area distinctly darker than the inner marginal area; a double blackish spot at the end of the fissure, another single small one between these and the base of wing; sometimes a faint longitudinal streak in the inner half of upper lobe, and two towards the outer margin of lower lobe; a faint dot at anal angle of upper lobe, and two on outer margin of lower lobe; scattered white scales are situated along the nervures in costal half, and a series of short dark streaks sometimes give the appearance of a longitudinal line close to, and parallel with, the middle of the inner margin; a faint transverse pale line sometimes crosses the upper lobe, and rarely both lobes; the fringes dark grey, paler towards the apex. The hindwings glossy brownish-grey, fringes glossy dark grey, paler at bases.

Variation.—This is a somewhat variable species, although the variation is confined to comparatively narrow limits. In Britain, there

* Length 4 lines. Forewings grey, with three black dots, and a fuscous longitudinal line towards the border (inner margin). In woody places. Upper wings bifid; the incision 1½ lines long, segments parallel; above, one pair of two black dots, distant from the apex of the wing by an interval of 1⅔ lines, another smaller dot separated by the same distance from the base, and from the other dots. Hindwings trifid, fusco-ferruginous, shining, etc.

are usually said to be two well-recognised forms: (1) A larger southern or lowland form, generally less distinctly marked with black spots and streaks. (2) A smaller northern mountain and moorland form, much more intensely marked. To a certain extent this distinction holds, and the races are more or less to be recognised, but each of these forms varies, *inter se*, and considerable overlapping appears to occur. The former, or more typical form, occurs freely, in very varied localities, on the chalk-hills, woods, fens, etc., and varies from specimens of an unicolorous drab or ashy tint, almost without any indication of markings, to others distinctly tinged with brown, but still with indefinite markings, and yet on to both greyish and brownish forms with the dots at the end of the fissure of the forewing, and other black dots, fairly well marked. Still these southern forms have rarely any of the conspicuous brightness frequent in the form from the Cumbrian mountains and other similar localities, the specimens of which were referred by Stainton to his *plagiodactylus*, and were called by Gregson, *scabiodactylus*, or the small size and uniform yellowish-grey tint of Zeller's *aridus*. Barrett (*Ent. Mo. Mag.*, xviii., pp. 178-179; *Lep. Brit. Isles*, ix., p. 173) confused the larger, more typical, form from the southern chalk-hills with the barely smaller mountain and moorland form, united them under the name of *plagiodactylus* (*scabiodactylus*), and attempted to connect them with *Scabiosa columbaria*, whilst he refers to two other forms—a small one found among *S. succisa* in moist open pastures, and a large umbreous form found in the fens. South's remarks (*Ent.*, xxii., p. 34) on the variation of this species are largely discounted by the remarkable statement that he cannot discriminate the various forms of *A. bipunctidactyla* from *A. pelidnodactyla* and *Stenoptilia coprodactyla*, two very distinct and separate continental species. We have often taken the species abroad, and, in some localities, very interesting examples occur; at La Grave, in early August, 1896, we took several, one form having a very dark costa; another form was of a delicate pale dove-grey, others again being very like our southern British examples. Even in the same locality there is considerable difference in the specimens of the different broods in the same year; and Hofmann notes that "the moths that emerge in June are much more brightly coloured than those which fly in August; they are richer in the white scales on the disc of the wing, and have the white transverse line through the black longitudinal dash in the upper lobe much more distinct, and running into the costal fringe; they much resemble the moths of the var. *plagiodactylus*, Zell." He further notes: "Of the typical markings, the dot on the inner margin is wanting, or is very indistinct, the discoidal spot is usually distinct, although rather less so than in *A. pelidnodactyla*. He considers *plagiodactylus* a variety of this species, being unable to find any constant character between undoubted *bipunctidactyla* and examples of *plagiodactylus*. [Among others examined, are four from Herrich-Schäffer's collection, from Neustrelitz, and the Schneeberg,* in the Vienna district (which are evidently those referred to by Herrich-Schäffer, *Sys. Bearb.*, v., p. 377, and from which the description was drawn up, and which exactly agree with his Suppl. fig. 22), and two of Zeller's original specimens from Bergün]. I have carefully compared these latter with 44 examples of *bipunctidactyla*, and found the characters usually relied on excessively

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* These are evidently some of Mann's original specimens, see *posteà*.

variable in both; they cannot, therefore, have specific value. He adds that the species mentioned by Büttner and Hering (*Stett. Ent. Zeitg.*, 1880, p. 472; 1891, p. 225; 1893, p. 117), and which was erroneously referred by Stainton to *plagiodactylus*, is not that insect, but *S.* var. *pneumonanthes*, Schleich. He then writes: "In his analytical table Heinemann places *plagiodactyla* among the species which have a thick, dark, longitudinal streak in the upper segment of the front wings, and which are said by this to be separated from *bipunctidactyla* (*serotina*); this character, however, as in *bipunctidactyla*, is very variable. Among the six examples above mentioned, it is absent in three, very indistinct in one, and only distinct in two; the same thing happens, however, often with *bipunctidactyla*. Again, the costal fringes in *plagiodactyla* are said to be brown, narrowly white towards the apex; this character, also, is only to be found distinctly in two of my original six specimens, while, on the other hand, it occurs in many a specimen of *bipunctidactyla*. The position of the dots at the fissure is exactly the same as in *bipunctidactyla*, namely, just on the fissure, never somewhat distant from it as in *graphodactyla* and *coprodactyla*. I, therefore, can only consider *plagiodactyla* as a variety of *bipunctidactyla*, which latter, according to Zeller (*Linn. Ent.*, vi., p. 361), has less brightly marked forewings, fewer white scales on the disc, not such a thick, blackish-brown, streak on the upper segment, which is also a little shorter than in *plagiodactyla*." We quite agree with Hofmann's conclusion. Hofmann also notices the important detail, *viz.*, that Frey merely quotes Zeller's diagnosis of *plagiodactylus*, and that his larval reference "belongs in all probability to *graphodactyla*," the latter having been bred by Hofmann from *Gentiana asclepiadea*. This suggestion is abundantly proved by the fact that the whole series of specimens in the "Frey" collection, labelled "*plagiodactylus*" are *pneumonanthes*. Haphazard records, combined with ignorance of the character of *plagiodactylus* as a race, have led to many more or less ordinary specimens of *A. bipunctidactyla* being recorded in Britain as *plagiodactylus* and *scabiodactylus*, the two names given to a slightly darker and more strongly-marked form than the type, and reams of paper have been wasted, in the British magazines, in trying to prove the specific distinctness of the latter form. That both forms are specifically identical, there can be no question, and that *A. bipunctidactyla* develops, in most localities, well-marked specimens of the *plagiodactylus* form, where the greater number of the examples are typical, is undoubted, but there are localities, chiefly those of higher latitudes, higher altitudes, and more exposed places, where the greater number of examples are of this form, and where it has developed into a well-marked race. The variation of a long series of British examples suggests the following subdivisions :—

1. Unicolorous greyish-white, with fissural and discal dots = ab. *albescens*, n. ab.

1*a*. Unicolorous pale drab-grey or ashy, scarcely sprinkled with black, or with white, scales, with fissural dots, but without discal dot = ab. *pallida*, n. ab.

1*b*. Pale drab-grey or ashy, sprinkled with black, and with white scales, with fissural dots, but without discal dot = ab. *pallida-mixta*, n. ab.

1*c*. As 1*b*, but also with discal dot = *bipunctidactyla*, Scop.

1*d*. As 1*c*, but with black lineolæ in the upper or lower lobes, or in both = ab. *pallida-excessa*, n, ab.

2. Costal area greyish-drab, or darkish-grey, the inner marginal area ochreous or brownish, scarcely sprinkled with black, or with white, scales, with fissural dots, but without discal dot = ab. *bicolor*, n. ab.

2*a*. As in 2, but sprinkled with black and with white scales=ab. *bicolor-mixta*, n. ab.

2*b*. As in 2*a*, but also with discal dot=ab. *bicolor-typica*, n. ab.

2*c*. As in 2*b*, but with black lineolæ in the upper or lower lobes, or in both=ab. *bicolor-excessa*, n. ab.

3. Unicolorous brownish (or brownish-ochreous), scarcely sprinkled with black, or with white, scales, with fissural dots, but without discal dot=ab. *brunnescens*, n. ab.

3*a*. As in 3, but sprinkled with black and with white scales=ab. *brunnescens-mixta*, n. ab.

3*b*. As in 3*a*, but also with discal dot=ab. *brunnescens-typica*, n. ab.

3*b*. As in 3*b*, but with black lineolæ in the upper or lower lobes, or in both=ab. *brunnescens-excessa*, n. ab.

The *A. bipunctidactyla* in the Frey collection are particularly interesting. One tiny example is only about 13mm. across=ab *minor*, n. ab.; most of the examples are strikingly brown, especially along the inner margin of the forewing, whilst one specimen has the whole of the forewings of a brown tint; the transverse lobal line is, in this example, fairly well-developed, less so, however, than in an example from Glogau. The costal area of one Frankfurt example, and of three from Zürich, is particularly dark; the former is also particularly well marked with black scales, especially in the upper lobe; the white scaling, too, is conspicuous, and the costa towards the base is speckled with white, reminding one of the same character in *Amblyptilia cosmodactyla*. The described forms of the species are:—

a. var. (*et* ab.) *plagiodactylus*,* Sta., "Sys. Cat.," app. p. 28 (1851); Zell., "Linn. Ent.," vi., p. 368 (1852); H.-Sch.. "Sys. Bearb.," v., p. 377 (1855); supp. fig. 22 (1853); Sta., "Ent. Ann.," ii., p. 45 (1856); "Man.," ii., p. 442 (1859); Gregs., "Ent.," iii., p. 186 (1866); Jord., "Ent. Mo. Mag.," vi., p. 123 (1869); [Barr. and Buckl., "Ent. Mo. Mag.," viii., p. 156 (1871);] Staud., "Cat.," 2nd ed., p. 343 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 796 (1877); Zell., "Stett. Ent. Ztg.," p. 164 (1878); Frey, "Lep. Schweiz," p. 430, *in part* (1880); [Barr., "Ent. Mo. Mag.," xviii., pp. 178-9 (1882);] Gregs., "Ent.," xviii., pp. 150-1 (1885); South, "Ent.," xviii., pp. 273-5, pl. i., figs. 1-1*c* (1885); Hofm., "Pteroph. Deutsch.," p. 78 (1895); Tutt, "Brit. Pter.," pp. 87-89 (1895); Porrt., "Buckl. Larvæ," etc., p. 360 (1901); Barr., "Lep. Brit. Isles," ix., pl. 415, fig. 5*a* (1904). *Scabiodactylus*,† Gregs., "Ent. Mo. Mag.," vi., p. 115 (October, 1869); "Ent.," iv., p. 363 (1869); Barr., "Ent. Mo. Mag.," xviii., p. 179 (1882); Gregs., "Ent.," xviii., p. 150 (1885); Porrt., "Buckl. Larvæ," etc., ix., p. 361 (1901). *Scabiosae*, Jord., "Ent. Mo. Mag.," xviii., p. 122 (1882). [*Hirundodactylus*, Gregs., "Ent.," iv., pp. 363-4 (1867).]—*Pterophorus plagiodactylus*. Very closely allied to *mictodactylus*, but the anterior wings have an ochreous tinge towards the inner margin, and the black streak in the anterior lobe is much more strongly marked; in the second lobe are also two distinct black streaks (Stainton, *Sys. Cat.*, app. p. 28). [Stainton observes that *plagiodactylus* was obtained from Joseph Mann, of Vienna, in 1849, by Herrich-Schäffer. Mann had discovered it on the Austrian Alps—Schneeberg.] OVUM.—Pale [green] in colour, oval in

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* *Plagiodactylus*, Mill., "Icon.," i., p. 209, pl. xxvii., figs. 8-12, is not *plagiodactylus*, whatever species it may be. He says the larva feeds openly, but what marks it as not even a *Stenoptilia* is the pupa, which is "brown and covered with numerous hairs." It might even be *Alucita monodactyla*. Millière says that *millieridactylus* is a variety of his *plagiodactylus*, and is described from a single specimen taken by Millière near Lyons. I should be quite satisfied to leave it where Rebel has put it (Chapman).

† Head and face fuscous; forewings irrorated with dark scales on the anterior portion; inner margin ochreous, irrorated; a small dark spot on the third part of the wing; then a large wedge-shaped one at the head of the cleft, and a dark streak in the first lobe, the cleft edged with a whitish streak; underwings, together with their cilia, brownish; thorax dark; first segment of abdomen triangular, ochreous, edged with white; upper surface of the legs dark, spurs and feet light (Gregson, *Ent.*, iii., p. 186, *cf. Ent.*, iv., p. 363).

outline, very small, noticeably long in comparison with width, plump and somewhat cylindrical in shape; surface shiny, apparently smooth, with what looks like a faint reticulation at the ? micropylar end. [Tutt. Described with a hand lens on August 17th, 1901, from seven eggs laid, in a little heap on a setting-board, by a dying ♀, captured the same day at Bobbie.] Habits of larva: The spring larvæ feed on *Scabiosa columbaria* in April and May, eating down into the heart of the plant before the flowering stem is thrown up, and thus utterly destroying it. Larva: The young larvæ were found abundantly at Llanferres, on March 25th, 1873. They are hirsute, the dorsal region suffused with lightish pink as seen through the rather dense hairs; each change of skin reduces the colour of the pink streak until the larva is fullfed, when it has no pink upon it (Gregson). Fullfed: Three-eighths to half-an-inch long. One of a pale yellowish-green slightly inclining to olive, the other a fuller and rather deeper green, more the colour of the leaf of the foodplant; the body not very stout, and very slightly tapering to the rounded hinder extremity; the head is smaller than the 2nd segment, which last is less than the 3rd, so that it tapers in front from the 3rd. There is a faintly darker dorsal line or pulsating vessel, though, on the shining 2nd segment; this is represented as a double line of faint blackish, and, on either side of it, on the subdorsal region, is a black amorphous spot. The head is much of the same tint as the body, though faintly browner; the jaws are darkish-brown, with a rather large black spot at the lower side of each cheek in the usual situation of the ocelli; the head is very lustrous in polish; very faint indications exist of a rather paler stripe along the subdorsal region, but so softened at the edges as to be so ill-defined as not to warrant its being noted until the larva has fixed itself after being fullfed; the whole surface of the body is covered with very short bristles of a dirty whitish colour, mixed in places, or sprinkled, with a few blackish ones, notably on the 2nd, 3rd, and 4th (the thoracic) segments, and more sparsely along the dorsal vessel and last segment; in addition to these which clothe the body, are regular series of long bristly hairs, dirty-whitish, issuing chiefly from the usual tubercular positions, sometimes in twos or threes; the spiracles are of the ground colour ringed with darkish-brown (Buckler, *Larvae*, etc., pp. 360 *et seq.* From larvæ sent May 9th, 1872, as *scabiodactylus*, by Gregson). Foodplant: *Scabiosa columbaria* (Gregson). Variation of larva: Fullfed larvæ received from Gregson, June 5th, 1885, were characterised by the absence of dorsal markings of any shade of either red or brown; a slight rosy suffusion of the anal segment took place as soon as the larvæ attached themselves for pupation, whilst the pink or rose-coloured dorsal markings are developed in the pupa, one of the latter being suffused over the whole dorsal area with rose-madder; with the exception of the obsolete dorsal markings, the larvæ are identical with those before described, *viz.*, whitish-green; dorsal stripe reddish-pink (or rose-madder), most distinct on the 9th and 12th segments. The larvæ (typical) from Folkestone appear to be identical with those sent as *scabiodactylus* by Gregson, from Lancashire, and have the same habits (South). Pupation: The fullfed larva suspends itself by the tail to its foodplant on a blade of grass, or any other object it may find in the neighbourhood of its food, the pupal stage lasting about fifteen days (Gregson); larva fullfed on May 9th, 1872, fixed itself by its tail on May 10th, and pupated in due course, the pupa being figured on May 27th, the imago emerged June 9th (Buckler); larvæ (from Gregson) fed until May 23rd, 1881, pupated May 27th and following days; in 1885, fullfed larvæ from North Wales, received on June 5th, pupated almost at once, imagines appearing from June 20th onwards (South). Pupa: Slender, with green wing-cases and a pinkish body (Gregson). Three-eighths of an inch in length, slender; the wing-cases long, the tips well-produced and projecting a little, though lying close along the abdomen; the head and thorax rise a little at the top to a ridge; the tail is pointed. Colour green, slightly inclining to olive, the wing-covers darker green; a purplish-brown dorsal stripe, and two parallel lines of the same colour along the subdorsal region (Buckler, figured May 27th, 1872, *Larvae*, etc., pl. clxiii., fig. 9*e*). Time of appearance: It occurs in June and July in Switzerland (Frey), and Constant notes it in June at Couches-les-Mines, but in Savoy, Dauphiny, and Piedmont, our captures have all been made in the latter part of July and the first half of August. Whether it is single- or double-brooded in the mountains, we do not know. The dates we have are—July 23rd, near Raibl (Zeller); August 5th-12th, 1896, at La Grave; August 13th-20th, 1896, at Bourg d'Oisans; July 26th-30th, 1897, at Grésy-sur-Aix; August 1st-5th, 1897, at St. Michel de Maurienne; August 6th-12th, at Lanslebourg; July 27th-31st, 1898, at Bourg St. Maurice; August 3rd, 1898, on the Little St. Bernard; August 8th-12th, 1901, at Bobbie; July

30th-August 3rd, 1902, at Chavoire (Tutt); July 29th, 1901, on the Prenj; June 27th, 1902, at Maklenpass (Rebel); April 6th, 1902, in Malta (T. B. Fletcher). In Britain it appears to be only double-brooded, the first brood in late May and June, the second in late July and August. June 19th, 1860, at Elston Barrows (Gregson); June 26th, 1861, at Black Halls, Hartlepool (Sang); July, 1868, in Rossshire (F. B. White); July 4th-15th, 1869, at Witherslack (Hodgkinson); July 16th-17th, 1869, at Witherslack (Gregson); May 28th, 1870, at Witherslack (Hodgkinson); June 13th, 1870, at Witherslack (Porritt); July 23rd, 1871, at Shields (Sang); July 19th, 1872, at Grange; July 10th, 1877, at Witherslack (Hodgkinson); July 13th, 1878, at Witherslack; August 14th, 1879, at Hartlepool (Sang); July 17th, 1890, at Aberdovey (Arkle); July 9th, 1896, at Corsemalzie (R. S. Gordon); June 10th, 1902, common at Keswick (Beadle). Habits: The imagines fly freely among *Scabiosa columbaria* at Witherslack (Gregson); also in Hesleden Dene among scabious, and on railway banks at Black Halls (J. Gardner); flies at dusk on honeysuckle flowers in garden at Corsemalzie (R. S. Gordon). Habitat: Usually in hilly, moorland, or mountainous localities in Britain. At Llanferres, the insect is found among scabious plants growing on the ledges of rocks, along which only sheep and goats can travel (Gregson); on the Cumbrian mountains it is usually found in or near woods, and haunts such a locality among rough herbage at Keswick (Beadle). In France it occurs on the pasturages of the high alps above Pontarlier (Bruand); in Savoy and Dauphiny among the hills above Lac Bourget, also in the high mountains, to about 5000ft., at La Grave and on the Little St. Bernard Pass. In Piedmont, at Bobbie, it is also found among the mountains where the herbage is not at all stunted, and the scabious is luxuriant. In Switzerland, in damp localities in mountain woods, and on both shores of Lake Zürich (Frey). In Germany, on the turfmoor at St. Leonhard, in Baden (Reutti), etc. In Bosnia and Hercegovina it is also a mountain species, going up to nearly 6000 ft. at Treskavica, and 5500ft. at Velezi (Rebel). Localities: Carnarvon: Llandudno (Porritt). Cumberland: Keswick (Beadle), Lake district (Stainton), Carlisle district (Day). Denbigh: Llanferres (Gregson). Durham: Darlington, Black Halls, Hartlepool, South Shields (Sang), Hesleden Dene (J. Gardner). Gloucester: Cotswolds (Merrin). Isle of Man (Gregson). Kent: Folkestone (Purdey). Lancashire: Grange (Hodgkinson). Merioneth: Aberdovey (Arkle). Norfolk: Norwich (as an aberr.) (Barrett). Ross (F. B. White). Warwick: Knowle (Bradley). Westmorland: Witherslack (Hodgkinson), Kendal district, Coot Scar (Gregson). Wigtown: Corsemalzie (R. S. Gordon). York: Great Ayton (Lofthouse). Distribution: Mountains of Central Europe, including Great Britain (Rebel). Austro-Hungary: distributed everywhere in the Austrian Alps (Rebel), Hernstein district—Gahns (Rogenhofer), Schneeberg (Mann), Hochschwab, Stelvio (Rebel), Trafoi (Wocke), Carinthia (Höfner), Carniola (Mann), Tyrol—Innsbrück, to 6600 ft. (Weiler), Franzenshöhe, Lafatscher Joch (Heller), Bozen (Hedemann), Kaiser (Hofmann), Glockner (Mann), Upper Austria (Aigner), Galicia (Garbowski). Bosnia and Hercegovina: Trebevic (Apfelbeck), Treskavica, at 1800m. (Rebel), Maklenpass (Hilf), Prenj, Velezi, at 1700m., Gacko (Rebel). Corsica: Monte Corte (Curò). France: Doubs—Pontarlier (Bruand), Seine-et-Loire — Couches-les-Mines (Constant), Savoy—Lanslebourg, Bourg St. Maurice, Petit St. Bernard, Grésy-sur-Aix, Chavoire, Dauphiny—La Grave, Bourg d'Oisans, St. Michel-de-Maurienne (Tutt). Germany: Baden—Ueberlingen, St. Leonhard (Reutti), Württemberg—Eisenbach (Steudel and Hofmann), Mecklenburg—Friedland (Stange), Neustrelitz (Herrich-Schäffer), Pomerania — near Stettin (Büttner). Italy: Italian Alps (Curò), Piedmont—Bobbie (Tutt). Malta (T. B. Fletcher). Switzerland: near Zürich, on the Uitliberg (Frey), Bergün (Zeller), Degersheim, Gäbris (Müller).

Stainton's two descriptions of *plagiodactylus* (*Syst. Cat.*, app. p. 28; *Ent. Ann.*, ii., p. 45) make this a darker, yet more brightly-tinted, insect than the type, the anterior wings with (1) an ochreous tinge towards the inner margin; (2) the black streak in the anterior lobe much more strongly marked; (3) two distinct black streaks in the second lobe; (4) the costa, beyond the middle, much clouded with dark fuscous. The original specimens, on which the first description was based were taken on the Schneeberg, one of the Austrian mountains, by Mann, but Stainton had no hesitation in admitting the insect as British, and in concluding that the insect that Gregson took in June and July, 1853, in North Wales, was the insect he had named *plagiodactylus*, and further, that it had also been taken in Cumberland, thus uniting *plagiodactylus*, Sta., with *scabiodactylus*, Gregs. Jordan described it under the name *scabiosae* (*Ent. Mo. Mag.*, xviii., p. 122) as the small bright-looking form of the Lake district, at first sight very different from German specimens, which have a much larger blotch on the costa, but the "plagium" distinct in both. South says that specimens bred from Gregson's Llanferres larvæ in 1881 and 1882, are more strongly marked, and perhaps smaller than imagines from Folkestone, but that others, bred in 1885, were somewhat larger than those bred in 1881 and 1882, one or two less strongly marked, so that they did not differ at all from specimens from Folkestone (*Ent.*, xviii., pp. 274-5); but, as he further states that he could not distinguish between these and *S. coprodactyla* and *A. pelidnodactyla*, his opinion is somewhat discounted. Barrett appears to have fallen into a sad muddle (*Ent. Mo. Mag.*, xviii., p. 179) by trying to separate the more typical examples into *plagiodactylus* and *bipunctidactyla*. He also attempted to connect the latter with *Scabiosa succisa*, and the former with *Scabiosa columbaria*. He states that, at Ranworth Fen, a patch of *S. succisa* produced examples that leaned altogether to the *plagiodactylus* form, whilst at Brandon, among *S. columbaria* and *S. arvensis*, the two forms were so mingled that one could not separate them. As, however, he goes on to make *plagiodactylus* the larger, and *bipunctidactyla* the smaller form, and also says that, in some specimens of *plagiodactylus*, the characteristic markings, as defined by Stainton, disappear, whilst in some *bipunctidactyla* these markings are seen pretty distinctly, one may conclude that he was only dealing with the usual aberrative conditions found in all localities where the type is common, in fact, he shows that he had not the local race described by Stainton and Gregson in his mind, for he further goes on to say that *scabiodactylus* from the Lake district has the clouding of the costa and the black streak much exaggerated. He appears to be later in the same confused condition of mind (*Lep. Brit. Isles*, ix., p. 375), although he gives a very good description of *plagiodactylus* (*scabiodactylus*), stating that, in the northwest of England, the tendency to the development of small black dashes on the lobes of the forewing, and a bordering of white between them, etc., becomes exaggerated, the costa above the fissure being blackened, so as sometimes to form a flattened dark triangle with the usual two dots at its apex; these dots are also joined together, and the hind marginal dots elongated into streaks. He then unaccountably connects this with the "umbreous form" of the fens, which he says, with considerable variation in colour, has the precise markings of the typical form. Unfortunately, he does not define the latter. We have already (*anteà*, pp. 336-7) referred to Hofmann's notes on this form, and his reference to original specimens captured by Mann (on the Schneeberg) and Zeller (at Bergün). Bankes observes that, in the "Mason coll.," the *plagiodactylus* only contained one specimen of the darker form, whilst the series of *scabiosae*, Gregs., though including several typical *A. bipunctidactyla*, were mostly of the darker form (*plagiodactylus*, Stn. *Man.*) with the forewings distinctly speckled with black and white, tinged with ochreous towards the dorsal margin, and with a strong black streak in the upper lobe. He adds (*in litt.*): "I secured 15 out of the 30 so-called *scabiosae*, and, of the 15, the majority are of this dark form, though only one shows the 'two distinct black streaks in the second lobe,' referred to above, whilst a few are typical

A. bipunctidactyla. Most of them are unlabelled, but 6 of the dark form are labelled (by C. A. Briggs) 'Purdey, Folkestone.'" Staudinger and Rebel diagnose (*Cat.*, 3rd ed., p. 77) the variety shortly as follows: "Alis anterioribus saturatioribus, squamis albis mixtis, striga fusca digiti primi longiore et crassiore."

β. var. *hodgkinsonii*, Gregs., "Ent. Mo. Mag.," iv., p. 178 (1868). *Hodgkinsoni*, [Hodgk.," Ent. Mo. Mag.," iv., p. 38 (1867);] Knaggs, "Ent. Ann.," p. 111 (1868); Jord., "Ent. Mo. Mag.," vi., pp. 123-5 (1869); xviii., p. 122 (1882); Barr., "Ent. Mo. Mag.," xviii., p. 180 (1882); Hodgk., "Ent. Mo. Mag.," xviii., p. 212 (1882); "Ent.," xxi., p. 295 (1888); South, "Ent.," xxii., p. 35 (1889); Hodgk., "Ent. Rec.," viii., p. 190 (1896). *Zophodactylus* var., Barr., "Ent. Mo. Mag.," xviii., p. 180 (1882); Tutt, "Pter. Brit.," pp. 94-5 (1895); Barr., "Lep. Brit. Isl.," ix., p. 379 (1904). *Bipunctidactyla* var., South, "Ent.," xxii., p. 35 (1889).—Alar expanse 7-8 lines; head, face, thorax, body, and legs, of a light, creamy, ashy-grey, lightest towards the cleft; very slightly irrorated with darker atoms; the discoidal and cleft-spots scarcely perceptible. Underwings rather darker than the upperwings. *P. hodgkinsonii* differs from *P. lowei* (*loewii*), to which it is nearly allied, in the general colour being lighter, the less irrorated or suffused appearance, its lesser size, and its want of the light canary-coloured terminal costal edging to the tip, and also in its time of appearance; from *P. plagiodactylus* it differs in its smaller size, much lighter colour, the entire want of the bright buff and light ashy-white upon the thorax and body,* the absence of the dark blotches so conspicuous upon good specimens of that species, the absence of any light edging to the cleft, and in being devoid of any light colour upon the terminal joints of the legs; from *P. bipuntidactylus* it differs in its smaller size, more yellowish ashy-colour and lighter-coloured legs, and from the spurs being of the same colour as the legs, those of *bipunctidactylus* being lighter than the legs. A single specimen captured in early June, *circa* 1860, in a small pasture-field at Witherslack (between the inn and "moss"); three captured later in the juniper field near, by Hodgkinson, of which one each was given to Gregson, Doubleday, and Burney. One or two others taken since by Hodgkinson. Very closely allied to *P. lowei* (*loewii*); indeed, none but a practised eye would detect the differences (Gregson, *Ent. Mo. Mag.*, iv., p. 178).

Whether this is a form of *A. bipunctidactyla* or *A. zophodactylus* has long been a matter of controversy, but, in spite of our remark (*Pter. Brit.*, p. 95), South was the first British lepidopterist who rightly suggested that this insect was a form of *bipunctidactyla*. That this is so, is abundantly proved by the example in the "Doubleday collection," mentioned by Gregson (*anteà*), which is an undoubted specimen of *A. bipunctidactyla*, and Bankes observes that he is in possession of six examples that stood as "*hodgkinsoni*" in Hodgkinson's own cabinet series; they are all worn *A. bipunctidactyla*, and appear to have been, when fresh, almost typical examples of the species. He has also six others from the "Mason collection," which were also part of Hodgkinson's original series, and of these, five are very worn *A. bipunctidactyla*, and probably, when fresh, not really paler than typical specimens, whilst the remaining one, wasted to a mere shadow, may not be this species, and is certainly not *A. zophodactylus*. Bankes further observes that he examined the whole of the series in Hodgkinson's collection, and concluded that all were worn *A. bipuntidactyla*, some of normal size, others small. Hodgkinson himself observes (*Ent. Rec.*, viii., p. 190) that "there is, in all specimens, a light (very pale) streak on the lower side of the upper wing, and the heads of all are of a very pale ash-colour, as also are the legs." He further says that he took, "with *hodgkinsoni*, some examples of *plagiodactylus*, with the tips more hooked." He records the capture of eight examples at Witherslack on May 19th, 1867, three others in 1863, and observes that it appears to

* Very indistinct or obsolete in the ♂s of this species.

be a very early species, differing from its allies in its manner of resting. Four of the 1867 examples were very fine, and a few eggs were obtained. Others, he says, were captured on June 12th, 1888, at Windermere. He rightly maintained (*Ent. Mo. Mag.*, xviii., p. 212), when Jordan (*Ent. Mo. Mag.*, vi., p. 122) and Barrett (*op. cit.*, xviii., p. 180) referred to the insect as a slight aberration of *A. zophodactylus*, that it was quite distinct from the latter, and that centaury did not grow within miles of the spot where the insect was taken. He further observes (*Ent.*, xxi., p. 295) that the insect is without the slaty shade that is on both *A. bipunctidactyla* and *A. zophodactylus*, and that none of the foodplant of the latter grew in the localities where *hodgkinsoni* had occurred. South records (*Ent.*, xxii., p. 35) the capture of two specimens in North Devon that agreed with Gregson's description, and he suggested that these, as well as *hodgkinsoni*, were probably referable to *bipunctidactyla*. In spite of the overwhelming evidence that is offered by the specimens themselves of the accuracy of this suggestion, Barrett repeats (*Lep. Brit. Isles*, ix., p. 379) that *hodgkinsoni* "appears to be nothing more than the first brood of *zophodactylus* from northern Lancashire and Westmorland."

γ. var. *aridus*, [Zell., "Isis," p. 904 (1847); "Stett. Ent. Ztg.," xi., p. 210 (1850); "Linn. Ent.," vi., p. 366 (1852); H.-Sch., "Sys. Bearb.," v., p. 376 (1855); Hein. and Wocke, "Schmett. Deutsch.," p. 795 (1877);] Sta., "Ent. Ann.," p. 143 (1870); Gregson, "Ent. Mo. Mag., vii., p. 88 (1870); Knaggs, "Ent. Ann.," p. 94 (1871); [Buckl., "Ent. Mo. Mag.," x., p. 182 (1874);] South, "Ent., xiv., p. 77 (1881); Barr., "Ent. Mo. Mag.," xviii., p. 179 (1882); [Pal., "Nat. Sic.," p. 193 (1885-6); Mill., "Nat. Sic.," p. 223 (1885-6);] Tutt, "Pter. Brit.," pp. 87-8 (1895).—Alis anterioribus gilvescenti-griseis, juxta costam obscurioribus, puncto sub fissura fusco, ciliis costæ apicalibus fuscescentibus, puncto in ciliis anguli postici laciniæ anterioris unico fusco; ciliis digiti tertii breviusculis. *Var. B*, puncto sub fissura obsoleto. *Var. C*, strigula albida per laciniam anteriorem obsoleta (♂, ♀). The size is like that of the smallest *fuscus* of the autumn generation, and the colour has a similar reddish dusting, only still paler. The parts of the wings are more slender, especially the front lobe of the forewings, which is narrower and longer. The fringes of the hind margins of the lobes are whitish at the base, and on those of the front lobe the brown spot shows out distinctly. The costal fringes of this lobe are very narrowly whitish only at the beginning of the fissure of the wing, but, from there to the tip, the brown gradually increases in width. Before the fissure is a brown spot, somewhat variable in shape, smaller than in *fuscus*, and not reaching so far above the fissure, like the lower part of the same spot in *fuscus*; this spot is in var. *B* entirely obsolete. Sometimes the front lobe has, in the usual position, a faint, whitish, transverse line. On the underside, the wings are greyish-brown, the apical half of the lobes of the forewing, and the first feather of the hindwing, are tinged with whitish. The legs are dirty whitish. This species appears to be not rare in Italy and Sicily, and to be the local representative of *fuscus*. It flies near Syracuse in May (on the 23rd, an especially large and dark example of var. *C* was captured; on the 30th, a ♂; on the 31st, two ordinary ♂s and one ♀), and in June (4th, 6th, 7th, 19th). Near Messina, at Castellacio, it was not rare throughout the whole of July, amongst dry grass. Singly, I have obtained it near Rome (August 27th), Narni (September 4th), Tolentino (September 6th), and Ancona (September 11th). Its localities were always dry grassy places (Zeller, *Isis*, 1847, p. 904). Middle of May, near Ardivoza, on the pastures, not scarce, and collected at the time as small specimens of *mictodactylus* (Zeller, *Stett. Ent, Ztg.*, xi., p. 210).

Whether this insect is really only a southern race of *A. bipunctidactyla*, of which similar aberrations occasionally occur in other parts of its range, whether it is a form of some other allied species, or whether it is a distinct species, we have no means of judging without a sight of Zeller's original specimens. Hofmann favours (*Die Deutsch. Pteroph.*, p. 72) the last-named view, noting it as "manifestly a species that only occurs in the Mediterranean region, where the larva feeds on *Coris monspeliensis*, a plant belonging to the *Primulaceae*," although, strangely, we cannot find, in Zeller's notes on the species, that he confines it to this particular foodplant, this conclusion having been reached by Buckler (*Ent. Mo. Mag.*, x., p. 182). In the Frey collection are two specimens labelled "*aridus*," "Brussa (Mann)," and "Corsica (Mann)," of pale greyish colour and very doubtfully to be referred to *A. bipunctidactyla*, and quite possibly distinct therefrom. Rebel, however, does not even query it, but makes it a var. of *A. bipunctidactyla*, and diagnoses (*Cat.*, 3rd ed., p. 77) it, as "Minor, multo dilutior, lutescens. Southern Europe, Armenia, Hyrcania, Palestine." In 1852, Zeller wrote (*Linn. Ent.*, vi., p. 366) that "the principal difference between it and *loewii* (*zophodactylus*) is the presence of a small blackish-brown dot at the inner angle of the upper lobe. The best species with which to compare *aridus* is *stigmatodactylus*, which occasionally agrees with it almost exactly in size. It (*aridus*) is paler at the apex of the anterior wings, which is less produced; the blackish-brown dot at the end of the cleft is less distinct, and, if enlarged, is increased upwards towards the costa; whilst *stigmatodactylus* usually has a sharp black dot situated in a very oblique direction inwards above the lower one, and the fringes of the anterior border of the apex of the forewings are not edged with white." Millière records (*Nat. Sic.*, 1885, p. 223) the insect from the Esterel and Cannes, in October; and Palumbo notes (*op. cit.*, 1888, p. 193) it from May to July, at Monte Medio, Syracuse, and the Madonie mountains, all in Sicily. Turati says (*Bull. Soc. Ent. Ital.*, 1879, p. 207) that it occurs in the Brughieri di Alzate, in Lombardy, in September. In favour of supposing that a form of *A. bipunctidactyla* occurs in this country, agreeing with *aridus*, is Stainton's remark (*Ent. Annual*, 1870, p. 143) that Zeller writes that, amongst the specimens of *Pterophorus* which he had received from Jordan, was one which had been captured by D'Orville, in Devonshire, and which appeared to be identical with the Italian *P. aridus*, and raises the question whether *aridus* is only a pale variety of *serotinus* (*bipunctidactyla*), or whether the English and Italian climates are sufficiently in accord for the same species to exist in both. Gregson observes (*Ent. Mo. Mag.*, vii., p. 88) that he captured a specimen in the Isle of Man, which, on comparison with D'Orville's example, was found to be identical with it. Since then, several supposed examples have been taken of this particular British form, and referred to *aridus*, the name, in Britain, being thus used merely for an aberration of *A. bipunctidactyla*. Hofmann, referring to the German records of *aridus*, says: "The examples recorded from the Baltic coast of Russia, are probably (*teste* Wocke) based on incorrect identification; the same is probably the case with the statement of its occurrence at Heudorf, in Württemberg." Bankes refers to fifteen so-called *aridus* in the "Mason" collection, as "all typical *bipunctidactyla*, except three, the worse for wear, which, when fresh, were perhaps rather paler than usual, though by no means so pale a form as is occasionally met with in Britain; but it is quite possible that their pallor is solely due to absence of scales." Crombrugghe de Picquendaele says that, in Belgium, *aridus* only occurs in the Campine, on the edges of the little lakes distributed over the large lande or plain of Calmpthout; here it was common in July, 1900. [Buckler's account of the insect he referred to *aridus*, is given at the end of our notice of *A. bipunctidactyla*.]

Egglaying.—The eggs of the August moths are laid freely on the flower-buds, generally between the florets, or between the florets and involucre, none on the leaves or stem. Eggs laid between August 23rd-28th, 1904, commenced to hatch on August 31st (Bacot).

Ovum.—Pale yellow in colour, a rather long ovoid in shape, with flattened sides; for so small an egg it is coarsely sculptured, in some places with an irregular cell pattern, in others with rude longitudinal corrugations; these are chiefly on the sides towards the smaller end, the cell pattern on the shoulders and micropylar end. Length, 0·475mm. to 0·5mm.; width, about 0·25mm.; as I cannot manage to balance the egg on its edge, I can only guess at its thickness, but this is probably about 0·2mm. [Bacot, July 27th, 1904. Several eggs laid in a small cluster, forwarded from Folkestone by Purdey.] Clear yellow in colour, form ovoid; length, 0·45mm.; width, 0·24mm., narrowing a little more acutely to the non-micropylar end; height, 0·21mm. towards micropylar end, a little less towards nadir. The ribs are very bold, but the pattern is not polygonal, at least the cells tend to run together into longitudinal waved furrows, *i.e.*, in somewhat sinuous lines from end to end of the egg. The ribs are not, as is usual, like fine beads laid on, but are merely the tops where the regularly-curved hollow of one furrow meets the next one. Towards the micropylar end, or rather just on it, and round the micropylar area, the sculpture is in more ordinary polygonal pattern. [Described August 25th, 1904. Eggs laid by ♀ a few days before.] Some eggs laid August 29th, differed somewhat from these, smooth and shining, the sculpturing was much less pronounced, and the hollows were here represented by mere flattenings; they were also somewhat shorter than the others, *viz.*, 0·40mm. The height was 0·21mm. towards the micropylar end, 0·19mm. towards the nadir (Chapman).

Habits of larva.—From eggs laid in August and September, hybernating larvæ hatch, the autumn habits of which are practically unknown, but, in the early spring, the larvæ may be found actively boring into the main central stem, clearing out the leaf-bud, and going down for some distance, even below the surface of the ground. On May 23rd, 1904, in Raindene Wood, Folkestone, the young scabious plants had begun to make good growth, and were some six inches above the ground, and, in these scabious plants, larvæ of *A. bipunctidactyla* were not uncommon. They were feeding in the central shoot, mining down the length of the two central leaves, eating out the bud and into the shoot, causing considerable lateral growth, and filling up their burrows with dark, thick, frass. The affected shoots were easily recognised, when found, by their dark colour, and, generally, by a hole in the upper part of the two leaves, which close over the central shoot, by which hole they seem to have entered rather earlier, when leaving their hybernacula. Pulling these leaves apart, at once discloses their workings, the larvæ being generally fairly well down in the mine, and of various sizes, from about 4mm. to 9mm. (*i.e.*, nearly fullgrown), and very variable in colour. Some of the mines were quite cleared out, and the larva was then found in one of the adjacent lateral shoots, which it appeared to have entered from the side of the two enclosing leaves. Although one speaks of the larva as a burrower, it really feeds entirely on the leaves forming, and enclosing, the bud, but does so entirely from the inside. It is hardly a burrower in the sense that the Platyptiliid larvæ are. Barrett says he found larvæ on May 19th, 1871, near Norwich, that the work of a larva "causes the shoot to droop, when it is quickly hidden by the young plant," but this is hardly so, for the bud of the main shoot, even when almost cleared out, remains enclosed in two upright folded leaves, which do not droop, although the growing is very effectively stopped, and the attacked shoots are usually exposed, not hidden, pupation taking place before the unattacked lateral shoots are tall enough to hide those in which the larvæ have fed. Hofmann writes (*Woch. für Ent.*, iii., p. 307) that the little larvæ of the spring generation, are found from April 25th to May 18th, deep in their burrows in the central shoots of *Scabiosa columbaria*, which, he says, they forsake later in order to live openly on the leaves. Gregson makes (*Ent.*, xviii., p. 150) a similar observation, *viz.*, that the young larvæ eat into the central unopened leaves of *Scabiosa succisa*, and later eat the radical leaves. We have never been able to confirm this external mode of feeding in nature, although we have found an abundance of fullfed larvæ in the mines. The moths from these larvæ appear from May to early July. The feeding-habits of the second brood are entirely different, although little again is known of the life-history of this brood. Chapman notes that a plant, on which eggs must have been deposited, was sleeved on July 4th, 1904, and on August 13th he found pupæ, as well as living and dead moths, therein. Examination showed that the tips of all the branches were dead, that they had been mined inside, the cavity extending into the living tissue; in one case the cavity was very large, suggesting that the larva was very large before it left it (quite half-grown) and had a hole attached much like that of *Adaina microdactyla*, whilst those of the others were smaller. One living and one dead imago, and two empty and two full pupa-cases, were on the muslin on August 13th, but the two living pupæ yielded imagines the next day. The suggestion, therefore, is that the larvæ finally fed up externally. The habits of the larvæ of the next brood are the best known. Larvæ, hatched on August 31st, 1904, and following days, disappeared at once between the florets and flower-head; by September 5th, several florets on one or two heads looked very unhappy; some half-dozen larvæ also were mining in the leaves near the flower-heads (not the lower larger leaves), either from eggs on stems overlooked, or wanderers from the overstocked flower-heads. By September 8th, the florets in many places obviously failing, only a few coming out well, larvæ were now visible elsewhere on the plant mining in several of the narrow stem-leaves, generally in direction from tip to base. On September 12th, a young larva was noticed walking down flower-stem (it was well grown in first instar); two heads have the stem beneath them dying, and are drooping, one of these is found to be drying up, and has the receptacle well mined by larvæ, but all have gone. The other is less dry, but the larvæ have all gone except one that is fullgrown in first skin, and that is mining into the stem. The leaves or flower-stems seem to have more miners than they had; the larvæ in them, seen against the light, are growing, but not fullgrown, in first skin. On September 16th, a flower-head is seen to be drooping. This is a rather small flower-head with abundant eggshells. It looks all right, though it has not developed at all for a week or more; the stem for an inch below it seems all right, but, at the node below, and for some distance above, it is withered. The flower-head, when opened, has had the interior, especially the layer of ovaries, eaten out, but all the larvæ have gone; one larva, about half grown in first skin, is found at the node mining in the stem, and is apparently the cause of the withering. Where are the others from the flower-heads? Various mined leaves are also withered, and drying up. The mines show a small hole of the larval escape. Some mines are still occupied; in one a larva can be seen with the head dislocation that indicates preparation for a moult (in this case the first); an adjacent mine has a larva with a distinctly larger head, *i.e.*, in the second instar. This and one or two others eject the frass from the mine, the smaller ones leave it in the mine (Chapman). In another lot that Chapman had, belonging to this autumn brood, a larva was buried deeply in the bud, on August 17th, which, little disturbed outwardly, had the bases of many flowers replaced by frass; on September 20th, one of these moulted and burrowed into a flower-bud, spinning a few threads to the involucre; smaller larvæ were completely buried, the place of entry being marked by a trace of frass. On the 22nd, a large larva, partly exposed the previous day, was also practically out of sight, the bud not being quite large enough to allow it to be within and retain its outer form unimpaired, so that some flowers are so far destroyed, by the feeding, as to allow the larva to be discerned, apparently in a curved attitude, near the centre of the bud; by the 23rd, this larva had so eaten out the centre of the bud as to be well exposed, and, in the afternoon, descended to a lower flower-head, on which it was fully exposed; it seemed to be nearly fullgrown. By the 24th it had cleared out this bud and had entered another in which the front segments were buried; after this, the larva ate a flower-head per day until the 27th, when it fastened itself up for pupation (Chapman). Bacot also notes (*in litt.*) the habits of this brood; the ova, placed on the flower-buds of a growing plant, gave larvæ that immediately bored between the flowerets and involucre of the buds on the main and lateral stems; another bud had been bored through by a larva that remained invisible, a small heap of frass being seen when the outer leaves of the involucre had been removed; the interior of the bud had been removed, and there were large quantities of fresh frass low down among the flowerets. The larvæ are by no means easy to find, in spite of unmistakable signs of their presence, and require some search before they can be finally run down; as they increase in size, they feed at a great rate, emerging to seek fresh feeding-places, entering buds that have just commenced to open or are unexpanded, and often leaving the bud of the main stem for the smaller lateral buds. Their feeding makes little difference to the outward appearance of the bud, a small quantity of silk being used to spin around the portion of the bud attacked (Bacot). Larvæ found at Newbury in early September, 1890, were feeding on the flowers of scabious; they were then very sluggish, and ate through the bases of several florets, being completely hidden, and, until the flower-head was pulled apart, there was no sign of the larva within (Kimber). In Germany, we observe that, in Mecklenburg, Stange found larvæ at the end of June and July, in the flowers of *Scabiosa columbaria* and *S. succisa*; Rössler found the larvæ in the Wiesbaden district in the beginning of May, in the stalks of *Scabiosa columbaria*, whilst he describes the feeding-habits of an autumnal brood found at Wiesbaden in early September, 1863, in the flowers of *Scabiosa succisa*, the larvæ only betraying their residence therein, by small threads on the blue petals; he observes that they pupated in a few days, and emerged 10 days after pupation. He also says that the statement that the larvæ feed on *Galium* appears to be very doubtful, and requires verification. Feeding in the blossoms at the same time, he discovered the larvæ of *Nemotois scabiosellus* (*Ent. Mo. Mag.*, xviii., p. 183 ; *Wien. Ent. Zeitschr.*, 1864, p. 201) ; in Silesia, Wocke found the larvæ in April, in *Succisa pratensis*, and again in the summer; whilst, in Württemberg, Steudel and Hofmann record it in May in the shoots, and in July-August in the blossoms, of *S. pratensis*. Hofmann observes that he found the larvæ, on July 21st, 1895, in the interior of the hollow flower-heads of *Scabiosa columbaria*, the flowers offering no outward indication of the larvæ within ; when fullfed, the larvæ were seen sitting on the blossoms, feeding thereon, and boring holes from the outside through the separate florets. According to Sorhagen, "the larva lives in May, July, and September, on *Scabiosa succisa*, *S. arvensis*, *Scutellaria galericulata*, *Linaria cymbalaria* (in France), *Galium mollugo* (Herrich-Schäffer), *Saxifraga granulata* (Angerer), in spun-up flowers or shoots." Hartmann also notes that the larva is said to feed on *Saxifraga granulata* in April-May, and September; and Koch on *Galium mollugo* in mid-September. No doubt, Hartmann's reference is to *Stenoptilia pelidnodactyla*, the larva of which feeds on *Saxifraga granulata*, whilst, of Koch's record, evidently copied from Herrich-Schäffer, one would like confirmation.

LARVA.—*First instar* (newly-hatched) : Barely 1mm. long. Head about same width as body, which tapers a little towards tail. The head dark, body whitish, or faintly yellowish (or colourless). Prothoracic plate large, faintly tinted. Amongst a number of ordinary hairs on head (about 0·015mm. long) are two from the eye-region, very long, at least four times the length of the others (about 0·06mm.), and standing forwards like horns or antennæ. Two lateral hairs on the prothorax are about as long, and several on the 9th and 10th abdominal segments; the rest are about 0·03mm. in length, stiff and straight, slender, and faintly clubbed at tip. The tubercles are faint black dots, the hairs colourless, or faintly tinted towards the tip ; each tubercle has only one seta or hair ; i and ii are placed about $\frac{1}{4}$ length of segment apart, and rather farther than this from middle line, ii being decidedly further out than i ; the setæ upright, that from i inclined slightly forwards, from ii rather backwards, iii has a seta directed forwards; iv and v are well separate, the forward one (v) higher, and with a shorter hair, about three-fifths of that on iv, which is about equal to the seta on ii or iii ; the long hairs on the 9th and 10th abdominal segments are apparently iii or v ; on the prothorax, the long hair is subspiracular. The spiracles on an elevation. The prolegs on longish pedicels, with three minute hooks ; the anal claspers larger, hooks also larger, but apparently only two hooks, a third merely vestigial (Chapman, August 29th, 1904). *Second instar ;* Head rounded, black, highly polished, and partly retractile beneath the skinfolds of the prothorax. The scutellum large ; anal plate small, both very dark, but not quite as dark as head. The body is of nearly even thickness, only slightly tapering to anus; the segmental divisions sharp, but not particularly deep. The colour is a dull pinkish, and the skin-surface very rough, owing to spicules. Hairs rather short and tapering, not serrated. Tubercles on the meta- and mesothorax are—i and ii side by side, i the inner, and slightly to the front ; iii and iv on the same plate, v having a longer hair with a small one below and behind it; vii has two hairs. On the abdominals, i and ii are somewhat separated; iii close above the somewhat raised spiracle; iv and v together beneath it, as usual. The spicules are dark points [The facts that v has another hair close to it, and that the spicules are present, show that this larva is in the second, not the first, instar.] (Bacot, August 4th, 1905). *? Third instar* (small): 3mm. long. Deep brown-red in colour, with traces of paler subdorsal and spiracular lines. Each tubercle (i, ii, iii, iv, and v) carries a long hair, nearly as long as the larva is thick, slightly thickened at the tip, and quite white; it has also a number of short, white, secondary skin-hairs, about $\frac{1}{4}$ length of tubercle-hairs; no secondary hairs on tubercles. Head pale in front, but, dorsally, deep brown-red; this tint runs into the pale as three or four interrupted broad streaks, narrowing downwards. *Third instar* (grown): [Another bud contained another larva very much larger, but apparently in same skin; this one is ready to moult;] the thoracic segments being very swollen, with a pale, long, white neck; legs widely separate, etc.; the hairs relatively short; length, perhaps, 6mm., but I did not fully disturb larva. Its colour is pale, with two irregular longitudinal red bands on either side (very like that of *Platyptilia gonodactyla*); the extension of the skin by growth, affecting chiefly, apparently, the pale portions (Chapman, August 17th, 1904). *? Fourth instar:* Colour dark green, with a darker dorsal shade, that fades into a paler area, ending just outside ii, as a sudden change from whitish-green to dark green, but, even here, there is no definite demarcation, though it is more sudden than the change from the dark dorsal to the whitish subdorsal area; there is a paler lateral line along flange below iv and v, and obscure paler lines above this; spiracles black; tubercles i, ii, and iii each has a single white hair; iv + v carry two, the front one higher; the hairs on i, iii, and v incline forwards; those on ii and iv backwards; all with a slight curve, length about 0·5mm. The secondary skin-hairs are numerous, black on the darker dorsal area, white elsewhere, except a long one behind iii, which is rather a secondary tubercular hair, and several that seem also rather tubercular, than skin, hairs, round iv + v. These are about 0·1mm. long, that of iii 0·15mm., whilst the ordinary skin-hairs are about 0·08mm., but vary a good deal, some round i and ii are rather longer, and seem to incline to be tubercular. These, like the other skin-hairs, have dilated tips, which is hardly so with the black ones of iii, and iv + v, and are fine skin-points. Prothoracic plate with black markings (Chapman, August 25th, 1904). [These larvæ hung up for pupation August 27th and 28th.] *Final instar* (spring larva, not fullgrown): Only 6mm. in length. It differs chiefly from the fullgrown larva in that it is reddish-purple in colour, without any green, and that the skin-areas at the bases of tubercles are more raised; this, of course, may be partly owing to its not having filled out and so stretched its skin. The dorsal tubercles have not, as a rule, a second medium-sized hair in addition to the normal primary one, and the upper accessory post-spiracular is not so conspicuous, owing to its small size. *Final instar* (spring larvæ, fullgrown):—Length of the largest larva when crawling (it will not rest), 12mm.; width slightly less than 2mm.; in form, a long slender larva, nearly or quite cylindrical, and tapering gradually in both directions to a small head and rather pointed anus. The segments are plump and full, with well-marked incisions, but no noticeable overlap. The subsegments are only slightly in evidence on the abdomen when crawling, but are rather better marked on the thoracic segments. The body is bright green, softened somewhat by the secondary hair growth; a broad crimson mediodorsal band, and a narrow, somewhat interrupted, white subdorsal line. Hairs, and the bases of tubercles, white, but some of the secondaries are dark. Head smooth and glassy in appearance, very pale brown, with black ocelli, and a black spot on either lobe near the crown; there is also a slight mottling of pale brown on the cheeks. Body: the prothoracic scutellum fairly distinct, but the anal plate less so, although both are more chitinous in appearance than the general skin-surface. The scutellum bears the two, dark-coloured, depressed, spots as in *S. pterodactyla*, etc. The spiracles are large, but not highly raised, their dark brown chitinous rims showing up in marked contrast against the pale skin; as usual, those on the prothorax and the 8th and 1st abdominal segments are larger than the rest, the two former considerably, and the latter slightly so, but there is no marked difference in shape. The spicular coat is a marked feature, being both coarse and dark-coloured as well; one hardly knows whether to call the spicules buttons, or spines, but, perhaps, the latter is more correct, as they seem to be low, broad-based, pyramidal spines. A strong development of secondary hairs is fairly evenly scattered over the general skin-surface; these are short and bristle-like, slightly knobbed at the top; some are dark, but they are mostly pale; these are much more numerous than in *Stenoptilia pterodactyla*, and remind one, when viewed under a hand-lens, rather of the coats of *Gillmeria pallidactyla* and *Platyptilia gonodactyla*, but a 1in. objective shows up the difference at once, the hairs, in comparsion with those of *G. pallidactyla*, in its last skin, being much sparser, but individually larger, and knobbed at the tip, those of *G. pallidactyla* forming a finer, more even, and much thicker, growth. Tubercles are not primitive, yet can hardly be called warts; the hairs are white and have white bases, and they appear fairly smooth, but are, I think, very finely thorned, and slightly knobbed at the tips. As a rule, there is one large primary hair and a medium secondary, and possibly one or two of the small secondary hairs, similar to those scattered over the skin-surface, associated in each tubercular group; though, whether the proximity of the small skin-surface secondaries is a matter of accident, or really an association, is not clear, but I am inclined to think the latter, as these small hairs, when so placed, seem to my eyes to be slightly larger than those elsewhere. On the meso- and metathorax, i and ii are united at their bases, the inner and forward hair, probably i, being the larger; iii and iv form a similar pair; v and the subprimary vi form another pair; beneath them, and the posterior subprimary, is a single hair slightly above the level of the last-named pair; vii is a two-haired pair at the base of legs. [Only the larger hairs are noticed in the above remarks.] On the abdominal segments i and ii are set trapezoidally, their bases well apart, both having, usually in close proximity to their bases, a hair rather larger than the normal secondaries, as well as two or three of normal, or only very slightly above normal, size, these latter are not infrequently dark; iii is also a large hair with another much smaller hair adjoining its base, and one or more of the normal or nearly normal secondaries; iv and v conjoined at base, directly below spiracle, each with long hair. The upper post-spiracular, accessory group is represented by a single medium-sized hair as in *S. pterodactyla*. This hair is not nearly so large as the primary hairs; there is, however, no trace of the lower subprimary postspiracular group of hairs which is represented in *Stenoptilia pterodactyla.* Below the pale, whitish, lateral line, is vi, with a single large hair, and two rather smaller ones at, or close to, the margin, represent vii; there is a slight tendency to develop a lateral flange. The true legs are dark; the prolegs tall as usual, and pale-coloured (Bacot. Larvæ received from Tutt, May 24th, 1904. Larvæ described at once). *Final instar* (fullgrown): A deep summer grass-green, as compared with the delicate, light, spring green of *Leioptilus tephradactyla*, with a broad, brown-red, dorsal stripe, and the same colour tints the rest of the larva, giving the green its dark tint, when, on a general view, one calls it green with red dorsal line; really the colour is not green, but red; but, except dorsally, it is so thinly spread, that the green contents show through. There are two very distinct subsegments; tubercles i and iii with single long white hairs (no other tubercles) on the 1st subsegment, and ii on the 2nd subsegment; outside i and ii is an irregular, almost green, line; above i and ii are short secondary hairs, regularly scattered, *i.e.*, about equally spaced, but not in any symmetrical position; of these, about 10 or 12 are black, 25 to 30 white; they are placed similarly over the rest of the larva. Immediately below the spiracle is a tubercle with two long hairs (iv and v), one forward, one backward; lower down, a tubercle with a solitary hair, and yet another nearly at base of proleg. The prolegs are on long props. The underside of the larva is more definitely green; the head green, marbled with brown (Chapman). Fullgrown: About 5 lines in length, of moderate proportion, neither stout nor slender, tolerably cylindrical, tapering a little posteriorly; the head rounded and rather smaller than the second segment, of a very pale colour and shining; the body is very pale olive-yellow, with a conspicuous brown dorsal line attenuated at each end, and with two faint lines along the side a little deeper than the tint of the ground colour; on the lowest line are the black spiracles, each on a slight swelling; the tubercular warts are of the pale ground colour and furnished with rather long curved whitish hairs; the head and other parts of the body emit short hairs (Buckler). Larva spindle-shaped, verdigris-green; a broad, dull, red, dorsal line, margined on both sides with whitish-green, as far as the usual position of the subdorsal line. Head, anterior legs, and spiracles, brown-black, the anterior segments with some brown dots; the body clothed with isolated whitish hairs (Rössler). Buckler figured (*Larvae*, etc., pl. clxiii., figs. 9, 9*a*, 9*b*, and 9*c*) larvæ of this species in various stages of growth, of which fig. 9 was drawn on May 10th, its imago appearing on June 17th, 1872; 9*a* was figured on May 21st, 1871; 9*c* was also figured on May 10th, 1872, its imago appearing on June 9th, 1872). He also figures (fig. 9*d*) the attacked foodplant, showing the point of ingress of larva (9*b*) in a shoot of *Scabiosa columbaria.* He further figures the pupa, a poor figure compared with some of the other figures. The larva is also described by South, *Ent.*, xviii., pp. 273-4.

Comparison of larvæ of Adkinia bipunctidactyla and Stenoptilia pterodactyla.—The larva of *A. bipunctidactyla* agrees with that of *S. pterodactyla* in—the curve of the primary hairs, the presence of the depressed black spots on the scutellum, the pale lateral line, the faint subdorsal band, and dark median band; it also agrees somewhat in shape and slenderness; it is very close in regard to the growth of secondary, or skin-surface, hairs, and there are also a good many minor points of resemblance that would be difficult to enumerate, but which all help the general likeness. It differs at least, in the following points, the absence of the lower accessory post-spiracular group of hairs (or secondary post-spiracular tubercle), and also in regard to the greater strength of the spicular growth which is much more marked than in *S. pterodactyla*. The development of the tubercles has also not advanced so far in the direction of the formation of warts, the instar compared being the final one (Bacot).

Foodplants.—*Scabiosa columbaria*, *S. arvensis*, *S. succisa* (Barrett), [*Galium mollugo* (Herrich-Schäffer), *Scutellaria gallericulata* (*teste* Sorhagen), *Linaria cymbalaria* (*test.* French authors),] *Saxifraga granulata* (Angerer *teste* Sorhagen).] One would like confirmation of the four last-named as foodplants of this species. There is little doubt that the larvæ found on *Saxifraga granulata* were those of *Stenoptilia pelidnodactyla* and not *A. bipunctidactyla*. The various statements that the species is connected with *Galium mollugo* (*e.g.*, South, *Ent.*, xiv., p. 52, etc.) are to be traced to that of Herrich-Schäffer, which was quoted by Sorhagen. Hofmann long since noted that the statement was probably due to an error of observation, and apparently had no foundation in fact.

Parasites.—*Limneria ruficincta*, Gr. (W. H. B. Fletcher *teste* Barrett), *Apanteles difficilis*, Nees (Carrington), *A. sericeus*, Nees (Fitch).

Puparium.—The larvæ of the spring brood appear to leave their feeding-burrows for pupation, spinning a silken pad on an adjacent object, and, attaching themselves thereto by the cremaster, change to pupæ thereon. Gregson says that the fullfed larva suspends itself by the tail to the foodplant, or a blade of grass, or any other object it may find in the neighbourhood of its food, the pupal stage lasting about fifteen days. Buckler observes of a larva that suspended itself May 10th, that the imago did not emerge until June 9th. South observes that larvæ that commenced to pupate on June 5th, 1885, appeared from June 20th onwards, etc. The larva attaches itself like a butterfly larva, the pupa hanging, head downwards, by its anal attachment (Rössler); it is attached to a stalk of the foodplant (Hofmann); fastened either to a leaf or stem (South).

Pupa.—Long, slender, smooth, without distinct nose-horn or snout; green in colour with red dorsal line; this may be merely indicated, or it may invade most of the pupa. The usual colour forms are: α. Green, whitish on head and prothorax, with pink line from middle of prothorax to cremaster, where the red extends round the pupa. β. Red, in which the head and prothorax are still white, the mesothorax green, but with a pink line across the front; elsewhere the pink overlies the green, producing a brick-red subdorsally, a modified green laterally, and an olive-green on the wings and appendages, which are much darker than in the greenest pupa, but without any definite red tint. Length 10mm.; antero-posterior diameter at mesothorax 2mm.; 1·7mm. from 3rd to 5th abdominal segments, but with slight tapering. The mesothorax is swollen both laterally and dorsally, and gives this, with other Alucitid pupæ, much suggestion of dipterous pupæ, such as *Culex*, with swollen thorax. The swelling of the thorax is assisted by the subdorsal flanges rising here more markedly than elsewhere; they are somewhat close together, and form a double hump. These flanges extend backwards, separating gradually to the 3rd abdominal segment, but are not very evident on the 4th, though the hairs, etc., of tubercles i and ii give a superficial appearance of their continuing to the tail. Though described as smooth, it has these flanges or ridges, and also has the tubercles well expressed. The wings, etc., are fixed to the end of the 3rd abdominal segment, and the points of the wings extend a little further, forming a base to the penlike 3rd legs, which extend nearly to the end of the 5th abdominal segment, but quite free. The free segments are the 4th, 5th, 6th (7th in the ♂) abdominals. On the head and prothorax several hairs are found, but only one on either side, definitely, on meso- and metathorax; these are all short, curved, clubbed hairs, clubbed in that they gradually get thicker to the end. On the 1st abdominal segment, similar (but smaller) hairs occur on the extreme anterior (i) and posterior (ii) ends of the subdorsal ridges, and tubercle iii is observed laterally. The 2nd abdominal segment is a comparatively long segment; the ridge is divided into three nearly equal portions by i, just inside it, and ii, on it; tubercle iii and the spiracle being well-spaced laterally, *i.e.*, not at all crowded together or with others. On the 3rd abdominal segment, the ridge extends down to the intersegmental membrane, which occupies the posterior fourth of the segment; tubercle ii is at the extreme end of the ridge, and i, in front of it, one-fourth the length of the ridge (segment without membrane) in front of it. Their structure is curious; i is a round knob with a hair pointing forward from its anterior face; ii has the hair slightly more from the summit and pointing backwards. These knobs are whitish, but too small to have any colour effect on the pupa unless seen through a lens; iii is directed forward. The transverse wrinkling or ribbing is much the same here as over the rest of the pupa. The ribs are about 22 in number, and are fairly pitted along their ridges; they are too numerous to be subsegments, and too regular and continuous to be regarded as the anastomosing wrinklings occurring on many pupæ. They may, perhaps, be called ribs, without any theory being involved. The 4th abdominal segment has 20 ribs, and no flange-ridge; i, ii, and iii are as on the 3rd abdominal segment; the large white beads here, carrying the hairs, have, very definitely, the air of being erect and symmetrical, and then bent or rotated forwards (*e.g.*, i and iii) or backwards (*e.g.*, ii); below the spiracle are two hairs, curved and clubbed as the others, but without raised bases; they are about at the same level, the anterior one below the spiracle, and with two ribs between them; the next lower is four ribs behind the last, is strongly directed backwards, and has a raised base in front of it. The 5th abdominal segment has only about fifteen ribs, and is narrower; the tubercles, etc., are the same; the length of the hairs is about 0·08mm.-0·09mm. The 6th and 7th abdominal segments are narrower, but the same otherwise, still with fourteen or fifteen ribs, but they tend a little to anastomose. On the 8th abdominal segment, tubercles i and ii have a ridge between them, which is continued down the 9th and 10th segments as a support to the cremaster, but seems to be the same ridge that has been obsolete from the 4th-7th abdominal segments. There are about 50-60 hooks to the cremaster under the 8th abdominal segment, but they are much more numerous on the 10th abdominal. The eyes are well marked, the head projects forward (*i.e.*, ventrally) beyond the otherwise straight front line; such beak as there is, is directed ventrally. The maxillæ reach to half the length of the wings, the antennæ to three-fourths, and the 1st legs fall just short of the wings. The neuration of the wings is strongly marked by pale ridges (Chapman, May 29th, 1904). Pale green with an obscure reddish-pink dorsal line or stripe, which, in some examples, is only represented by short dashes behind the thorax and on the last four segments; the anal segment and tip of leg-cases pale pinkish; sometimes the whole of the dorsal area is also suffused with pinkish; wing-cases tinged with yellowish; leg-cases detached from the abdomen (South).

Time of appearance.—The species appears to be double- or treble-brooded, according to the season. In forward seasons, larvæ, collected in April-May, give imagines in late May and June; from eggs laid in June, imagines may be reared in August; and from eggs laid in August, the imagines emerge in late September and October. In backward seasons, one finds larvæ still feeding throughout May and June, which rarely give imagines until late June or early July; eggs laid in early July rarely produce imagines until late August or September, when a third brood is rarely attempted. On the continent, in central Europe, the same times of appearance are noticed, *e.g.*, Rössler says that, in Germany, the imagines appear in the end of April and through May, then at the end of July, and on into August, and lastly, in late autumn. Reutti states that, in Baden, it is common in May, July, and September. Stange says that, in Friedland, the imagines are to be found from the end of May to September, apparently in three broods. In Pomerania, the insect occurs through the summer and on to September (Büttner). Speyer observes that, at Waldeck, it occurs in June, and again at the end of August and beginning of September. In Silesia, it occurs rather rarely in May, then much commoner from the end of July to beginning of October (Wocke). At Mödling, in Lower Austria, the imagines appear in May and June (Mann). In Roumania, it occurs almost everywhere in meadows in August (Caradja). In the Baltic Provinces, Nolcken notes its occurrence in May and June, again July 15th-August 8th, and yet again September 24th. In the mountains, the var. *plagiodactylus* occurs, and appears to have only two broods (at most) in the year. We have made no attempt to distinguish in the following dates those referring to the type, and those referring to var. *plagiodactylus*. Continental records: Just appearing May 29th, 1869, worn examples found July 11th, 1869, near Meseritz (Zeller); April 20th, 1870, at Marshen, in Morocco (Blackmore); July 18th-23rd, 1890, at Tancarville (Leech); July 20th-August 17th, 1892, at Erfjord (Strand); July 29th, 1894, at Bourg St. Maurice; August 22nd, 1894, at Grésy-sur-Aix; July 25th-31st, 1895, at Mendel Pass (Tutt); July 28th, 1896, at Odde (Chapman); August 5th-12th, 1896, at La Grave; August 13th-20th, 1896, at Bourgd' Oisans; July 26th-30th, 1897, at Grésy-sur-Aix; August 1st-5th, 1897, at St. Michel-de-Maurienne; August 6th-12th, 1897, at Lanslebourg; July 27th-31st, 1898, at Bourg St. Maurice; August 3rd, 1898, on the Little St. Bernard Pass (Tutt); July 31st, 1900, at Coq-sur-Mer; July 23rd, 1901, at Calmpthout (Crombrugghe); July 29th, 1901, on the Prenj (Rebel); August 8th-12th, 1901, at Bobbie (Tutt); June 27th, 1902, at Maklenpass (Hilf); July 30th-August 3rd, 1902, at Chavoire; August 4th-12th, 1902, at Megève; August 18th, 1902, at Chamonix (Tutt); July, 1903, at Ottignies, and

August, 1904, at Bergh (Crombrugghe); July 26th, 1904, on the Faucille; August 9th, 1904, between Balen and Hüteck, August 19th, 1904, at Stalden (Tutt); May 30th, 1905, at Velthem, August, 1905, at Uccle (Crombrugghe); May 30th, 1906, at Namur (Dufrane). British records: July 13th-27th, 1864, at Bournemouth (Knaggs); common last week of July, 1864, at Portland (Blackmore); July 19th, 1872, at Witherslack (Hodgkinson); August 16th, 1876, at High Force (Sang); August 1st-7th, 1877, at Witherslack (Hodgkinson); July 3rd, 1878, on Coniscliffe Moor (Sang); June 22nd, 1880, at Kilkerran Bay (J. J. Walker); August 22nd, 1880, at Witherslack; August 4th, 1881, at Hellkettles; August 21st, 1881, on Coniscliffe Moor (Sang); August 4th, 1881, at Kingsdown (Tutt); imagines on the wing from June 12th-October 14th, 1882, at Lepton Great Woods, but in greatest abundance in July (Porritt); bred July 24th, 1882, from larvæ collected July 2nd, 1882, at Brandon (South); August 17th, 1882, in Isle of Purbeck (Bankes); September 5th, 1882, at Llangennech (Richardson); July 3rd-7th, 1883, between Deal and Dover (Coverdale); mid-August, 1883, between Deal and Sandwich (A. H. Shepherd); August, 1883, at Ventnor (South); August 6th-13th, 1883, at Llangennech (Richardson); August 15th-September 14th, 1883, in the Morthoe district (Riding); September, 1883, in Epping Forest (Sheldon); May 28th-31st, 1884, in the New Forest (Bankes); June 5th, 1884, at Kingsdown (Sheldon); July 10th, 1884, at Oaks (Sang); July 5th, 1885, on Sandwich Marshes; July 20th-24th, 1885, at Cuxton (Tutt); bred July 28th-30th, 1885, from larvæ taken at Gravesend (Whittle); September 19th, 1885, and following days, at the Lizard (Riding); bred June 9th, 1886, caught July 31st, 1886, in the Isle of Purbeck (Bankes); July 13th, 1887, at Corrie (Dalglish); August 2nd, 1887, in the Isle of Portland; August 5th, 1887, in the Isle of Purbeck (Bankes); August 4th, 1887, at Kingsdown; August 6th, 1887, by the Old Haven, on the Deal sandhills; June 2nd-11th, 1888, in Chattenden Woods; June 12th, 1888, at Cuxton; August 6th, 1888, at Kingsdown; August 19th, 1888, at Cuxton; June 11th, 1889, in Chattenden Woods (Tutt); July 18th, August 31st-September 6th, 1889, in the Isle of Purbeck (Bankes); August 1st-12th, 1889, at Freshwater (Tutt); May 24th, August 30th-September 9th, 1890, in the Isle of Purbeck (Bankes); June 6th, 1890, on the Belfast Hills (Watts); May 27th, 1890, in Chattenden Woods; July 4th, 1890, on the Deal sandhills; August 1st-10th, 1890, at Deal and St. Margaret's Bay (Tutt); August 18th, 1890, at Swanage (Raynor); bred October 1st-14th, 1890, at Newbury (Kimber); June 3rd, 1891, in the Isle of Purbeck (Bankes); June 8th, 1891, in Chattenden Woods (Tutt); abundant mid-July, 1891, in the fens near King's Lynn (Atmore); September 21st-24th, 1891, at Brentwood (Raynor); June 11th, July 21st, 1892, in Chattenden Woods (Tutt); June 18th, August 17th, 1892, in the Isle of Purbeck (Bankes); July 15th, 1892, at Mauchline (Dalglish); July 22nd, 1892, at Cuxton; July 27th-August 17th, 1892, in Wicken Fen; August 3rd-7th, 1892, in Chippenham Fen; June 30th, 1893, in Chattenden Woods; July 2nd-22nd, 1893, at Cuxton (Tutt); July 22nd-30th, 1893, at Eastwood (Whittle); second week in July, 1894, at Stonehaven (Dalglish); July 26th, 1894, at Mansfield (Daws); June 2nd, 9th, 22nd, 1895, at Cuxton (Tutt); June, 1895, in Glen Lochay (Morton); October 21st, 1895, quite fresh, in the Isle of Purbeck (Bankes); July 4th, 1896, at Milngavie; August 12th, 1896, at Cadder

(Dalglish); July 9th, 1896, at Corsemalzie (Gordon); June 2nd, 1897, at Tuddenham; August, 1898, at Mucking (Burrows); July 30th, 1898, at Eastwood (Whittle); August 15th, 17th, 1898, at Buckerell (Riding); August 23rd, 1898, at Campsie (Dalglish); August 12th-22nd, 1899, at Shoeburyness (Whittle); June 29th, 1900, at Crookston; July 14th, 1900, at Dundonald (Dalglish); abundant mid-July, 1900, about Chester (Arkle); July 22nd-September 8th, 1900, at Shoeburyness (Whittle); August 1st-3rd, 1900, common at St. Margaret's Bay (James); July 11th, 1901, at Oxton, Devon (Studd); June 10th, 1902, common at Keswick (Beadle); June, 1903, at Waldridge Fell (Harrison); July 11th, 1903, in the Isle of Purbeck (Bankes); June 18th-30th, July 23rd-August 10th, 1903, on the Norfolk Broads (Edelsten); June 16th, 1903, at Wicken; June 18th, 1903, at Chippenham (Burrows); July 16th, 1903, in Hesleden Dene (Harrison); July 23rd, 1903, at Keswick (Beadle); August 13th, 1903, in the Isle of Purbeck (Bankes); June 20th, 1904, at Folkestone (Purdey): June 21st, 1904, in Chattenden Woods (Ovenden); July 6th-12th, 1904, at Witherslack (James); June 10th, August 11th, 1904, in the Isle of Purbeck (Bankes); September 5th, 1904, at Gomshall (Chapman); June 23rd, 1905, in the Isle of Purbeck (Bankes).

Habits.—The species is on the wing naturally before dusk, flying freely, from just before sundown, about the scabious plants on which the larvæ have fed. The imagines, too, are readily disturbed in the daytime, when they hide among the lower parts of the plants of scabious, or the surrounding herbage, flitting away softly, gently, with their conspicuous long legs hanging stiffly below, and then clinging to supports, where they are turned round, or moved from side to side, by the slightest breeze. Bankes says that the moth flies at dusk, and Barrett states that it can hardly be said to hide during the day, for it hangs on the scabious plants, and, when disturbed, dances away with a curious *Tipula*-like flight, its long legs conspicuous, and apparently buoyant, but only flies a few yards to a similar resting-place on the scabious or grass. It must, however, fly also at night, for we have taken it at light on Wicken Fen, and Edelsten has found it similarly on the Norfolk Broads. Here, also, the same entomologist has taken it on the wing at dusk, as well as at flowers of *Sedum spectabile*, in August and September, and at flowers of rocket in May, at Enfield. Reid used to take it flying among *Scabiosa succisa* at dusk, at Pitcaple, and Gordon asserts that it came to flowers of honeysuckle at Corsemalzie. Rössler notes that it flies in dry sunny weather among *Scabiosa succisa*, at Wiesbaden. He also suggests that the imago may hybernate, but there appears to be no doubt that the insect hybernates in the larval stage.

Habitat.—We find it difficult to say what are not the habitats of this insect. Wherever *Scabiosa* grows abundantly, there the species may be expected. In the ditches at the sides of the ridings in Chattenden Woods, in the rough ash plantations there, and in the fields outside, we have taken this species regularly and commonly; it is abundant among the thick herbage that grows on the chalkhills at Cuxton and Halling, particularly on the borders of the cultivated ground, where great clumps of *Scabiosa*, *Centaurea*, *Hypericum*, etc., come down to the ploughed edge of a field. In the thick growth of the hedgesides between Strood and Cuxton; on the banks leading down to the Ham Ponds, at Sandwich; in the rough pastures at Freshwater, in the Isle of Wight; in Wicken, Chippenham, and Ranworth Fens, and on the Breck sands at Tuddenham; again, on the undercliff at Shanklin and Ventnor, in the Isle of Wight, and between Kingsdown and St. Margaret's Bay, as well as on the chalk downs at Dover and Folkestone, we have taken this species in the south of England. It appears also to be as abundant by the sides of the drives running through our large woods, *e.g.*, Chattenden Woods and Raindean Wood, near Folkestone. On the continent its habitats are just as varied; we have taken it on the hot sun-baked slopes at Bourg d'Oisans, the mountain uplands at La Grave, up to the moraines of the Meije, on the Brévent and the slopes of the Chapeau at Chamonix, and the billowy slopes of the Mendel Pass; from sea-level to at least 6500ft. above the level of the sea, the insect has in some haunt or other occurred to us. Constant notes it on the heaths of Saône-et-Loire. Barrett reports that, near Norwich, it haunts chalkpits, the sloping banks of which are covered with a profusion of wild flowers, including *Scabiosa columbaria* and *S. arvensis;* also, he says, it is to be met with in boggy meadows, marshes, and open damp woods, among *Scabiosa succisa*. It is also reported in woods at Saffron Walden (Jeffrey), in woods among scabious at Eastwood, etc. (Whittle), in or near woods, among rough herbage, at Keswick (Beadle), abundant in rough fields overgrown with scabious, adjoining Lepton Great Wood (Porritt), by the hedgesides in fields and orchards, at Buckerell (Riding), in the hedgerows about Chester (Arkle), in old pastures at Wilsden (Butterfield), on rough ground at Mansfield (Daws), common in rough weedy meadows, where *Scabiosa succisa* abounds, in Dorset (Bankes), in the chines to the west of Bournemouth (Knaggs), on downs amongst scabious, near Bristol (Hudd), on a wet heath at Pitcaple (Reid), and among the herbage by hedgesides bordering pasture-fields, where scabious grows in the pastures (South), etc. In Germany it is to be found in similar places to those already noticed in this country, *e.g.*, it is recorded as common in upland meadows in Nassau (Rössler), common in sunny flowery spots at Friedland (Stange); in wet meadows in Silesia (Wocke), on the St. Leonhard turf-moor in Baden (Reutti); throughout the limestone district of Hernstein, in Lower Austria (Rogenhofer), and not at all rare on the hillsides at Mödling (Mann). In Roumania it is recorded as occurring almost everywhere in meadows (Caradja).

British localities.—Generally distributed throughout England and Scotland, and not uncommon in Ireland (Tutt) [for localities see also *anteà*, p. 340, var. *plagiodactylus*], common throughout Ireland (Kane). Aberdeen: distributed, Pitcaple, etc. (Reid). Antrim: Belfast Hills (Watts), Belfast (Birchall). Ayr: Barr, Mauchline, Dundonald (Dalglish). Berks: common — Aldermaston Park, etc. (Hamm), Newbury (Kimber). Bute: Corrie, Arran (Dalglish). Cambridge: Chippenham Fen, Wicken Fen (Tutt), Cambridge (Stainton). Carmarthen: Llangennech (Richardson). Cavan (Kane). Cheshire: occasionally, Sealand, near Chester (Arkle), Wallasey (Prince), New Brighton, Knutsford (Ellis), Birkenhead, common (Stainton). Cork: Glandore, Courtmacsherry, Ummera Woods, near Timoleague, common (Donovan), Cork (Carpenter). Cornwall: Land's End, St. Levan, common (Baily), The Lizard (Riding). Cumberland: Hayton Moss (Routledge), Keswick (Beadle), Lake district (Stainton), Carlisle district (Day). Derby: Burton district—Repton (Garneys), near Derby (Baker). Devon: Buckerell, Morthoe district (Riding), Oxton (Studd), Alphington (d'Orville). Dorset: Portland (Richardson), Isle of Purbeck (Bankes), Bloxworth, abundant (Cambridge), Swanage

(Raynor). Dublin: Howth (Birchall). Dumbarton: Garelochhead (Henderson), Milngavie (Dalglish). Durham: Waldridge Fell (Harrison), Darlington, common, near Edder Acres (J. Gardner), High Force, Coniscliffe Moor (Sang), Hesleden Dene (Harrison). Edinburgh: Edinburgh district (Evans). Essex: generally distributed (Harwood), Shoeburyness, Eastwood (Whittle), near Saffron Walden (Jeffrey), Epping Forest (Sheldon), Rainham, Mucking (Burrows), Brentwood (Raynor), Colchester (Harwood). Fermanagh: Enniskillen (Partridge). Fife (Barrett). Galway: Kilkerran Bay (J. J. Walker). Gloucester: Bristol, Clifton, Almondsbury, Woodchester (Hudd). Hants: generally distributed in New Forest and Isle of Wight (Fletcher), Isle of Wight—Ventnor (South), Yarmouth, Freshwater (Tutt), New Forest—Brockenhurst (Bankes), Rufus Stone (Gill); Bournemouth (Knaggs). Hereford: Tarrington (J. H. Wood). Hertford: near Hitchin, Knebworth (Durrant), Sandridge (Griffith), Cheshunt (Boyd). Isle of Man: Maughold—Glen Mona, Dhoon Glen, Lonan-Garwick, Ballaugh-Curraghs (Cassal). Kent: Folkestone (Courtice), Gravesend (Whittle), Alkham, Pembury (Stainton), Sandwich, Deal, Kingsdown, St. Margaret's Bay, Raindean Wood, near Folkestone, Chattenden, Cuxton, Orpington (Tutt), Dover (Coverdale). Kincardine: common (Reid), Stonehaven (Dalglish). Lanark: Carluke (Morton), Possil Head, Glasgow (Henderson), Cadder (Dalglish). Lancashire: Grange (Hodgkinson), Manchester (Stainton). Merioneth: Aberdovey (Arkle). Middlesex: Enfield (Edelsten), Mill Hill (South), Kingsbury (Bond). Moray (Barrett). Norfolk: Norwich, Merton, Croxton, Swaffham, Ranworth Fen (Barrett), Norfolk Broads (Edelsten), King's Lynn (Atmore). Northumberland: Newcastle (Stainton), Morpeth (Finlay). Nottingham: Mansfield (Daws). Perthshire: Glen Lochay (Morton). Renfrew: Paisley (Dunsmore), Crookston (Dalglish). Roxburgh (Barrett). Somerset: Leigh, Clevedon (Hudd), Castle Cary (Macmillan). Stirling: Campsie (Dalglish). Suffolk: Brandon (Barrett), Tuddenham (Burrows). Surrey: generally common (Briggs), Gomshall (Chapman), Lowestoft (W. C. Boyd), Elveden (H. Williams). Sussex: generally distributed (Vine and Fletcher), Hastings district, common (Bloomfield), Lewes (Stainton), Abbott's Wood (Porritt), Bognor (Lloyd). Warwick: Knowle (Bradley). Westmorland: Witherslack, Windermere (Hodgkinson). Wigtown: Corsemalzie (Gordon). York: Wilsden, Grassington (Butterfield), Lepton Great Wood, Huddersfield, abundant (Porritt), Sandburn, York (Prest), Scarborough, common (Stainton), Doncaster district (Corbett), Bramham (Smith), Edlington Wood (Porritt), Flamborough Head (Horton), Redcar (Sang), Sheffield (Doncaster), Great Ayton (Lofthouse).

Distribution.*—Europe (except the polar region), Asia Minor, Mauretania and Teneriffe (Rebel). Africa: Morocco—Marshen (Blackmore). Asia Minor: Brussa (Mann). Austro-Hungary: Galicia (Garbowski), Tyrol district—Innsbruck, Taufers district—near Schlafhaus, Jagdhaus, Knutten, Klammel (Weiler), Höttinger Berg, Brenner, Serles, Seiser-Alpe (Heller), Mendelpass (Tutt), Carinthia—Raibl and Preth district (Zeller), near Vienna (Rebel), Lower Austria—Hernstein (Rogenhofer), Mödling (Mann), Bohemia, Styria (Hofmann), Dalmatia—Ragusa (Mann), Buda-Pest district—Nagyág (Aigner), Siebenbürgen (Czekelius). Belgium: Calmpthout, Rochefort, Velthem, Bergh, Uccle, Ottignies, Coq-sur-Mer (Crombrugghe), Yernée (de Radiguès), Namur, Dinant, rare (Lambillion). Bosnia and Hercegovina: Trebevic (Apfelbeck), Treskavica, 1800m. (Rebel), Maklenpass (Hilf), Prenj, Velezi, Gacko (Rebel). Bulgaria and East Roumelia: near Slivno, singly (Rebel). Corsica: Monte Corte (Curò). Denmark (Bang-Haas). France: Normandy — Tancarville (Leech), Seine-et-Marne—near Paris, Montmorency, Aulnay (Duponchel), French Juras —Gex, La Faucille (Tutt), Savoy Alps—Grésy-sur-Aix, Bourg St. Maurice, Petit St. Bernard, Lanslebourg, Chavoire, Megève, common, Chamonix, Dauphiny Alps—La Grave, St. Michel de Maurienne, Bourg d'Oisans (Tutt), Doubs dept.—Couches-les-Mines (Bruand), Indre—Nohant (Sand), Saône-et-Loire—Autun, etc. (Constant). Germany: distributed throughout north and south Germany (Hofmann), southwest Germany, Prussia—distributed (Speiser), Pomerania—Neu-Vorpommern, Rügen, near Dänholm, Rönkendorf (Paul), Stettin, near Grambow, Tantow (Büttner), Mecklenburg—near Friedland (Stange), Posen—Meseritz (Zeller), Hamburg—Lower Elbe district, near Bahrenfeld (Sauber), Hanover—near Hanover (Reinhold), Rhine Provinces—Aix, Crefeld, near Uerdingen (Stollwerck),

* The following also include the recorded localities for var. *plagiodactylus*, the difficulty of determining those which refer to the latter only, being too great to attempt to separate them.

Neuenahr, Altenahr (Maassen), Hesse-Nassau — Wiesbaden, common (Rössler), Frankfort-on-Main (Koch), Cassel (Knatz), Waldeck (Speyer), Thuringia —Jena, Sprötau, Sömmerda (Knapp), Saxony—Mühlhausen (Jordan), Halle (Stange), Anhalt (Gillmer), Brandenburg — Potsdam (Hinneberg), Frankfurt-on-Oder (Pfützner), Silesia, distributed—Schwoitsch, Oswitz, Lissa, Glogau, Reinerz, Lauban (Assmann), Schönberg, Siegersdorf (Sommer), Saxon Upper Lusatia, distributed (Schütze), Bavaria, Regensburg (Hofmann), Bayersdorf (Gillmer), Munich (Hartmann), Württemburg—Eisenbach, etc. (Steudel), Baden—Constance, Ueberlingen, Thalmühle, Geisingen, Schweigmatt, Freiburg, Lahr, Herrenwies, Rothenfels, Carlsruhe, Durlach, Heidelberg, Tauberbischofsheim, Wertheim, common (Meess), Rhine Palatinate (Bertram). Italy: Piedmont—Little St. Bernard Pass, Bobbie (Tutt), Italian Alps (Curò), Lombardy—Alzate (Turati). Netherlands: Friesland, Hilversum, Gelderland—Hattem, Overijssel—Malden, Wijhe, Zwolle, Limburg, Maastricht—Venlo, Valkenburg, north Brabant—Rijen, Breda, Bergen-op-Zoom, Ijsselmonde (Snellen). Roumania: generally distributed (Caradja). Russia: Moscow district—Konobeewo (Albrecht), ? Casan district (Eversmann), Orenburg (Hansen), Baltic Provinces—Rambdau, Kokenhusen (Lienig), Frauenburg, Groesen (Rosenberger), Lechts (Huene), Ebelshof (Beinert), Kurtenhof (Berg), Magnusholm, near Neuhof, Pichtendahl, Rotsiküll (Nolcken). Scandinavia: Norway — Stavanger district, Erfjord, Suldal (Strand), Scania, Blekinge, Småland, West Gothland, East Gothland, Oeland (Wallengren), Odde (Chapman). Spain: Tragacete, Moncayo (Chapman). Switzerland: distributed in the lowlands, replaced by var. *plagiodactylus* in the mountains (Frey), Orsières (G. B. Baker), Weissbad, Gais, common (Peyerimhoff), Zürich, Baden (Frey), Bremgarten (Boll), Villeneuve (La Harpe), the Juras (Rothenbach), the Saas-Thal—Stalden, Balen, Hüteck (Tutt).

[ADDENDUM (pp. 343-4).—It has seemed advisable, since pp. 343-4 have been passed for press, to add the following notes on the "var. *aridus*."

Variation.—γ. var. *aridus*, Zell.—Buckler writes [*Ent. Mo. Mag.*, x., p. 182 (1874)] that, on April 25th, 1873, he received from Stainton, larvæ, feeding on shoots and flower-buds of *Coris monspeliensis*, one of the *Primulaceae*, taken at Mentone. The young larvæ seem, at first, to feed in the stems of the young shoots of the plant, the heads of which then hang and become bleached; as they grow, they enter the flower-buds, feeding on the calyx and its contents; at this time, the only sign of the presence of a larva consists of a hole in the lower part of the calyx, and two or three minute grains of frass just within the cavity. As they advanced towards maturity, their assimilation to the flower-buds, in point of colour, was very close; and they were often noticed either outside among the flower-buds, or on the stems of the plant. The larvæ pupated on May 6th, 11th, and 13th; the imago from the first appeared on June 12th, but the other two pupæ dried up. The moth, although somewhat dwarfed in size, appears to be, without doubt, *aridus*, Zell. The youngest larvæ, when first detected, were described as being :—

About 2 lines long, of a deep purplish-pink colour, slightly subdued by a greenish tinge; the skin much covered with exceedingly minute, short, bristly points; the wart-like tubercles on the back each bearing a single white bristle, rather long, and a trifle thickened at the tip; the small head greenish, and marked on each lobe with dark brown, and studded with white hairs; dorsal and subdorsal lines of darker purplish-pink than the ground colour could also be seen.

The fullgrown larva was noted as :—

Attaining a maximum size of little more than 4 lines in length; the figure slender in proportion; cylindrical above, and a little flattened on the belly, tapering in front from the third segment to the head, which was small; the three hinder segments also a little tapering; all the legs tolerably well-developed; the segments plump, with divisions deeply indented, and the subdividing wrinkles well-defined; the colour greenish, suffused with pink; the inflated spiracular region a little paler than the rest, no trace of any lines; the head brown; the spiracles dark brown, circular, and very small; all the hairs brownish.

The slender pupa was 4 lines in length, smooth, and without hairs, with the head blunt and broad; the broadest part being at the top of the thorax, just at the junction of the wing-cases, from whence it gradually tapered to the point of the tail, by which it was attached to the stem of its foodplant; in colour the body was pale yellowish-green, the head ochreous-green, the wing-cases of a darker greyish-green tinged with pink; a faint darker green dorsal line was just visible, and, along either side, a row of subdorsal, elongate, black spots (Buckler).

Whether this belongs to *aridus*, Zell., or not, we are not prepared to say, on the determination of the one specimen bred by Buckler. If it does, we suspect that the British specimens referred by British lepidopterists to *aridus*, are not *aridus*, Zell., and that *aridus*, Zell., is not a form of *Adkinia bipunctidactyla;* in this respect, our opinion agrees with that of Hofmann. Herrich-Schäffer says (*Sys. Bearb.*, v., p. 376) that he received his examples of *aridus*, from Mann, as *loewii*, but that they are quite different, being a little larger than *loewii*, and much smaller than *serotinus*.]

Genus: Stenoptilia, Hübner.

Synonymy.—Genus: **Stenoptilia,** Hb., "Verz.," p. 430 (1825); Stphs., "Ill. Haust.," iv., p. 372; app. p. 424 (1834); Meyr., "Trans. Ent. Soc. Lond.," p. 487 (1890); "Handbook," p. 440 (1895); Hofmn., "Deutsch. Pteroph.," p. 82 (1895); Fern., "Pter. Nth. Amer.," p. 56; revised ed., p. 58 (1898); Staud. and Rebel, "Cat.," 3rd ed., p. 77 (1901); Dyar, "List Nth. Am. Lep.," p. 447 (1902); Tutt, "Ent. Rec.," xvii., p. 35 (1905). **Alucita,** Linn., "Faun. Suec.," 2nd ed., p. 871 (1761); "Syst. Nat.," 12th ed., p. 900 (1767); Müll., "Faun. Ins. Frid.," p. 59 (1764); Göze, "Ent. Beit.," iv., pt. 3, p. 173 (*in part*) (1783); de Vill., "Linn. Ent. Faun. Suec.," ii., p. 535 (1789); Haw., "Lep. Brit.," p. 476 (1811); Hb., "Schmett. Eur.," Aluc. ix., figs. 16, 25 (*circ.* 1819); Treits., "Die Schmett.," ix., p. 244 (1833); Evers., "Faun. Volg.-Ural.," p. 606 (1844). **Pterophorus,** Fab., "Syst. Ent.," p. 671 (1775); Sam., "Ent. Usef. Comp.," p. 409 (1819); Curt., "Brit. Ent.," fo. 161 (1827); Dup., "Hist. Nat.," ix., p. 666, pl. 314, fig. 3 (1838); Wood, "Ind. Ent.," p. 235, pl. li., fig. 1630 (1839); Zell., "Isis," p. 277 (1839); p. 841 (1841); Dup., "Cat. Meth.," p. 382 (1844); Tgstrm., "Finl. Fjär.," p. 155 (1847); Zell., "Linn. Ent.," vi., p. 371 (1852); H.-Sch., "Sys. Bearb.," v., p. 375 (1855); Frey, "Tin. Pter. Schw.," p. 413 (1856); Sta., "Man.," ii., p. 442 (1859); Schmid, "Berl. Ent. Zeits.," viii., p. 66 (1864); Nolck., "Lep. Faun. Estl.," p. 808 (1871); Porritt, "Ent.," xv., p. 44 (1882); "Buckler's Larvæ," ix., p. 365 (1901). **Mimaeseoptilus,** Wallgrn., "Skand. Fjäderm.," p. 18 (1859); Jord., "Ent. Mo. Mag.," vi., p. 123 (1869); Staud. and Wocke, "Cat.," 2nd ed., p. 343 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 797 (1877); Frey, "Lep. der Schweiz," p. 431 (1880); South, "Ent.," xv., p. 148, pl. iii., figs. 4*a*-4*c* (1882); Sorh., "Kleinschm. Brandbg.," p. 6 (1886); Tutt, "Young Nat.," x., p 165 (1889); "Brit. Nat.," ii., pp. 160, 226 (1892); "Pter. Brit.," p. 100 (1895); Snell., "Vlind. Ned.," ii., 2, p. 1040 (1882).

The genus *Stenoptilia*, Hb. (*Verz.*, p. 430), was created by Hübner for a mixed assemblage of species belonging to very different groups of the "plume" stirps, *e.g.*, the modern genera *Stenoptilia* and *Adkinia* on the Platyptiliine side, and *Emmelina*, *Leioptilus*, *Hellinsia*, and *Adaina* on the Alucitine side. His diagnosis reads as follows:

The forewings narrow, speckled with scattered black spots—*Stenoptilia mictodactyla*, Schiff., *Verz.*, Alu. A, 3; Hübn., *Alu.* 3. *S. ptilodactyla*, Hübn., *Alu.*, 16, 25. *S. pterodactyla*,* Linn., *Syst.*, Phal., 458; Hübn., *Alu.* 4. *S. scarodactyla*, Hübn., *Alu.*, 21, 22. *S. tephradactyla*, Hübn., *Alu.*, 17. *S. carphodactyla*, Hübn., *Alu.*, 19, 20. *S. microdactyla*,† Schiff., *Verz.*, Alu. A, 12, Hübn., Alu., 26, 27.

It would be difficult to find a more heterotypical genus than this.

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* Hübner's *Alucita pterodactyla*, "Eur. Schmett.," Alu. fig. 4=*Alucita monodactyla*, Linn.

† Schiffermüller and Denis, *Verz.*, p. 320, Alu. A, 12, is named *mictodactyla*. These authors mention no species under the name *microdactyla* so far as we can discover.

Stephens, in his application of the Hübnerian classification to our British species (*Illus. Brit. Ent. Haust.*, iv., app. p. 424) maintains it in its original form, whilst Zeller (*Isis*, 1841, pp. 756 *et seq.*) also keeps the Hübnerian hotch-potch, but sinks the name *Stenoptilia* as a synonym of *Pterophorus*. He was followed in this by Herrich-Schäffer, who, however, separated the Platyptiliine part of the group as Sect. i, leaving a very mixed lot as Sect. ii. Wallengren isolated the Platyptiliine section (*Kong. Svens. Vetens. Akad. Handlingar*, iii., p. 18) under the name *Mimaeseoptilus*, his grouping being followed by Staudinger and Wocke (*Cat.*, 2nd ed., p. 343) under the same name. Meyrick, however, in 1890, restored (*Trans. Ent. Soc. Lond.*, pp. 487) the Hübnerian name to this group, and was followed in this by Hofmann, in 1895 (*Die Deutsch. Pteroph.*, p. 62), who gave us our first true grip of the group, without, however, naming the separate parts, or fixing a type for Hübner's genus. This we did in 1905, dividing (*Ent. Rec.*, xvii., p. 35) the *Stenoptilia* of Hofmann into its two constituent parts, and naming one *Adkinia*, with *bipunctidactyla* as type, and retaining *Stenoptilia*, Hb., for the group of which *pterodactyla*, Linn. (=*ptilodactyla*, Hb.) was named as the type. It is in this limited sense that *Stenoptilia* is here used. Hofmann's subdivisions may be referred to (*anteà*, p. 317). It will be observed that we have not followed these out in detail, as, at the present time, much too little is known of the early stages of the species to support his further subdivision on imaginal characters. That much difference exists, however, within the two Stenoptiliid genera we have no doubt. There is no real need to repeat the comparative diagnosis of *Adkinia* and *Stenoptilia* already given (*anteà*, p. 319).

Stenoptilia pterodactyla, Linné.

Synonymy.—Species: **Pterodactyla,** Linné, "Faun. Suec.," 2nd ed., p. 371 (1761); "Syst. Nat.," 12th ed., p. 900 (1767); Müll., "Faun. Ins. Frid.," p. 59 (1764); Göze, "Ent. Beit.," iv., pt. 3, p. 173, *in part* (1783); Meyr., "Trans. Ent. Soc. Lond.," p. 487 (1890); "Handbook," etc., p. 440 (1895); Tutt, "Brit. Nat.," ii., pp. 160, 226 (1892); "Pter. Brit.," p. 100 (1895); Fern., "Pter. Nth. Amer.," p. 56; revised ed., p. 58 (1898); Staud. and Reb., "Cat.," 3rd ed., p. 77 (1901); Dyar, "List N. Amer. Lep.," p. 447 (1902); Tutt, "Ent. Rec.," xvii., p. 35 (1905). **Pterodactylus,** Fb., "Syst. Ent.," p. 671 (1775); Wallgrn., "Skand. Fjäderm.," p. 18 (1859); Staud. and Wocke, "Cat.," 2nd ed., p. 343 (1871); Nolck., "Lep. Fn. Estl.," p. 808 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 797 (1877); Porrt., "Ent.," xv., p. 44 (1882); South, "Ent.," xv., p. 148, pl. iii., figs. 4*a*-4*b* (1882); Barrt., "Ent. Mo. Mag.," xviii., p. 180 (1882); Sorhgn., "Kleinschm. Brandbg.," p. 6 (1886); Tutt, "Young Nat.," x., p. 165 (1889); Barr., "Lep. Brit. Isles," ix., p. 380, pl. 416, fig. 2 (1904). **Fuscus,** Retz., "Gen. et Spec.," p. 35 (1783); Zell., "Isis," p. 841 (1841); Dup., "Cat. Méth.," p. 382 (1844); Tgstrm., "Finl. Fjär.," p. 155 (1847); Zell., "Linn. Ent.," vi., p. 371 (1852); H.-Sch., "Sys. Bearb.," v., p. 375 (1855); Sta., "Man.," ii., p. 442 (1859); Schmid, "Berl. Ent. Zeits.," viii., p. 66 (1864); Jord., "Ent. Mo. Mag.," vi., p. 123 (1869); Frey, "Lep. Schweiz," p. 431 (1880); Porritt, "Buckler's Larvæ," ix., p. 362 (1901). **Fuscodactyla,** de Vill., "Linn. Ent. Faun. Suec.," ii., p. 535 (1789); Haw., "Lep. Brit.," p. 476 (1811). **Fuscodactylus,** Sam., "Ent. Usef. Comp.," p. 409 (1819); Curt., "Brit. Ent.," fo. 161 (1827); Stphs., "Illus. Haust.," iv., p. 372 (1834); Wood, "Ind. Ent.," 1st ed., p. 235, pl. li., fig. 1630 (1839); Frey, "Tin. Pter. Schweiz," p. 413 (1856). **Ptilodactyla,** Hb., "Eur. Schmett.," Aluc. ix., fig. 16 (1811-17), fig. 25 (*circ.* 1819); "Verz.," p. 430 (1825); Treits., "Die Schmett.," ix., p. 244 (1833); Stphs., "Illus. Haust.," iv., app. p. 424 (1834); Evers., "Faun. Volg.-Ural.," p. 606 (1844). **Ptilodactylus,** Dup., "Hist. Nat.," xi., p. 666, pl. 314, fig. 3 (1838); Zell., "Isis," p. 277 (1839). **Fusca,** Hofmn., "Deutsch. Pteroph.," p. 82 (1895).

Original description.—*P. Alucita pterodactyla*, alis patentibus fissis testaceis; puncto fusco. Habitat in nemoribus. Alæ superiores ferrugineo-testaceæ, bifidæ, sed fissura, nisi flectantur, non apparente; in medio punctum nigricans (Linné, *Fauna Suecica*, 2nd ed., p. 371).

Imago.—22mm.-23mm. in expanse. Forewings of a rich ochreous-brown colour, rather darker along the costal half, and paler along the inner marginal half; the outer margin and borders of cleft finely edged with whitish; the basal half of costa marked with white scales; two small blackish spots at end of cleft, one (often ill-developed) discal spot; a sprinkling of black scales along the upper and lower edges of the discal cell, and along the basal half of the cubital nervure; the upper lobe with a few scattered black scales, and many white ones towards the apex; the fringes of the upper lobe dark grey, whitish at their bases, with a small dark brownish dot at anal angle; the fringes of the lower lobe similar, but with two dark brownish dots towards the apex. The hindwings glossy brown, slightly darker towards outer margin and apex of plumules; cilia dark grey, brown at their bases.

Variation.—This species is not particularly variable, the main feature, in this direction, being the tint of the ground colour, which varies from dull greyish-ochreous to bright ochreous-brown. In size, however, there is great difference, our British examples varying from 16·4mm.-25mm., the average being about 22mm. The smallest form we would call ab. *minor*. The Linnean type appears to be an intermediate colour-form "ferrugineo-testaceæ"; the paler greyish-ochreous form we would call ab. *pallida*; for the extreme red-brown form we retain the name ab. *fusca*. Jordan describes (*Ent. Mo. Mag.*, vi., p. 124) a very remarkable specimen sent to him from the Lake district by Hodgkinson. It is noted as:

> The size of a very large *fuscus*. Anterior wings cinnamon-brown, the outer half rather more dusky than the inner portion which has an ochreous tinge, the spot at the fissure replaced by a very narrow black streak beginning at the fissure and extending more than half-way towards the base of the wing; below this is another faint black streak along the fold; in the upper segment, parallel with the fissure, near the apex of the wing, is another well-marked black streak; fringes dusky-brown, almost unicolorous, though there is rather a fainter line marking the border of the wing. At the extreme apex of the superior angle of the lower segment is a minute black dot. Posterior wings dusky-brown, with fringes of the same colour.

In the Frey collection there are two forms, one distinctly brown, the other decidedly greyish, especially on the costal half of the wing. The brown forms are from Göttingen and Zermatt, the grey form from Zürich and Trafoi. There is, also, in this series, considerable variation in the irroration along the nervures longitudinally, both of the white and of the black scales. Hofmann says (*Die deutsch. Pteroph.*, p. 83): "The spot on the inner margin and the discoidal spot, usually found in the Stenoptiliine imagines, are absent. The fissural spots are small, as a rule, one lying directly over the other, but moved somewhat from the fissure towards the base; in other respects they are rather variable, being irregularly formed, sometimes more streaklike, at others rounder, whilst sometimes they are dissolved into a small heap of black scales. The lower spot is, as a rule, somewhat larger, and lies with its upper edge at the same height as the costa of the lower lobe. The upper spot lies, in exceptional cases, also a little nearer the base; this is also occasionally the case with the lower spot; in one example from Hanover, there is only a very slight trace of the upper spot to be seen, and no trace at all of the lower one. The costal fringes of the upper lobe have a fine white line. Equally variable with the fissural spots are the typical spots in the outer marginal fringes of the lower lobe. The dark spot at the anal angle of the upper lobe is always distinct and constant, the spots at the apex of the lower lobe, on the other hand, are variable; occasionally there are, instead of two, three present, or four (in one example received from Staudinger as *paludicola*), or the two spots are lengthened, nearly coalescing, so as to form a brown line round the apex of the lower lobe, as described in ab. *paludicola;* in yet other cases, the spots of the lower lobe are very pale and indistinct, or they are, in exceptional cases, quite absent (*e.g.*, a specimen from Frankfort-on-Main). It not rarely occurs that the dots in the fringe, as well as those before the fissure, are different on the right and left wings; an example in my collection, taken at Immenstadt, has a distinct brown line in the fringe of the right lower lobe, but two distinct dots in the left one. The same is the case in an example received by Dr. Rebel, from Tegel, as *S. paludicola*, in which a distinct brown line is present at the apex of the left lower lobe, whilst, in the right, this line is divided by a rather broad whitish space into two large dots." Rebel notes the specimens from Sophia as being unusually large. This species, like others already noted, extends into North America, having been taken (*teste* Fernald) in the New York State. His description of the American form (*Pter. Nth. Amer.*, p. 58) reads as follows:

Forewings reddish-brown; the entire costa, and the apex of the second lobe, heavily sprinkled with dark brown scales; a dark brown reniform spot at base of fissure; fringes ashy-brown, with a very pale line at their bases. Hindwings fuscous, with ashy-brown fringes.

Zeller describes five forms of this species (*Linn. Ent.*, vi., p. 371), *viz:*

(1) Alis anterioribus fuscescenti-luteis, juxta costam obscurioribus, dorso late gilvescente, puncto gemino fusco ad fissuram, costæ totius linea externa angustissima albida; ciliis digiti tertii breviusculis (♂ ♀).

(2) Var. *a.*—In ciliis puncto uno ad angulum internum laciniæ anterioris, duobus ad apicem laciniæ posterioris nigris, distinctis; major.

(3) Var. *b.*—Ut *a*, sed litura longitudinali fusca obsoleta in lacinia anteriore.

(4) Var. *c.*—In ciliis puncto uno elongato duobusve ad angulum internum laciniæ anterioris, linea circa apicem laciniæ posterioris fuscis obsoletis; minor.

(5) Var. *d.*—Ut *b*, sed strigula obsoleta canescente in lacinia anteriore.

Of these, vars. *c* and *d* are, by common consent, referred to the form (or species) *paludicola*, Wallgrn. (see *posteà*). Zeller himself writes (*Linn. Ent.*, vi., pp. 371 *et seq.*) that "it is probable that the vars. *c* and *d* (to which possibly also the var. β of Haworth belongs) are specifically distinct from *fuscus*. The latter, including vars. *a* and *b*, is of the size of *mictodactylus*, and is, therefore, larger than *serotinus* and *aridus*, and easily recognised by its fawn colour, and the white edge which surrounds the outer half of the upper lobe. Specimens of a dull brown colour come near the somewhat smaller *stigmatodactyla*, which always looks paler and has narrower forewings and more slender lobes, whilst the upper black spot at the cleft does not stand vertically over the lower, as in *fuscus*, but at an angle inwards; the discal spots also are sharper, and the white margin, as a rule, surrounds the apex only, and does not extend so far towards the base as in *fuscus*. *P. mannii* differs from *fuscus* by the less pointed apex, the darker colour of the costal half of the forewings, the blacker, more conspicuous, dots, and the brown-grey hindwings. It differs from vars. *c* and *d* by its larger size, less dark and dull ground-colour, by the edging of the costa extending further towards the wing-base, by the marking of the fringes of the lobes, the upper one having one sharply defined black spot at the inner angle, and the lower one two such spots, one of which is at the apical point, and the other below it, whilst in the var. in question, there is, on the front lobe, a somewhat distinct brown spot, elongated towards the apex, and which has not infrequently, behind the extension, a tiny dot; the apex of the lower lobe is surrounded by a brown line, which thickens somewhat at the points where vars. *a* and *b* have spots. Finally, vars. *a* and *b* have not the light, greyish, transverse line so frequent in the smaller vars. *c* and *d*, across the first lobe. . . . . The var. *b* is not scarce, the black scattered scales forming the longitudinal dash in the upper lobe, being more or less numerous and mixed with white ones, so that the shade is sometimes very inconspicuous and incomplete." Although treated by Staudinger and Rebel (*Cat.*, 3rd ed., p. 77) as distinct species, both *paludicola*, Wallgrn., and *mannii*, Zeller, are, by many competent authorities, considered to be only geographical races of this species. For this reason we think it advisable to add here the original descriptions of these two insects. These read as follows:

a. var. (*an* sp. dist.) *paludicola*, Wallgrn., "Fjäderm.," p. 18 (1859); Zell., "Stett. Ent. Zeit.," p. 337 (1867); Hein. and Wocke, "Schmett. Deutsch.," p. 798 (1877); Hofm., "Deutsch. Pter.," p. 85 (1895); "Staud. and Reb., "Cat.," 3rd ed., p. 77 (1901). *Fuscus*, Zell., "Isis," var. *c*, ex parte, p. 84 (1841); vars. *c* et *d*, Zell., "Linn. Ent.," vi., p. 371 (1852).—Alis anticis supra cinereo-fuscescentibus, juxta costam obscurioribus, dorso late gilvescente, puncto gemino fusco ad fissuram, costæ totius linea externa angustissima albida, puncto uno duobusve ciliarum ad angulum internum laciniæ anterioris lineaque circa apicem laciniæ posterioris fuscis obsoletis. The forewings above brownish-grey, darker towards the costa, the inner margin broadly yellowish, a double, dark, brown spot at the end of the fissure, and a very narrow whitish line along the whole costa; one or two indistinct black spots at the base of the cilia of the hinder angle of this lobe; the bases of the cilia of the lower lobe edged with an indistinct blackish line at its apex. [*P. fuscus*, Zell., *Isis*, 1841, var. *c*, ex parte; *Linn. Ent.*, vi., 371, vars. *c* et *d*.] This species is to be found in Scania (the southernmost part of Sweden), but is much more scarce than the previous species, at the end of July and in the beginning of August, and haunts only damp meadows and mosses. Its later time of appearance, different habitat, and the difference in the coloration, as well as its smaller size, make us consider it to be specifically different from the previous species, with which it has (with reservation) been united by Zeller. It is considerably smaller than the preceding species, and the forewings are grey-brown, or more slaty-grey than *pterodactyla*, which it otherwise resembles very much. It has often, like the latter, a light grey transverse line across the upper lobe of the forewings, which, however, does not reach the fringes of the front edge, and consists of scattered scales. There is also often an indistinct brownish vertical streak. In the anal angle of the upper lobe of the forewings, there are also to be found, in the cilia, one or two indistinct blackish spots, but, on the lower lobe, there are no signs of spots, their place being taken by an obscure brown line passing round the apex at the base of the cilia. As regards the ground colour of the forewings, it resembles very much that of *M. serotinus* (*bipunctidactyla*), but is easily differentiated by the narrow white line on the front edge (Wallengren).

Hofmann observes (*Die deutsch. Pteroph.*, p. 85) that "*S. paludicola*, Wallgrn., is a variety of *S. fusca*; Zeller has described it as *fusca*, vars. *c* et *d* (*Linn. Ent.*, vi., p. 371). This form, which appears to differ solely in the somewhat darker coloration, and in the presence of an indistinct brown line running round the apex of the lower lobe at the base of the fringes, I cannot, on account of the variability of the markings above described, bring myself to recognise as a distinct species, as clearly intermediate forms prove that the line in question arises solely from the coalescence of the two spots typical to the genus. The var. *paludicola*, according to Zeller, flies in Glogau from the end of July to the beginning of September, in damp meadows, or on the borders of swamps, not rare, and generally several together; *Veronica chamaedrys* does not occur in these situations, but probably other species of *Veronica* do grow there, such as *V. serpyllifolia*, *V. arvensis*, and *V. triphyllos*." The vars. *c* and *d* of Zeller, referred to by Hofmann, have been already described (*suprà*, p. 360), and Zeller himself considered (*Linn. Ent.*, vi., p. 371) that his vars. *c* and *d* were most probably not specifically identical with *pterodactyla* (*fuscus*), and writes: "My vars. *c* and *d*, which certainly go together, and of which *d* is the commoner, are smaller, darker, and marked differently in the fringes from the type form. This fringe-marking separates them very readily from the paler *stigmatodactylus*, which, in this particular, agrees exactly with *fuscus*, the upper lobe of which has also a pure white edging, whilst the black spots at the end of the cleft, have a different position from those of the four *fuscus* vars. The vars. *c* and *d* frequently come close to *serotinus* in darkness, but the latter has the fringe-spots as in *fuscus*, and no white or whitish costal edge appears, which is also the case with *aridus*. *P. loewii* has a white costal edge, and has, as have these doubtful vars. of *fuscus*, two spots at the inner angle of the first lobe, but, in this species, these spots are sharp, and deep black, like those at the apex of the lower lobe; besides, *loewii* is smaller, more delicate, almost grey with longer lobes. . . . The var. *d* has, crossing the upper lobe, an indistinct light grey, transverse line, consisting of scattered scales, which does not reach the costal fringes, and frequently more distinct to the naked eye than when observed through a lens. In some examples, one wing may have this transverse line faintly expressed, whilst, on the other wing, it is quite absent. The vars. *c* and *d* fly near Glogau, from the end of July till the beginning of September, and are to be found in damp meadows, or in swampy places, which have previously been inundated, and are generally abundant where they occur at all. The larvæ cannot feed on the same species of *Veronica* as vars. *a* as, *b*, as, in several places where I found them abundantly, no other species but *V. serpyllifolia*, *V. arvensis*, and the early *V. triphyllos* was to be found." A ♀, with a hardly indicated transverse line across the upper lobe, was received from Mann, who had taken it in Dalmatia. Crombrugghe de Picquendaele observes the occurrence of this form in the Ixelles district of Belgium, at Uccle and Groenendael, in July, each year, with typical *pterodactyla*. Other localities noticed are: Baden—Constance (Reutti), Berlin (Stern), Jungfernhaide (September 3rd), Finkenkrug (Sorhagen).

β. var. (*an* spec. dist.) *mannii*, Zell., "Linn. Ent.," vi., p. 375 (1852); Hch.-Schäff., "Sys. Bearb.," v., p. 375 (1855); fig. 21 (1853); Staud., "Hor. Soc. Ent. Ross.," xv., p. 428 (1880); Staud. and Reb., "Cat.," 3rd ed., p. 77 (1901).—Alis omnibus ochraceo-lateritiis, anteriorum costa angustissime albo-marginata, laciniis acuminatis, punctis duobus minutis fuscis ad fissuram; ciliis digiti tertii breviusculis (♂). Readily distinguished from *fuscus* var. *a*, to which it comes nearest as far as colouring is concerned, by the pale light-red colour of all the wings, the more elongated upper lobe, the smallness of the black dots, which are separated widely at the fissure, the entire absence of dots in the outer margin of the lobe. Described from a single ♂. Head and thorax reddish-grey; the antennæ, at the basal half, white, ringed sharply with brown, then unicolorous reddish-grey; on the upper ocellar edge is a white line, which expands and continues to the end of the frontal protuberance; the palpi deep rusty-brown, above, and narrowly white, below. The abdomen light ochreous-yellow; the first two segments above white, owing to the two wide longitudinal stripes almost uniting; the remaining segments have, in the centre, a broad, and on either side a very narrow, yellowish-white, nearly obsolete, longitudinal line; at the posterior edge of the five hindmost segments, the central line has, on either side, a black dot; the venter is marked similarly, only the central line is whiter, and the lateral lines on either side of the abdomen interrupted. The anal flap yellowish-white. The legs dark ochre-yellow, almost rust-coloured, the hind femur and the first two tibial joints externally light ochre-yellow; the spurs smaller and more delicate than in *fuscus*, brownish, but white on sides. The forewings almost $5\frac{1}{2}'''$ long, reddish-ochreous in colour; towards the costa gradually becoming darker, striated weakly with white and brown scales, the brown costal line extending from the base to the beginning of the upper lobe; the brown discal spot is entirely absent; just before the cleft is a small black-brown dot, not sharply defined, whilst, considerably above it, but somewhat outside, is another, still less distinct, of similar colour. The costa, from the end of its first third to the commencement of the last fourth of the upper lobe, is edged by a fine whitish line, which has its greatest width at the upper lobe. The lobes are more sharply pointed than in *fuscus*, with a very blunt inner angle, and only marked in the centre with a faint, fine, whitish, longitudinal shade. Fringes reddish-grey at the outer edges of the lobes, with whitish basal line, almost without any indication of the spots which are found in *fuscus;* a careful examination shows that, at these positions, the fringes are of the same tint as the ground colour of the wing. Hindwings of the colour of the forewings. The fringes greyer, with fine pale reddish basal line; the 1st and 2nd plumules more pointed than in *fuscus*, and the 2nd is almost without an inner angle. The underside is reddish-brown; the costal edge of the front wings, from the base up to half of the upper lobe, with a sharp yellowish line; the apical half of the 1st plumule, and the entire 3rd plumule, are dusted with pale yellow. Habitat near Brussa, in Asia Minor. Flies in July. Taken by Mann (Zeller).

Zeller describes this as a distinct species, and Rebel (*Cat.*, 3rd ed., p. 77) also treats it as such. Staudinger, however, says (*Hor. Soc. Ent. Ross.*, xv., p. 428) that he caught "two examples on June 24th, at Amasia, and on July 13th, at Ak Dagh, which appear to belong to Zeller's insect, and which may be only a southern form of *pterodactyla*, Linn. (*fuscus*, Retz.). One example has only one black spot at the end of the cleft, the second has none at all. According to Zeller, there should be two small black spots, widely separated. These vary, however, and others also, as shown by an examination of ten specimens of *mannii* from the Balkans, Greece, Brussa, south Caucasus, and north Persia. Zeller described the species from one male example only, taken at Brussa, where Mann captured some in June, in the mountain meadows. We have seen none of Mann's or Zeller's original examples.

Egglaying.—The eggs of this species, appear to be laid almost without exception on the underside of the leaves of the foodplant, with the colour of which they harmonise very strikingly. Eggs of *Stenoptilia pterodactyla*, laid on June 23rd, 1904, on the underside of the leaves of *Veronica chamaedrys*, are of a yellowish-green tint, not quite that of the leaf (Chapman).

Ovum.—The form of the egg is very similar to that of the Agdistids, more so than that of any other plume examined. The micropylar end is very flattened, but is not so squared at the angles as is the Agdistid egg, nor is there any special sculpture of its margin, which is rounded and not definitely marked off, as the beading marks off that of *Adactylus*. The length of the egg is 0·49mm. Seen from above, the micropylar end is a transverse line, 0·16mm. long, the egg widens out towards the other end to 0·25mm., and terminates in an oval or circular end. Seen laterally, the flat micropylar end is highest, 0·21mm., and, towards the nadir, the egg is only 0·15mm.; the nadir seen in this view is a good deal flattened, unlike the round margin as seen from above. The sculpturing on the micropylar end shows cells arranged rosette fashion, in several rows, to a width of nearly half the diameter of the end. The rest of the egg has longitudinal ribs, rather faint, and difficult to make out and count, rather waved and irregular, but fairly parallel to each other, eight or ten visible in a top view of the egg. It is also possible, in some illuminations, to glimpse transverse ribs, dividing the furrows between the primary ribs, much as those of an ordinary upright egg, are divided; there are about ten of these to half the length of the egg; more cannot be seen at one view (Chapman, June 23rd, 1904). By June 27th the eggs were showing dark eye-spots through the eggshell (Chapman).

Habits of larva.—Some larvæ that left the egg on June 27th, 1904, were put on the tops of a sprig of *Veronica chamaedrys;* an hour afterwards no trace of them could be found, nor any indication of what had become of them (the piece of plant being in a closed tube, escape was impossible).* Next day, tearing open a piece of one of the above-mentioned tops, two tiny larvæ were found in the interior of the stem, thus solving the mystery; other larvæ hatched this day, and were put at once on a covered plant; the larvæ made straight for the axils, and soon disappeared. The young larva, therefore, as soon as hatched, seeks out the axil of a young leaf, and mines into the pith of the leading shoot; each had entered a stem near the top and burrowed down the pith. Later examination exposed, in one or two cases, a trace of frass, which showed that entry had been made at an axil less than ½in. (probably much less, if the shoot grew at all after entry was made), from the end of the shoot. In other cases, it was not clear, but, in all, the shoot had been mined downwards for a greater or less distance, in one case past two nodes and for a distance of about 1½ins., but in some instances decidedly less, as the larva was less than this, in one or two barely ½in., from the end of the shoot. This appears to depend largely on the vigour and size of the shoot. In all cases the end of the shoot was dead down to just beyond the larva. This was always in a living stem, once ¼in. from the dead portion, but usually quite close to it. Though fat in their present instar, they seem to be still eating. The larva feeds in the pith until fullfed in its 2nd stadium, at which time it is about 2mm. in length, and finds ample accommodation in the pith of a slender stem of speedwell. Here it makes a neat little cavity, shuts off the terminal end with one or more screens of silk, and enters on its hybernation period whilst we are still in the midst of summer. A search in the open, on August 27th, 1904, showed that the hybernating larvæ are easily found in hedge-bottoms, existing in their habitats, the dead ends of the branches of *Veronica* being conspicuous; a few were collected, and some of them were found to have a definite

* The larvæ commence life as complete miners in the stems of *Veronica*, starting in a terminal shoot, and travelling downwards. I noticed, a few days since, that the upper ½in. or 1in. of the *Veronica* stems was withering, though I did not connect this with the hatching of the ova at the time; I can now detect the extrusion of a minute amount of frass, with a strong hand-lens (Bacot, July 11th, 1904).

hybernating cocoon, consisting of the end of the burrow in the living stem, with one or more, generally two or three, diaphragms of silk cutting it off from the rest of the burrow containing frass, and, no doubt, acting as a protection against animal or vegetable parasites using the frass-filled burrow as an approach to the dormant larva; several of these larvæ were placed in the split ends of branches of growing plants, and appeared to make their way into them. On January 25th, 1905, a plant was examined, and a larva found much as in August last; it was in a cavity in the stem, 2ins. from the end, and with a little protective spinning (Chapman). Bacot notes that, in April, the stems of a plant, in which larvæ had wintered, began to wither, although previously they had been flourishing, suggesting that the larvæ may do some boring in the spring. About this time, however, the larvæ leave the stems and feed externally, the approximate date not yet determined, and by mid-April may be found lying on the extending bloom-spike, or almost hidden among the flower-buds, and, when resting on the spike, which is usually a little yellowish, are rather difficult to see, so well does their colour respond to that of their resting-place. Ovenden notes (May 17th, 1904) that "the larvæ are best found on warm mornings, before the flowers are fully out, looking exactly like a peculiar bud, when, with only the hind segments showing, they have pushed their heads into one of the buds to eat out the heart of it; when not too badly bitten, the flowers subsequently expand, and the remains of the corolla are to be observed adhering to the calyx. When the flowers are fully expanded, the larvæ are more difficult to find, and are then often found on the underside of the leaves, where their resemblance to the midrib of the leaf makes their discovery very difficult." On the afternoon of May 23rd, 1904, just outside Folkestone, small larvæ of this species were not at all uncommon, generally resting within one of the two upper leaves that expand directly below the flower-spike. They were not very difficult to find, although the larval hairs, and those of the plant, especially on the edge of the calyx, are very similar, and help in their protective resemblance to their surroundings. Their small size was very remarkable, as some, taken some three or four weeks before at Strood, were spun up for pupation at the time. Bankes observes that, on May 7th-9th, 1904, at Corfe Castle, he found young larvæ living in slightly spun-up shoots of *Veronica chamaedrys*, eating out the tender heart of the shoot. Some (2·5mm. in length) were preparing to moult, (an operation which two had already completed). They were sent to Bacot, who reports that, "by the 10th, the others were preparing to moult, each resting along a young leaf of the shoot, and casting off, at this change, the generalised appearance that it has hitherto possessed, and which makes it look rather unlike a typical plume larva in its earliest stages." For moulting, the larvæ spin together a few leaves or flowers, making a sort of cocoon in which the change takes place. Ovenden further notes that "larvæ varied very much in size at Cuxton, on May 4th, 1904, none, however, being at all well-grown, but, on May 26th, 1904, at Higham, larvæ were very abundant, feeding on the speedwell that covered a bank, and now in full bloom, most of the larvæ evidently quite fullfed, and resting, exposed to the full glare of the sun." Sich writes: "I received some larvæ from Mr. Ovenden, May 11th, 1904. The first spun up May

30th, and was a pupa May 23rd; a second spun up May 23rd, and a third spun up May 24th, a fourth May 29th, and two more May 30th. The larvæ attach themselves to the stalk of the foodplant for pupation, and the 9th and 10th segments turn brown and have a shrivelled appearance. The larva of *S. pterodactyla* is of a much more lithe and pliant nature than many other Alucitid larvæ, such as those of *Porrittia galactodactyla* and *Ovendenia septodactyla* for example. These latter seem rather stiff and prefer to keep their bodies all in the same plane, but that of *S. pterodactyla* will twist round a spike of its foodplant, so that half its body may be parallel with the stalk and the other half bent round at right angles to it. It is very fond of eating the large blue petals of the *Veronica chamaedrys*, but will also eat the young seed-vessels and young leaves. When this larva is placed against a white or other definite back-ground, it is sufficiently conspicuous, but, when seen among its foodplant, there is a certain indefiniteness about it. The outline is much softened and broken by the larval hairs, and also by the hairs growing from the surface of the racemes of the speedwell, on which it usually rests; besides this, the pale hairs and markings of the larva seem to allow the eye to see, and the sight to pass beyond, the larva without the brain perceiving what it is." Larvæ can be obtained from mid-April until the commencement or middle of June, in most seasons. Fletcher found fullfed larvæ June 13th, 1881, at Worthing, and imagines flying at the same time. Larvæ from May 4th-27th, 1904, at Cuxton (Ovenden); as late as June 14th-16th, 1904, in Thorndon Park (Whittle). Hofmann observes that the larvæ live in May, exposed on *Veronica chamaedrys*, eating the flower-buds, unripe seeds, and also the leaves. Schmid says that he finds the larvæ, varying in size, from the end of May, feeding openly on flower-buds and unripe seeds of *Veronica chamaedrys*, at Frankfort-on-Main.

Larva.—*First instar* (newly-hatched): Pale greyish-white in appearance, really white with black dots. Head black, a dark prothoracic scutellum; the larva is just 1mm. in length, and has single hairs on each tubercle; its width is about 0·16mm., and the length of the hairs about 0·05mm. Tubercles i and ii are situated widely apart; the hair on i is directed forwards, that on ii backwards, on iii rather forwards, those on iv and v outwards and a little divergently, the front one, v, higher and shorter than the hind one, iv; that on vi is long, touching the surface on which the larva walks. The hairs on the prothoracic plate are the usual ones. The prolegs and claspers have four hooks, and the former possess long pedicels. The true legs have very long claws, and no observable battledore palpi (Chapman. June 30th, 1904). *First instar* (fullfed): Long, slender, of rather even thickness, but tapering off slightly at head and anus; segmental incisions very marked. Head rounded, almost black, the prothoracic shield (scutellum) and anal plates dark brown, not black; skin-surface apparently quite smooth; spiracles raised, but not very highly, of brown colour; hairs as in larva of *Capperia heterodactyla*, smooth and tapering, not thorned, and of dark colour, basal plates large. Tubercles on the abdominal segments are, i and ii, set trapezoidally with their bases well separated, iii as usual; iv and v also normal, forming twin spots. On the meso- and metathorax, i and ii are close together, not so widely separated as on abdominal segments; i, the inner and smaller, slightly in front, ii, the larger and outer; iii and iv are close together as usual, iii, in front and the larger; v, a large single seta below them, and vii, a twin-haired plate. I cannot trace any spicular growth (Bacot. July 11th, 1904). *Second instar* (before hybernation): In length the larva is nearly 2mm., stout, and, magnified, has a very great resemblance to the fullfed larva of *Platyptilia gonodactyla* in form, and especially in colour and marking, having a pink dorsal line, and a subdorsal extending downwards to the supraspiracular network of pink, in a definite pattern. The tubercles have each one hair (about $\frac{1}{5}$ the diameter of the larva in length), *viz.*, on i, ii, iii, iv, v, vi (half-way from iv to prolegs, and rather to the back of the segment); three hairs at the base of the prolegs (? vii) placed triangularly, not in a row. The head is black, and the prothoracic and anal plates are very dark. The red marks are hardly present on the thorax, but are bright on all the abdominal segments (August 27th, 1904). *Third instar:* 3mm. long (feeding externally on stamens and petals of flowers); tubercles i and ii well separated; i carries one long, white, slightly-clubbed, hair, and two short, black, clubbed secondaries on its inner side; outside is another secondary hair, sometimes black, sometimes white, and another longer one, the origin of which gives the idea of its being rather a subsidiary tubercle than an appendage to i; ii is constructed similarly, so as also to look like two conjoined tubercles; it has a second white hair outside and behind the first, and two black hairs on the inner margin, sometimes also a third. There are similar black secondary hairs arising from the skin-surface by the dorsal line, three in the middle line, and two, paired, behind; there are also white secondary hairs, like the black, except in colour, two or three on either side in front of i. The disposition of these secondary hairs differs much on different segments, and on opposite sides of the same segment. [I am examining this larva as it lies with its head buried in a flower-bud of *V. chamaedrys*, and observe that the margin of the calyx has a row of hairs which are identical, even to minute details, with the primary hairs of the larva; their length is identical, they are a little thick and colourless, but this gives them exactly the same value as the more slender white hairs of the larva; they are somewhat knobbed, or clubbed, at the extremity, and they spring from a raised, coloured, disc, which is very like the tubercular base of the larval hairs.] Tubercle iii is a large boss with one long white hair, two black secondaries behind, and often another above, in front, or with the other two. Directly behind the spiracle, on the 2nd subsegment, is a small tubercle with one long white hair (shorter than those on i, ii, and iii), and one or two black hairs; iv + v, directly below the spiracle, have two long primary hairs, the front one rather higher, two or three secondary ones above and behind; this is on the flange; some way below is a tubercle (vi) with one solitary long hair (no secondaries), and then the three hairs (vii) at base of prolegs. The spiracular region is without secondary hairs, but several occur below iv + v, and others near supplementary tubercle which is towards the posterior margin of the surface. The general surface is covered by fine black-tipped skin-points. There is a curious bare pit between i and iii. The colour is the result of colourless skin over most of the surface, the black skin-points, and a brown colour below i and ii down the dorsum. Head black; prothoracic plate nearly black (Chapman). *Third instar* (fullfed): Length 4mm., width hardly 1mm.; rather long and slender; greatest girth at 4th abdominal segment; it tapers gently from this towards the rather small head and towards the pointed anus; segments somewhat swollen; well-marked segmental incisions. Head rounded, polished, of a black hue, with a few whitish hairs; the prothoracic shield and anal plate are of chitinous appearance, dark smoky-green, the former with the two depressed dark-coloured spots as in the later stages. In addition to the two large subsegments that are present in the next instar, there is a small, poorly-marked, central subsegment situated centrally between the anterior and posterior dorsal tubercles, while, on the meso- and metathorax there is, in addition, a very distinctly marked, but small, subsegment in front of the three poorly-marked ones, which make up the bulk of the segments. The skin is pale (whitish or yellowish), glistening in appearance, with a well-marked, and relatively coarse, coat of brown spicules. The prolegs are tall and slender; the true legs dark smoke-coloured, and the anal claspers show some tendency to extend backward as in the older larvæ, and are chitinous in appearance. The colour is white with a yellow mediodorsal band; also a very broad and much broken subdorsal one, extending downwards, as detached streaks and blotches, as far as the spiracular level; below this, the white extends as far as the ventral area, which itself is of a dull, and less vivid, white. The spiracles are large and conspicuous, of a pale brown colour, but not much raised for a plume larva; as usual the prothoracic and 8th abdominal spiracles are larger than the others. The tubercles are cone-shaped buttons, each bearing one, long, pale, white hair, tapering, but at the same time slightly knobbed at the tip, and minutely thorned. There are, in addition, a few short, dark-coloured (black or dark brown), knobbed bristles, apparently correlated with the primary hairs, but not always in close proximity. On the meso- and metathorax the dorsal tubercles i and ii are in close proximity, but their bases do not touch; they are set somewhat obliquely, i inner, ii outer; iii and iv are situated close together, their bases almost, or quite, touching; below these, rather posteriorly, there is a weak subprimary hair, and, in front of this, a strong v, and near it the usual subprimary vi; vii has two hairs. On the abdominal segments, i and ii are set trapezoidally and are well-separated, iii is close above the spiracle, while iv and v, with bases clearly separated but close together, are in the usual position beneath it; below these is vi, bearing a single hair, and a double- or treble-haired marginal vii just above the prolegs, on the segments bearing prolegs, three-haired, but on the other abdominals only two-haired. The black bristles above referred to are—one on either side of i, and one on either side of ii, making four dorsal rows; occasionally these are either missing, or very pale-coloured and inconspicuous; usually this happens to the row nearest the middle line; there is a similar secondary hair situated immediately behind iii, and another posterior to the spiracle (occupying about the position of the secondary wart in the larva of *Porrittia galactodactyla*, etc.). On the 5th abdominal, but on the right side only, there is, in this particular larva, an additional bristle (of only about half the normal length, however) between the postspiracular and the one beneath ii. A well-marked lateral flange is present (Bacot, May 4th, 1904). ? *Fourth instar:* Complete change from generalised to specialised conditions; 4mm.-5mm. in length, comparatively slender and of even thickness, with a large head. The segments, though well-marked, are not accentuated; of blunt-ended appearance, with little or no tapering exhibited; anal claspers large, and curiously stretched out posteriorly (after the manner of Liparid larvæ). There is a well-marked, chitinous, prothoracic shield; spiracles not raised, and rather large, with black rim and white centre. Each segment is, apparently, roughly subdivided into two large sections; this is, perhaps, partly, if not entirely, due to the tubercles i and ii being somewhat raised, and only narrowly separated, which gives the appearance of a dorsal subdivision. Colour dull yellowish, with dark median stripe. Head: Pale yellowish, slightly mottled at sides with brown, two large brown blotches round ocelli, and two dark triangles near crown of the same colour. Body: There is a deep brownish depression, or shallow pit, on either side of the scutellar plate, in line above the spiracles,* and a few dark (black) spots across the middle line of scutellum. The long hairs are tapering and very finely thorned; on the dorsal area they have an oxhorn-like curve, that is, curve outwards laterally, and then turn in again towards the middle line at the tips. They are blunt-ended, or very slightly knobbed, and have opaque white tips like those of the larva of *Capperia heterodactyla*. The larva has, also, short, scattered, body-hairs; these appear slightly knobbed at the tips, and are, for the most part, white, though a few are black. The tubercles are not developed into definite warts; but round the primary setæ there are raised skin-areas, and some of the previously mentioned, scattered, secondary hairs approximate to, or are accidentally near, them in position; a fine spicular growth covers the skin, except on these raised areas surrounding the primary setæ; the raised skin-areas are, therefore, shiny, which gives them a chitinous wart-like appearance that is not altogether warranted. Tubercles: On the meso- and metathorax, i and ii are combined in a single group, on the anterior of the two subsegments; there is also a large secondary seta on the posterior subdivision. On the abdominal segments, i and ii are separate, both raised and wart-like, bearing two or three large, and several smaller, hairs; iii is a large, somewhat wart-like, tubercle, and the secondary postspiracular group of hairs forms a wart; this is present on the meso- and meta-thorax, but it is by no means certain that the group on these segments is homologous with the group in the same position on the abdominal segments. There is a somewhat marked flange beneath the spiracles, and, on this, beneath the spiracle, are situated iv + v, forming a single wart; posterior to it, also on the flange, is another small group of hairs. The black, secondary, scattered hairs appear curiously irregular in position; on some segments they occur on the middle line, while, on other segments, the hairs in this position are white; one gets the idea that these secondary hairs are alike, but, by some accident, some become black; possibly, however, a careful comparison would show a regularity in this apparent disorder. A large, chitinous, anal plate is present, and bears three longitudinal rows of spots (Bacot, May 1st, 1904). Length, four larvæ are 4mm.-5mm.; thickness less than 1mm.; two others are rather larger, but in same skin, laid up for moult; these two looked fatter and balder than either of those that are smaller but

* This is probably a good generic or tribal character, as the depression can be found on all the allied larvæ (Bacot).

in same skin, or than larger ones in next stadium (vide *infrà*), due to the stretching of the skin and consequent dispersion of hairs. [These larvæ were mostly on flower-spikes, but had just left finishing the terminal buds of the shoot. For moulting, they make a little cocoon amongst the leaves and buds at the top of shoot. The smaller larvæ were dull dusky-green, with a slightly darker dorsal line and black spiracles. Dorsal tubercles two (or three), white-haired; secondary hairs few, inconspicuous, black above, below the flange white; tubercle iii with black hairs (?).] (Chapman, May 18th, 1904). *Penultimate instar:* 6mm.-8mm. in length, and show but very little alteration in appearance from that of the last instar; the spiracles are a little more raised in this individual, and the hairs appear less numerous, at any rate they are less conspicuous. The colour is brighter, more of an orange-yellow, while the median band appears to owe its existence to the large central blood-vessel that lies just beneath the surface. Most of the warts bear one large and one medium-sized hair, and from two to four small ones. The skin has the appearance of being shagreened, due to the development of the spicular coat. The same apparent want of symmetry is present, as regards the situation of the scattered black secondary hairs; in this skin these can be definitely seen to be trumpet-topped (Bacot, May 4th, 1904). 8mm.-9mm. long, 1·6mm. thick; numerous hairs, or warts; secondary hairs much more numerous, with many white ones (as well as black dorsally). Colours much the same, but the dark green is a marked dorsal line, and a broad band from below up to nearly ii. This band contains, on each segment, three paler patches. Between this band and dorsal line is a band of about the same width, much paler, whitish-green, which includes i and ii; below the lateral dark band the colour is again pale whitish-green. Primary hairs white; spicules, and some secondary hairs, black, but most of these latter white. Prolegs appear as long props. Seen at a proper distance, the lateral dark band has a chain-like aspect, owing to the white patches in it (Chapman, May 18th, 1904). *Final instar* (young): About 10mm. long, 1·6mm. wide, tapering to anus, blunter at head; more slender than the larvæ of many of the exposed feeders, which, again, are more so than those of the Platyptilias. Colour of body pale yellowish-green, with darker green dorsal line, and lateral band between dorsal (i and ii) and supraspiracular (iii) tubercles; it is darker again below flange, which gives the impression that the flange, and above, is paler from the skin being denser, and that below it is delicate, and shows green contents. The tubercles are disposed as described in small larva, but have now a larger number of hairs, and, though one may be selected as being *the* primary hair, on i, two others come rather near it, on ii two others are nearly identical, as also on iii; the postspiracular has two approaching the primary; iv+v have two primary hairs without strong competitors, vi also is still alone as a primary, but has five or six secondaries round it. Secondary hairs are abundant, scattered over the whole surface, and also on the tubercles; nearly all of them are now white, there are, however, a few black dorsally, and two or three on most tubercles (Chapman). *Final instar* (full-grown): The larva has a very transparent skin, and, consequently, presents two very different aspects, according to whether it is feeding or whether it is laid up for pupation, the feeding larva having the colour much dominated by the dark green contents of the alimentary canal. [Probably the feeding larva would vary in colour if the larvæ could be got to feed exclusively on petals or seeds, instead of leaves. The young larva eats the buds; in intermediate stages it rests largely on the flower-spikes, and eats the flower-buds; the older larvæ prefer the leaves, or, at least, do not confine themselves to the flower-spikes.] Length now about 14mm., thickest about the 4th and 5th abdominal segments, thence tapering to each end, fairly cylindrical, with long slender pedicels to prolegs. When young, in last skin, certain paler skin-markings and black secondary hairs give the larva a muddled, dirty, look. The general surface is clothed with minute black skin-points, except on certain paler (white ?) marks, where they are colourless. These white marks have the look of depending on some white substances beneath the skin. They form, especially, a line below i and ii, and a lateral (subspiracular) line. There are also other islets between; these must be fat-bodies, as they do not appear before the larva has grown a little in this skin, and, before they appear, the skin-points have not become black. Tubercles i and ii each carry one long white hair, and a good many secondary ones, black and white; one of these black ones on each, but especially on ii, is so long and spiculated, that doubt arises whether it, or the white (smooth) one, is the primary bristle; the secondary hairs on iii are 7 black and 2 white. There is a postspiracular tubercle carrying 5 black and 2 white hairs, all of which look secondary. Tubercles iv + v carry 2 long hairs (upper in front), and 4 black and 4 white secondary hairs. There is a small tubercle with several short hairs a little below this at the postspiracular margin of segment. Below the flange is a tubercle with 1 long hair and several short secondaries, a double one (with secondaries) lower down. The secondary hairs scattered over the surface are generally white—a good many, however, black dorsally; between the two white lines there are about 30 to 35, the neighbourhood of the spiracles is clear of them (Chapman). Length 10mm.-12mm., width 2mm. *Lateral view:* Head very small, yellowish-green, mottled with deep brown; three pairs of elongate marks down the suture, a curved mark with a straight one below it on the lobes above the ocelli, which are situated in a deep brown patch; mouthparts brown. Head retractile within prothorax. Prothorax small, mesothorax much larger, metathorax slightly larger than mesothorax. The 2nd abdominal segment is the largest, and the body tapers off from this segment to the 10th abdominal. The legs are small, and the claspers long and slender. The pale subdorsal line and pale lateral flange are very noticeable. Segmental divisions very well marked. [When the larva is at rest, it certainly reminds the observer of an Attacid larva. The small head is held down close to the legs, and partly buried in the prothorax, which is, in its turn, much overshadowed by the mesothorax. The warts, with their fascicles of black or white hairs, also tend to heighten the resemblance to an Attacid larva.] *Dorsal view:* Head hidden by the prothorax, which is nearly itself hidden by the mesothorax. The mesothorax is larger, and, though the body increases slightly in width to the 2nd abdominal segment, and from there tapers to the 10th abdominal segment, yet the difference in the width is so small, that the body appears almost the same width from the mesothorax to the 6th abdominal segment. The dark mediodorsal line and the pale subdorsal lines are conspicuous, as well as the black dorsal hairs, and the long pale lateral hairs (Sich, May 21st, 1905). *Quiescent stage preceding pupation:* When laid up for pupation, the larva is shorter and more slender, and gets enlarged thoracically; its length is only about 11mm. These changes are usual in larvæ preparing to pupate. The special change here is one of colour, due not to a change of the skin itself, but, apparently, merely to the emptying of the *prienae irae.* The result is a tolerably uniform and paler green, with nearly white subdorsal and lateral lines; these also are straighter, and of more uniform width than before. The black skin-points, and black secondary hairs, seem to have less effect in modifying the colour. There are pale patches between the two lines, but these are less visible than before. The white lines are sometimes nearly so, but really always have a creamy tint, and may be, especially the lateral one, quite yellow (Chapman). The larva is described by Schmid (*Berl. Ent. Zeit.*, viii., p. 66), by Porritt (*Ent.*, xv., p. 44), by South (*Ent.*, xv., p. 148), and Buckler (*Larvae*, etc., ix., p. 362).

Variation of larva.—Chapman observes (*suprà*) that the larva presents two very distinct aspects, according to whether the larva is feeding or laid up for pupation, dark green dominating the former, owing to the contents of the alimentary canal showing through the transparent skin. Porritt says that there are two distinct varieties among the fullfed larvæ:

(1) The ground-colour bright grass-green, with dark green dorsal stripe.
(2) The ground-colour bright yellow-green, the dorsal stripe dark green or dark brown.

Pupation.—The fullfed larva usually selects in nature a part of the foodplant for pupation, whilst, in confinement, it often comes off, and pupates on the side of the receptacle in which it is confined. It spins a silken web on which it takes up its stand; one was observed settling down thus on May 20th, 1904; next day the thorax was rather swollen, the body contracted; on the 22nd the thoracic area was more swollen, the head drawn in a little ventrally, and the larval colour very uniform; on the 23rd there was no apparent change, nor was there on the morning of the 24th, when, at about noon, another larva touched it, and it threw up its head and oscillated violently. Between 2 p.m. and 6 p.m. the larva changed to a pupa; the change was not observed. At 6 p.m. the newly-formed pupa was described (see *infrà*). A second larva fixed itself in position on the 21st, a day later than the one already described; this changed to a pupa in the afternoon of the 25th, and was as yellow as the one that changed the preceding day; a third larva that fixed itself on a stalk of the foodplant on the 22nd pupated on the 27th; a fourth larva that had been wandering for 4 or 5 days, and disturbing the others laid up for pupation, finally came to rest on the evening of the 25th, and pupated on the 27th on the bottom of the box, without attachment; although so active, it had, during the 23rd and 24th, quite the appearance (swollen thoracic segments, etc.) of a larva in the quiescent stage preceding pupation. Porritt says that the pupa is attached by the tail only, and is capable of considerable movement; on being disturbed, it turns up sharply the thoracic and upper abdominal segments. Bankes notes a pupa that was suspended by the anal extremity from the glass lid of the cage by means of a silken pad spun upon the glass. Schmid observes that the pupal stage lasts fourteen days.

Colour changes during pupal development.—*Newly turned:* Of a most delicate yellow-green colour, the tips of the limbs and the anal segment being somewhat transparent yellow; no dark markings anywhere on the pupa except a tiny black point within the eye-collar; two slender, whitish, subdorsal lines on either side of a fine mediodorsal line, rather darker than the ground-colour, and a somewhat similar prominent subspiracular line slightly raised, representing the larval subspiracular flange; the shiny spiracles very conspicuous, also the distinct transverse wrinkling; the abdominal segmental incisions of a bright yellow colour (Tutt, May 20th, 1904). *Colour changes on maturation* (June 4th, 1904): By June 4th the oldest pupa had undergone considerable change. It was now much paler in tint. The eyes were quite dark, of a greyish-black tint, the legs, etc., whitish; the thorax also was paler, and the green of the abdomen rather duller in tint. The double dorsal ridge (containing the mediodorsal depression) was also pale in tint, and the character of the ridges on the thoracic segments, uniting almost on the summit of the mesothorax, widening again from hence as they pass back over the abdominal segments, gave an unmistakable suggestion of the same character (still more marked, however, than in this species) in *Gillmeria ochrodactyla* and *G. pallidactyla*. *Final appearances:* June 8th, the wings turning brown. June 10th, the wings and appendages quite dark; the tiny slip of hindwing, lying along inner margin of forewing, almost black; the thoracic segments also brown, the mesothorax rather browner than the pro- and metathorax. (Imago emerged in the early morning, before 8 a.m., of June 12th.) Another pupa, on June 12th, showed the wings dark; the narrow slip of hindwings blackish; the apex of mesothorax dark; the rest of the thorax and abdomen pale brown, except the movable abdominal incisions which appeared greenish (Imago emerged from this pupa on June 13th.) (Tutt).

Pupa.—Length of pupa 10·5mm., width at thorax 2mm., at 4th abdominal, 1·6mm. Form and structure almost identical with that of *Adkinia bipunctidactyla*, and the colouring is also very close. The peculiar character of the tubercles, with their globular bases, and the hairs situated on their anterior (or posterior) faces, instead of springing from the top, are precisely the same. The pupa is also very like that of *A. zophodactylus*, a little larger, about 12mm. long, equally cylindrical, and nearly as slender; its colour, however, is less brilliant. There is a little rise to the top of the mesothorax, but otherwise the pupa tapers equally, and very slightly, from the mesothorax backwards, more rapidly, however, on abdominal segments 8, 9, and 10, which run to a sharp point, and, with two subdorsal and two subspiracular ridges very pronounced, give a quadrangular section. The dorsal ridges in front are well-marked, smooth, and rounded, except on posterior slope of mesothorax, where there is some crenulation; they are very close together here, but separate both in front and behind. They run back and include i of the 3rd abdominal segment, stopping there abruptly, although ii is in the same line, and only separated from i by two of the narrow transverse ribs. The tubercles i and ii arise from the front and back respectively of two of these ribs, with two between; the ribs they arise from here project almost as a little ball, and the hair comes from quite the side of it, and is nearly parallel with the pupal surface, i pointing forwards, ii backwards. They are all minute clubbed batons, about 0·03mm. long. It is curious how they suggest, in their directions and the swelling of their bases, the complicated structure of the Amblyptiliines. Tubercle iii is just above the spiracle; iv and v are on a level, and also on a little smooth antero-posterior ridge, that breaks through all the small transverse ribs, after the front three or four; tubercle vi is on nearly the last rib; vii has three hairs in an antero-posterior curve. The free appendages reach to about the end of the 5th abdominal segment; the appendages have fine transverse ribs, with apparently minute pits. The wings have fine dark lines with arborescent branches, invisible without strong magnification. The forward cremastral group of hairs is very distinctly in two bunches, one on each side, each radiating from a centre, and consisting of 35 or 40 hairs, 0·14mm.-0·3mm. long, with fine fish-hook points. The anal group is quite as numerous, closely packed in an area of 0·4mm. in length, shorter than the other set (about 0·2mm.). The transverse ribbing is rather bolder than that of *A. zophodactylus*, and the ribs are only about 12 in number in the dorsal line. The finer sculpturing of pits is not very clear, even in the spaces, and does not appear to go over the ribs. The ribs are, in fact, somewhat smooth on top, and have irregular margins, minute subridges branching down from the sides. This is, perhaps, as marked a difference from that of *A. zophodactylus* as the pupa presents (Chapman, May 27th, 1904). Length about 11·5mm. Width at thorax slightly over 2mm. Long and slender, of unmistakable Platyptiliid shape, but less robust. In outline, it forms almost a straight line medioventrally, and up the extended legs, and to the head. Beyond a very slight projection of the ventral headpiece, the contour sweeps backwards, in the segment of an arc, to the slightly raised hump on the posterior of the mesothorax; from here, to the extremity of the pupa, the dorsal outline is quite even, but either curved or straight, according to the posture of the pupa. Ventrally, from the extremity of the wing-cases, there is little or no tapering until the 5th abdominal segment, but, from here to the 8th abdominal, there is a quite noticeable curved tapering; from the 8th to the anus, the pupa has the usual Alucitid, sharply-cut, tapering, reaching to the termination of the anus. This gives the pupa the appearance of having been cut at an oblique angle, from the ventral side of the 8th abdominal segment to the extremity of the 10th, with a sharp knife. It is quite smooth and without hairs, except for the minute primary setæ. The diameter at the 3rd abdominal segment is about 2mm. (measured from empty pupa-skin). The 2nd and 3rd abdominal segments are the longest; the other segments shortening off in both directions, except the mesothorax, which is, as usual, of large size. The intersegmental area at the posterior end of the 3rd, 4th, 5th, and 6th abdominal segments, is a very marked feature of the pupal skin, after the emergence of the imago, owing to its smoothness and opacity; it comprises quite a quarter of the length of the 4th and 5th segments, and slightly more than a fourth of the 6th abdominal segment. The transverse striations, or ribs, are a marked characteristic of the dorsal area of all the segments from, and including, the metathorax, and, on the lateral and ventral areas of the free segments, on which their development is stronger—upwards of 20 may be counted on the 4th abdominal segment. Viewed ventrally, the tapering towards the anus is long and gradual, but, laterally, it is more abrupt, chiefly from the posterior end of the 6th abdominal. A marked double dorsal ridge rises on the prominence of the mesothorax, and is continued in both directions, widening out gradually as it descends downwards to the end of the 3rd abdominal segment, where it is interrupted by the intersegmental membrane ; on the 4th, 5th, 6th, and 7th abdominal segments, it exists only as a low ridge on the central area; on the 8th, 9th, and part of the 10th, it again becomes a continuous and conspicuous double ridge, narrowing down towards anus, owing to the diminishing size of the pupa, but, in reality, becoming relatively wider, as it gets nearer and nearer to the lateral area, and actually forms a sharp corner between the lateral and dorsal areas. In a forward direction the ridge widens out as it is continued forwards towards the head. A marked lateral ridge is also present from the anal segment forwards to the anterior of the 7th abdominal, where it becomes low and broad, and completely interrupted by the intersegmental membrane, like the dorsal ridge; its line is, however, continued forwards beyond the 3rd abdominal segment, by the edge of the hind margin of the forewings. This system of dorsal and lateral ridges gives the pupa a very angular appearance, and probably assists in its general scheme of cryptic resemblance. The narrow slip of hindwing does not extend so far as the end of the 2nd abdominal segment, but, owing to the length of the segments, it is a fairly long slip in relation to its width. The leg- and antenna-cases (as is usual in this group) project very far as free appendages, *viz.*, over the whole of the 4th, and the greater part of the 5th, abdominal segment, a supporting corner (formed by the apices of the wings) extending as far as the middle of the 4th abdominal segment. The spiracles are considerably raised, but not tube-like, as in those of many Alucitid larvæ; they have slit-like openings. The hairs, or setæ, are short, and the dorsal ones curved, and either knobbed or club-shaped. Tubercles i and ii are placed on the dorsal ridges, situated near together on the free segments, their bases back to back, the setæ pointing respectively in a posterior and anterior direction, in a manner suggestive of their position in the pupæ of some of the allied Oxyptilines. The intersegmental membranes are strongly, though finely, pitted; the pits having a diamond-shaped wall, but stretched lengthwise; on the ribbed areas pits are also present, but they are less numerous, of irregular or circular shape, and without walls. The sculpturing, so minutely described by Chapman in the pupa of *A. zophodactylus* (*anteà*, pp. 329-330) seems to be nearly, if not quite, identical in this species, with the possible exception that, in the pupa of *S. pterodactyla*, the sculpturing seems to be somewhat coarser. The setæ in *S. pterodactyla* are certainly longer than those of *A. zophodactylus* in the mounted specimens examined (Bacot. Described from pupa-case, November 25th, 1905). Rather long and slender; the head, which is the thickest part, is abruptly rounded, and has the snout very prominent; thorax and abdomen rounded above, rather flattened beneath, and attenuated strongly to the anal point; eye-, leg-, and wing-cases fairly prominent, the last prolonged a considerable distance over the abdominal segments (Porritt). South gives a short description of the pupa (*Ent.*, xv., p. 148).

Variation of pupa.—Porritt, who describes two forms of the larva (*anteà*, p. 375), finds two somewhat parallel forms of the pupa, which he diagnoses as:

(1) Bright green, with little of any other colour; the abdominal incisions pale

grey; two indistinct pale lines on the dorsal area; several faint purplish spots behind the thorax and on the anal segment being the only markings noticeable.

(2) Dingier green in tint, with a distinct purple dorsal stripe, edged on each side with greyish; the abdominal incisions and the tip of the prolonged wing-cases also purple.

In May and June, 1904, we examined many pupæ of this species, from larvæ found in different localities. In these, when at the same age, there appeared to be very little variation, some were of a little brighter green, *i.e.*, of a more yellowish-green, others rather duller in tint, and, on the dorsum, there was a slight variation in the amount of purplish shading on the mediodorsal line, on the metathorax, and 1st and 2nd abdominal segments (always, however, in the specimens examined, very small). There certainly was none of the clear dimorphism exhibited, in the eight examples examined, like that spoken of by Porritt. In one example, the mediodorsal line was marked throughout, from the mesothorax to the anus, very slenderly, with purplish-red. Chapman says: There is much less range of variation in colour than in pupæ of *Adkinia bipunctidactyla.* A few seem to be altogether green in colour, except for a pale or white tint on the dorsal flanges on the mesothorax. Most have some pink or reddish between these flanges, extending, usually, a little way into the abdomen, and most have the last three segments more or less reddish-brown, darkening to the apex. The dorsal, subdorsal, and sublateral lines are generally of a slightly darker shade of green. On a well-marked specimen, there is a white lateral line, with a faint reddish, or brownish, shading below it; the leg-cases, beyond wings, are slightly ruddy, distinctly so at the tips. In one specimen the wing-cases are darker, and there is a suspicion of a ruddy tinge over the abdominal segments. Yet even this specimen presents very little difference from the others, on a casual view, unlike the red form of *A. bipunctidactyla* which contrasts strongly with the green (May 27th, 1904). On June 1st a pupa appeared of an uniform brownish-red colour, the markings being very faintly indicated by a slight difference of tint.

FOODPLANTS.—*Veronica chamaedrys** (Stainton), [*V. serpyllifolia*, *V. arvensis*, *V. triphyllos* (Zeller), *Gratiola officinalis* (Disqué, *Iris*, xiv., p. 227†)].

TIME OF APPEARANCE.—The species appears to be absolutely single-brooded.‡ Emerging, in Britain, over a period of some five or six weeks in a season, and varying from early June to early July, for the earliest specimens in different years, it remains on the wing in late seasons until mid-August. It occurs at about the same time throughout central Europe, but, in the high alps of central Europe, and in Scandinavia, is rarely on the wing until mid-July, and often occurs well into late August. In Germany, it is recorded at Friedland from

* Hudd says: "Plentiful amongst *Veronica* and in strawberry beds." We can hardly think the larva has any connection with strawberry, although Crombrugghe de Picquendaele observes that it occurs in the Ixelles district, where *Veronica chamaedrys* is entirely absent.

† Disqué observes that he found fullgrown larvæ of the second brood on July 7th, on the Haderwiese, upon *Gratiola officinalis*. As *S. pterodactyla* is not double-brooded, one wonders whether he is really referring to this species.

‡ *Emmelina monodactyla*, L., was long known as *pterodactyla*, Linn., and one finds many records of *Stenoptilia pterodactyla* being double-brooded, occurring in June and July, and again in September-October, that must belong to the former species.

the end of June till the beginning of August (Stange), in the Hamburg district in July (Sauber), in Hanover during June (Glitz), at Frankfurt-on-Main in June and July (Schmid), in Hesse-Nassau during the last half of June (Rössler), mid-June till the beginning of August in Waldeck (Speyer), and in June and July in Silesia (Wocke), also in the Kingdom of Saxony (Schütze), in July in Bavaria (Schmid). In Lower Austria, it is noted as occurring in July and August in Carinthia from the end of June to the end of July, and in Carniola at the end of June (Mann); in the Tyrol we found it late in July on the Mendel Pass, and throughout the first fortnight of August in the Cortina district. In Switzerland, it occurs in June at Zürich, but in July in the Bernese Alps, and on the Simplon. In Belgium, it is recorded as occurring in July and August (Lambillion). In the lowlands of France —Tancarville, Fontainebleau Forest, etc.—the species occurs throughout June, but, in the Savoy mountains, it is well-out in mid-August, and is possibly on the wing until the end of the month. In the more northerly parts of Scandinavia also, the species occurs in late July and August. Zeller observes (*Linn. Ent.*, vi., p. 373) that he took the species from late June to early August near Glogau; on the Seefelder he caught two ♂s on July 15th, and received a somewhat brownish-grey Swedish ♂ from Zetterstedt, labelled "Furillen, July 21st, 1841"; he also notes a worn ♂ from the Sommering (from Fischer von Röslerstamm's collection), taken on August 6th; he concludes, therefore, that there is only one brood, which emerges through several months and lasts longer on the mountains than in the plains. The following details will give some idea of the range in the time of appearance of the species. CONTINENTAL RECORDS.—Early July, 1869, on the Simplon (Jäggi); June 19th, 1869, just appearing near Meseritz (Zeller); July 12th-30th, 1870, at Pichtendahl and Rotsikull (Nolcken); a worn specimen, probably referable to this species, at Marshen, April 20th, 1870 (Blackmore); June 4th-16th, 1890, at Tancarville (Leech); July 28th-31st, 1894, at Courmayeur; July 28th-31st, 1895, at Mendel Pass; August 6th-12th, 1895, on the Monte Cristallo (Tutt); mid-July, 1897, at Wolfsberg (Chapman); common, July, 1897, at Aal (Strand); June 28th, 1897, in the Forest of Fontainebleau; August 4th-12th, 1902, at Megève; August 17th, 20th, 1902, at Chamonix; July 26th, 1904, at Gex; August 7th-9th, 1904, at Saas-im-Grund (Tutt). BRITISH RECORDS.—July 16th-17th, 1869, at Witherslack (Gregson); July 16th-28th, 1879, at Skegness (Porritt); imagines bred June 13th, 1881, at Worthing (W. H. B. Fletcher); others bred June 29th, 1881, and following days from same locality (Porritt); July 14th, 1883, in Isle of Purbeck (Bankes); July 14th, 1883, at Wood Ditton (Raynor); August, 1883, common from Walmer to Kingsdown (Shepherd); June 2nd-28th, 1884, at Grange (Hodgkinson); June 20th-26th, 1884; in the Isle of Purbeck (Bankes); July 21st, 1885, at Cuxton; July, 1886, at Higham (Tutt); July 31st, 1886, in the Isle of Purbeck (Bankes); June 27th, 1887, at Sanderstead (Sheldon); July 7th, 1887, at Kingsdown; July 20th, 1887, at Cuxton; August (?) 18th, 1887, in Chattenden Woods (Tutt); July, 1887, at Sligo (Russ); August 4th, 1888, between Llangollen and Loggerheads; August 15th, 1888, at Rhydymwyn (Arkle); August 4th, 1888, at Kingsdown; June 23rd, 1889, in Westcombe Park; June 28th, 1889, at Maidenhead; July 28th, 1889, at Freshwater (Tutt);

July 2nd, 1889, at Portland (Richardson); July 18th, August 2nd, 1889, in the Isle of Purbeck (Bankes); June 4th, 1890, on the Belfast Hills (Watts); July 14th, 1890, at Bundoran (Johnson); July 16th, 1890, at Greenhithe (Bower); late July, 1890, at Deal and Kingsdown (Tutt); July 28th, August 4th, 1890, in the Isle of Purbeck (Bankes); July 5th, 1891, at Shoeburyness; July 3rd, 1892, at Leigh (Whittle); July 5th, 1892, at Panton (Raynor); July 5th, 12th, 1892, in Chattenden Woods (Tutt); July 18th, 1892, imago at Sidcup (Bower); July 29th, 1892, at Witherslack (Arkle); June 15th, 1893, imagines common at Lee (Bower); June 17th, 1893, in Chattenden Woods, getting worn on July 1st, 1893, but still odd specimens to be seen until July 22nd, 1893, at Cuxton (Tutt); July 7th, 1893, at Panton; July 14th, 1893, at Legsby (Raynor); July 12th, 1893, at Mansfield (Daws); June 27th-July 16th, 1894, in the Painswick district (Farn); July 13th, 1894, at Purley (Studd); July 15th, 1894, at Eastwood (Whittle); 2nd week in July, 1894, at Stonehaven, near Cowie (Dalglish); August 1st, 1894, at Panton (Raynor); June 25th, 1895, in Chattenden Woods; June 26th-July 7th, 1895, at Cuxton (Tutt); July 17th, 1895, imagines common at Shoreham, Kent (Bower); July 31st, 1895, at Keswick (Beadle); common at Oxton, Devon, June 30th-August 21st, 1896, and intermediate dates (Studd); July 4th, 1896, at Newball (Raynor); July 21st, 1896, at Cromer (McIntyre); July 11th, 1897, at Great Orton (F. H. Day); July 11th, 1897, at Cromer (McIntyre); July 24th-August 23rd, 1897, and intermediate dates at Oxton, Devon (Studd); August 3rd, 1897, imago at Sanderstead (Bower); common at Oxton, June 30th, 1898 (Studd); July 3rd-10th, 1898, at Eastwood (Whittle); July 5th, 1898, at Hazeleigh (Raynor); imago August 8th, 1898, at Buckerell (Riding); June 2nd-29th, 1899, at Birtley (Harrison); July 4th, 1899, at Hazeleigh (Raynor); July 12th, 1899, at Eastwood (Whittle); July 3rd, 1900, at Danbury (Raynor); July 11th, 1901, in Isle of Purbeck (Bankes); July, 1901, at Enfield (Edelsten); August 2nd, 1901, and following days at Yoxford (Pyett); June, 1902, at Lamesley, in the Derwent Valley, and at Birtley (Harrison); July 5th-28th, 1902, at Thundersley (Whittle); July 5th, 11th, 12th, 28th, 1902, in the Isle of Purbeck (Bankes); July 2nd, 1903, at Tuddenham (Burrows); June 27th, 1903, in the Isle of Purbeck (Bankes); July 11th, 1903, at Wendover; July 23rd-August 7th, 1903, at Dawlish (Turner); July 16th, 1903, at Hesleden Dene (Harrison); July 25th, 26th, 1903, at Tring (Barraud); bred June 29th-July 3rd, 1904, from larvæ at Thorndon Park (Whittle); bred from Halling larvæ, June 15th, 1904, on wing June 19th, 1904, at Halling; imagines flying at Cuxton, June 24th, 1904, larvæ still obtainable (Ovenden); bred June 12th-29th, 1904, from Folkestone larvæ; and June 12th, 15th, 1904, from Halling larvæ (Tutt); bred June 21st, 1904, from larvæ collected in Isle of Purbeck (Bankes); June 15th-20th, 1904, at Hailsham (Sich); June 25th-30th, 1904, at Dereham (Clutten); July 15th, 1905, at Clandon (Kaye).

Habits.—In the afternoon of June 29th, 1904, at 6 p.m., an imago was seen to emerge from the pupa and run along, coming to rest on a stem of *Veronica*, clinging tightly by the first two pairs of legs, holding the hindmost pair right over the back, at about an angle of 30° to abdomen, and stretched out so as to cross each other a little way beyond the lower pair of spines; the antennæ stuck out well on either side of head; the undeveloped winglets about 45° apart. After about a minute the bases of the wings were pulled together, and the tips curled outwards; the hindwings quite separate, much behind the forewings. The forewings then began to expand; the two points now only curved, the two lobes very distinct; the hindwings grow up to, and become level with, forewings; the tips of forewings now only slightly curled; tip of 1st feather of hindwing curled, others straightened out; all the wings have finished growth now, hanging down quite vertically, being parallel and close together; antennæ thrown back; fringes (at first solid-looking) now getting quite distinct; wings absolutely closed, back to back, touching throughout, except just at base; the third plumule of hindwing hangs just separate, the other plumules of hindwing directly behind the forewing, the clefts fitting each other. Complete expansion occupied only about four minutes. Twelve minutes afterwards the wings were put down horizontally, the lowest plumule of hindwing still separate; the hindlegs stuck out directly under the wings, forming, as it were, a rest for them, the tips of the hindlegs standing out beyond the apex of the wings; this appearance of wings resting on legs is very peculiar and striking. Thirty minutes after this, its hindlegs had been put by the side of the abdomen, the tips of the legs touching but not crossed, the wings still horizontal and about 60° apart. Ten minutes later the tips of the legs were crossed (Tutt, June 29th, 1904). [Bankes observed an imago, just emerged, drying its wings behind its back at 7 a.m.] On the move, the moth runs quickly, coming to rest somewhat suddenly, and, in nature, is not very conspicuous, as it rests on a grass culm, or similar object, although, when disturbed, it is seen readily enough. Its natural time of flight appears to be in the evening, just before, and at, dusk, but it is very easily disturbed as one walks through the rough herbage among which it hides, and it may be sometimes seen on a still day flitting about naturally in the afternoon sunshine. Bankes says that he has taken the imago on the wing, towards dusk, and that it is easily disturbed from amongst its foodplant during the evening. We have also seen it at light, after dusk, and Studd notes that it comes freely to the light trap at Oxton, Devon. Bower notes it as flying among *Veronica chamaedrys* in the afternoon, at Lee and Sidcup, and Gregson says that it is easily disturbed therefrom at Witherslack. Commonly as we have seen this species, we have never noticed it so abundantly as in the pasture-meadows at Megève, in Haute-Savoie; here, on several still afternoons, in early August, 1902, as one walked along the pathway through the fields, the species swung from stem to stem of the tall coarse herbage, on either side, in great numbers. Still it is sometimes exceedingly common in Britain, and we have seen it in abundance at Cuxton, Folkestone, and other places, always flitting in the same lazy fashion, towards the end of the afternoon, becoming most active just as the sun slants off the chalk banks, which they love there so well.

Habitat.—One may expect to find this species in almost any place where *Veronica chamaedrys* grows in Britain—roadside banks, hedgesides, edges of woods, ridings in woods, rough overgrown fields, edges of cultivated fields, chalk-hills, sand-hills, on old landslips and cliffs near the sea, ground at the sea-level, and moors and mosses at high elevations; whilst abroad, from the sunny shores of the Mediterranean to the bleak wastes as far north as the Arctic circle, this species finds some suitable spot in which to breed. At Cuxton and Halling, it abounds on the chalk-hills; at Chattenden Woods, on the outskirts of the woods, as well as in the sunny ridings; in or near woods among rough herbage at Keswick, and also commonly at Purbeck, where it occurs on clay and other soils; swarming in a wood near Horsley, at 7 p.m.; at Strood on the railway banks, and on grassy slopes and railway banks at Harrow; on railway banks near Hartlepool, in disused chalk-pits all over the downs of Kent; in a marl-pit at Shobnall; on the undercliffs at Kingsdown, Folkestone, and Shanklin; on the coast at Wexford; by the roadsides between Canterbury and Folkestone; on hedge-banks at Great Orton and at Worthing, and in grassy lanes at Oxton, in Devon. At Maidenhead it is found along the banks of the Thames, and, at Freshwater, on the banks of the Yar; at Sligo it occurs on the sandhills; whilst, until 1889, the species was to be found in Westcombe Park, and still occurs on waste spots in the neighbourhood of Blackheath. On the continent it is equally abundant, in some places, at a fair elevation (although usually over before the end of July, when our visits are paid), *e.g.*, in Fontainebleau Forest it is fairly abundant at the end of June, and in the Savoy Alps it is common at a considerable elevation, occurring on the mountains round Chamonix up to 5000ft., whilst at Megève it swarmed in the meadows, leading up to the "Calvary." On the other side of the Mont Blanc range, the insect occurs at Courmayeur, etc. In Germany, we note that, in Pomerania, it is widely distributed, and is especially so in ditches by the sides of the roads about Stettin, Tantow, etc. (Büttner); in Hanover, it is more usually found in meadows in woody districts (Glitz); in the Crefeld district the species occurs in open sunny places on the south border of the "Kleinen Hees," where shrubby plants of broom and bramble abound (Stollwerck); in Hesse-Nassau, it occurs in meadows and on the edges of woods (Rössler); especially in bushy places (Koch); also in open grassy spots near woods in Upper Hesse (Glaser); in Brandenburg, it frequents woods (Sorhagen); in Silesia, it is frequently found in damp overgrown places (Wocke), although everywhere pretty frequent in wooded districts (Schütze); near Glogau, on slopes shaded with bushes, or in open meadows (Zeller); in Moravia, near Brünn, it is widely distributed and abundant on dry sandy slopes (Fritsch), whilst, at Tivoli, it haunts the game-coverts, and at Mödling is found on bushy slopes (Mann); in the Tyrolean district it is very frequent, near Innsbruck, at from 1800ft.-6000ft. elevation (Weiler), common on the summit of the Mendel Pass and on Monte Cristallo, near Cortina, at considerable elevation (Tutt).

LOCALITIES.—Distributed throughout England, Ireland, and Scotland. [ABERDEEN: local—Pitscurrie Moss, Pitcaple, common (Reid).] ANTRIM: Black Mountain, Belfast, abundant (Kane), Belfast Hills (Watts). AYR: Ardrossan (Colquhoun), Barr (Dalglish). BEDS: Bedford, Luton (Barrett). BERKS: common (Hamm), Maidenhead (Tutt). BUCKS: Wendover (Turner). CAMBRIDGE: Wood Ditton (Raynor), Cambridge (Stainton). CHESHIRE: Wallasey (Prince), Dunham Park (Ellis), Birkenhead (Stainton), Sealand, near Chester (Arkle). CORK: Glandore, Ummera Woods, near Timoleague, Courtmacsherry (Donovan). CORNWALL: East Cornwall (Marquand), Scilly Isles—Tresco (Norgate). CUMBERLAND: common—Keswick (Beadle), Carlisle district, Great Orton (F. H. Day). DENBIGH: Rhydymwyn, Llangollen to Loggerheads (Arkle). DERBY: Burton district (E. Brown), Shobnall (G. Baker), Repton (Garneys). DEVON: Buckerell (Riding), Oxton (Studd), Dawlish (Turner). DONEGAL: Bundoran (Johnson). DORSET: Glanville's Wootton (Dale), Portland (Richardson), Isle of Purbeck, generally common (Bankes). DUBLIN: Howth (Birchall), Kingstown, etc. (Kane). DUMBARTON: Luss (Dalglish), Garelochhead (Henderson). DURHAM: Lamesley, Derwent Valley, Hesleden Dene (Harrison).

Darlington. common (Sang), near Hartlepool (J. Gardner), Castle Eden Dene(Robson). Edinburgh: Edinburgh district—Braid, Longniddry, Pettycur (Evans). Essex: generally common (Harwood), Danbury, Hazeleigh (Raynor), Saffron Walden (Jeffrey), Thorndon Park, Southend, Thundersley, Eastwood (Whittle), Mucking (Burrows). Gloucester: Bristol district (Hudd), Wotton-under-Edge (Perkins), Painswick district (Watkins). Hants: Isle of Wight (W. H. B. Fletcher), Freshwater (Tutt). Hereford: Leominster, common (Hutchinson), Tarrington (J. H. Wood). Herts: Tring (Barraud), St. Alban's (Gibbs), Sandridge (Griffith), Hitchin (Durrant), Cheshunt (W. C. Boyd). Isle of Man (Porritt). Kent: Folkestone (Courtice), Alkham, Pembury (Stainton), Sidcup, Lee, Greenhithe, Shoreham (Bower), Dover, Deal, Kingsdown, Cuxton, Chattenden, Farnborough (Tutt), Walmer to Kingsdown (Shepherd), Higham, Halling (Ovenden). Kerry: Killarney (Kane). Kincardine: Stonehaven, near Cowie, common (Dalglish). Lanark: Cambuslang, Glasgow district (Dalglish). Lancashire: Grange (Gregson), Manchester (Stainton). Lincoln: Legsby, Newball, Panton (Raynor), Skegness (Porritt). Louth: Clougher Head (Russ). Middlesex: Enfield (Edelsten), between Pinner and Rickmansworth (South), Kingsbury (Bond), Harrow (Rothschild). Moray (Barrett). Norfolk: Dereham (Clutten), Cromer (McIntyre). Northumberland: Killingworth, Harnham (Robson), Newcastle (Stainton). Nottingham: Mansfield (Daws). [Orkney Islands (*Ent.*, xxi., p. 98).] Pembroke: Pembroke (Barrett). Renfrew: Crookston, Giffnock (Dalglish), Paisley (Dunsmore). [Shetland and Orkney: Orkneys (Curzon).] Sligo: Sligo (Russ). Somerset: Castle Cary, common (Macmillan). Suffolk: Blaxhall Common (Harker), [Yoxford (Pyett),] Bentley, Tuddenham (Burrows). Surrey: generally distributed (Barrett), Sanderstead (Sheldon), Box Hill (South), Purley (Studd), Reigate (Chapman). Sussex: generally distributed (Vine), St. Leonard's-on-Sea (Ford), Worthing, Goring (W. H. B. Fletcher), Bognor (Lloyd), Hailsham, Horsley, (Sich), Hastings district—common (Bloomfield), Lewes (Stainton). Warwick: Knowle, Sutton (Bradley), Hockley Heath (Blatch), Rugby district—Overslade, Frankton (Rugby lists). Waterford: Cappagh, Dunmore (Kane). Westmorland: Witherslack (Gregson). Wexford: near Wexford (Kane). Worcester: common throughout the county (Rea). Yorks: Castle Howard (Porritt), Scarborough, York (Stainton), Doncaster district (Corbett), Skipwith, common (Ash), Boroughbridge (Prest), Bramham (J. Smith), Doncaster (Warren), Huddersfield (Inchbald), Richmond (Sang), Sheffield (Doncaster).

Distribution.—Europe (except the polar region), Asia Minor, Armenia (Rebel), ?Mauretania (Blackmore), North America—New York State (Fernald). Africa: Morocco—near Marshen (Blackmore). America: New York State (Fernald). Asia: Kentei Mountains (Staudinger), Asia Minor—generally distributed (Rebel), Brussa (Mann), Armenia (Haberhauer). Austro-Hungary: Bohemia—Prague (Fritsch), Moravia—Brünn district, Czernowitz (Gartner), Neutischein, Upper Austria, distributed—Linz (Fritsch), Lower Austria—Vienna district (Kollar), the Prater (Rebel), above the Wienerwald (Schleicher), Hernstein district (Rogenhofer), Tivoli, Mödling (Mann), [Salzburg—Salzburg (Fritsch),] Tyrol—Glockner district, Bozen, Trient (Mann), near Innsbruck, from 1800 ft.-6000 ft. (Weiler), Lafatscher Joch, Taufer Alps, Monte Baldo, Trafoi, Franzenshöhe (Heller), Kaprun, Moserboden (Hofmann), Mendel, Monte Cristallo, Cortina district (Tutt), Carinthia—Raibl, Bruck-on-Mur (Zeller), Wolfsberg (Chapman), Carniola—Gradischa, Croatia—near Josefsthal, Dalmatia (Mann), Slavonia (Koca), Transsylvania (Czekelius), Neu Sandec (Klemensiewicz), Buda-Pest district (Aigner). Belgium: Ixelles (Crombrugghe), Namur (de Radiguès), St. Servais, Bouge, Dinant (Lambillion), Louvain, Brussels, Uccle, Forêt de Soignes (Crombrugghe). Bosnia and Hercegovina: Dervent (Hilf), Sarajevo (Apfelbeck), Vucija-Bara (Rebel). Bulgaria and Eastern Roumelia: Sophia (Joakimow), the Rilo (Rebel), Varna, Slivno (Lederer). Channel Islands: Guernsey, common (Luff). Denmark (Bang-Haas). France: Normandy—Tancarville (Leech), Saone-et-Loire (Constant), Savoy Alps—Megève, Chamonix (Tutt), Aube (Jourdheuille), Doubs dept.—Maison Rouge (Bruand), Indre—Nohant, Cher (Sand), Seine-et-Marne—Fontainebleau (Tutt), Seine-et-Oise, near Paris, common, Boulogne, Bondy, Montmorency (Begrand), French Juras—Gex (Tutt). Germany: distributed throughout north and south Germany (Hofmann), east and west Prussia, very common—Neuhäuser, Dammhof, Gross-Raum, Königsberg, Kleinheide, Rastenburg, Sorquitten, Lyck, Elbing, Ohra, Danzig, Langfuhr (Speiser), Pomerania, distributed—Stettin, near Tantow, Nemitz (Büttner), Mecklenburg—Friedland, Garz (Stange), Parchim (Gillmer), Sülz, Neustrelitz, Rülow (Boll), Hamburg—Bahrenfeld, Boberg, Höpen (Sauber), Hannover—Quedlinburg (Jordan), the foothills of the Harz (Gillmer), Göttingen (Jordan), Rhine Provinces—[Krefeld, Trier, Aachen, Uerdingen (Stollwerck),] Frankfurt-on-Main (Schmid), Hesse-Nassau—Nassau (Rössler), Frankfurt, Taunus, Wiesbaden (Koch), Waldeck (Speyer), Thuringia—Kühlhausen, Sömmerda (Jordan), Province of Saxony—Erfurt (Keferstein), Halle-on-Saale (Stange), Anhalt—Dessau (Richter), Mosigkauer Haide (Gillmer), Brandenburg, everywhere—Frankfurt-on-Oder, Potsdam, Havel district, Schwetiger Forst (Kretschmer), Silesia, distributed—Upper Lusatia (Möschler), Kingdom of Saxony—Freiburg (Fritsche), Bavaria—Regensburg (Hofmann and Herrich-Schäffer), Oberaudorf, near Munich (Hartmann), Augsburg (Freyer), Württemberg (Steudel and Hofmann), Baden, everywhere—Freiburg, Carlsruhe, Feldberg, Constance (Reutti), Alsace (Meess and Spuler), Palatinate (Bertram), Posen—Meseritz (Zeller). GREECE: Parnassus (Krüper). ITALY: Piedmont—Courmayeur (Tutt), Sicily—Palermo, Messina, Madonie Mountains (Mina-Palumbo). NETHERLANDS: North Holland—Overijssel, Gelderland, in Zeeland, Gravenhage, Tiel, Zeddam, in Hulst, Limburg, near Maastricht (Snellen). ROUMANIA (Caradja). RUSSIA: Baltic Provinces, common—Lechts (Huene), Riga district (Berg), Magnusholm, Aathale, near Segewold, near Neuhof, Pichtendahl, Rotsiküll (Nolcken), Moscow district (Albrecht), Lower Volga district—Casan, Orenburg, etc. (Eversmann). SCANDINAVIA: Scania, Blekinge, Småland, Gothland (Wallengren), Norway—Bergun (Jordan), Aal, common (Strand). SWITZERLAND: rare—near Zürich, singly (Frey), Lenzburg (Wullschlegel), Bernese Alps (Boll), St. Gallen (Täschler), Degersheim (Müller), Bergün (Zeller), Simplon (Jaggi), Zermatt (Frey collection), Saas-Thal—Saas-im-Grund (Tutt).

Subfamily: MARASMARCHINÆ.

Tribe: MARASMARCHIDI.

The position of the genus *Marasmarcha* (*lunaedactyla*, etc.) has puzzled all our systematists, nor can we do more than indicate the characters that may aid in a right appreciation of its position. Hübner (*Verz.*, p. 430) placed it in the *Amblyptiliae* with *acanthadactyla*, Hb., *cosmodactyla*, Hb., and certain Oxyptilid species, *i.e.*, quite separate from the Stenoptiliines. In 1827, Curtis (*Brit. Ent.*, fo. 161) grouped it with the Stenoptiliids, on the Alucitine, and not the Platyptiliine, side of the plume phylum; as also did Stephens (*Illus. Brit. Ent. Haust.*, iv., p. 374), although, in his appendix (p. 424) to the volume, he combines it with the Amblyptilias and Oxyptilines, under the name of *Amblyptilia*. Zeller, in 1841 (*Isis*, p. 834), separated it both from the Amblyptiliids and Oxyptilids, and brought it into connection with the Stenoptiliids, placing both the latter and the Marasmarchids as sections of the same group as the Leioptilids, etc., whilst, in 1852, he united it with the Stenoptiliids, making the whole a group of *Pterophorus*, Zell. Herrich-Schäffer separated it entirely, and placed the group quite on the Alucitid side of the plumes; whilst Staudinger and Wocke (*Cat.*, 2nd ed., p. 87) brought it into the Stenoptiliines under Wallengren's name, *Mimaeseoptilus*, the grouping of this list being followed for a time by most continental authors. In 1886, Meyrick separated (*Trans. Ent. Soc. Lond.*, p. 11) *lunaedactyla*, together with a species named *liophanes* (from Réunion), under the name of *Marasmarcha*, his diagnosis being given under our account of the genus. In 1890, he gave (*op. cit.*, 1890, p. 488) a slightly modified diagnosis under the same name, and, for the first time, grouped the Marasmarchid species—*ehrenbergiana*, Zell., *agrorum*, H.-Sch., *rhypodactyla*, Staud., *trimmatodactyla*, Christ., *phaeodactyla*, Hb., *cinnamomea*, Staud.—to which he unaccountably added *microdactyla*, Hb. He observes that "*Marasmarcha* is a small genus, occurring in Europe, central Asia, and Africa. It closely approaches *Alucita*, and is a development from it." The heterogeneric character of *lunaedactyla* (*phaeodactyla*) and *microdactyla* led us, in 1892 (*Brit. Nat.*, ii., p. 61), to fix *lunaedactyla* as the type of the genus. In his *Handbook*, etc., p. 437, Meyrick places *Marasmarcha* (still containing these two divergent species) between two Alucitine groups, represented by *Pselnophorus* (*brachydactylus*) and *Alucita* (*osteodactyla*, *tephradactyla*, *lienigiana*, *monodactyla*, *lithodactyla*, etc.), with which, certainly, *lunaedactyla* has no really close relationship. Hofmann accurately, in our opinion, places it between the Stenoptiliines and Oxyptilines, but Rebel, after eliminating *microdactyla*, leaves *Marasmarcha* among the Alucitines (*Cat.*, 3rd ed., p. 75).

The fact is, *Marasmarcha* has such mixed structural characters, that it is difficult to place it really satisfactorily. Its early stages, and, up to a point, its imaginal structure, show it to be, in its broad characters, on the Platyptiliid, and not the Alucitid, side of the plume stirps. The larva is essentially Stenoptiliine, the pupa shows alliance with the Amblyptiliines and Oxyptilines, whilst the imaginal characters are very confusing. The genital organs show no close relationship with the Amblyptiliines, Oxyptilines, or Eucnæmidophorines, with which one is inclined, on the characters of the early stages, to place it. Concerning this, Chapman writes (*in litt.*): "*Marasmarcha* occupies a somewhat solitary position, and yet has a more central position than any other of our British genera (central, not basal). It is, in fact, an extreme Oxyptilid in some aspects, and has close affinities with the Alucitids, such as do not occur elsewhere on the Platyptiliid side of the group. The post-spiracular larval tubercles ally it with *Amblyptilia* (and suggest relationship to Alucitids); the larval habits are very close indeed to those of *Capperia heterodactyla*. The pupa may be described as an extreme Oxyptilid. In common with the Amblyptiliines, it possesses the dorsal processes associated with tubercles i and ii, and which attach both these genera to the Oxyptilines, but it possesses also the mediodorsal processes so characteristic of some Oxyptilids, and it possesses not only the median series that occurs in some Oxyptilids, nor only the lateral series found in others, but both sets. With this extreme development, and with the Alucitid features yet to be referred to, it is curious that the pupa of *Capperia heterodactyla* (*teucrii*) should exhibit the hair-processes so common in Alucitids, and that *Marasmarcha* should be entirely without them. Not, perhaps, entirely, however, as the appendage-cases and wing-nervures are roughly nodulated. The imago, in wing-form and -marking, is closer to the Alucitids than any other Platyptiliid. The hind-margin shows a strong tendency to be lost in the pointed form of the Alucitids, and, especially, the loss of submarginal line and other markings in, and parallel to, the hind-margin is notable. The ancillary appendages of the ♂ are still more remarkable. The Platyptiliid appendages differ from the Alucitid in two marked particulars. The Alucitids have spines on the clasps, often developed into long, almost hair-like, processes; these are wanting in all Platyptiliids (with the possible exception of *Eucnemidophorus*, where a beginning of this structure may be claimed) except *Marasmarcha*. Here, in *lunaedactyla* (*phaeodactyla*), two such spines are present, coiled round in a circle, and giving a curious appearance of carrying a disc, let into its middle to the clasp. These two spines are probably united at their bases. In any case, they are so close together, and parallel, that they often look as if united for their whole lengths. They are certainly separate for some distance at their tips. The relationship to *Alucita* does not, however, end here, for in an allied species (*agrorum*, H.-Sch.), of which the var. *tuttodactyla** replaces *lunaedactyla* in the French Alps—from Larche, in the Basses-Alps, up to Mont Blanc—these spines are not only shortened and lose something of the disc aspect on one side, but, on the other side, are very much shorter, and stand across the clasp, a definite asymmetry identical with that of the Alucitids."

Genus: Marasmarcha, Meyrick.

Synonymy.—Genus: **Marasmarcha,** Meyr., "Trans. Ent. Soc. London," p. 488 (1890); Tutt, "Brit. Nat.," ii., p. 61 (1892); "Pter. Brit.," p. 81 (1895); Meyr., "Handbook," p. 437 (1895); Hofmn., "Deutsch. Pter.," p. 91 (1895); Staud. and Reb., "Cat.," 3rd ed., p. 75 (1901). **Alucita,** Haw., "Lep. Brit.," p. 477 (1811); Hb., "Schmett. Eur.," Aluc. ix., figs. 14, 15 (*circ.* 1819); Tr., "Die Schmett.," ix., p. 240 (1833). **Pterophorus,** Sam., "Ent. Usef. Comp.," p. 409 (1819); Curt., "Brit. Ent.," fo. 161 (1827); Dup., "Hist. Nat.," xi., p. 657, pl. 313, fig. 10 (1838); Wood, "Ind. Ent.," 1st ed., p. 236, pl. li., figs. 1640, 1641 (1829); Zell., "Isis," p. 834 (1841); Dup., "Cat. Méth.," p. 382 (1845); Zell., "Linn. Ent.," vi., p. 356 (1852); H.-Sch., "Sys. Bearb.," v., p. 378 (1855); Frey, "Tin. Pter. Schweiz," p. 410 (1856); Sta., "Man.," ii., p. 442 (1859); Nolck., "Lep. Fn. Estl.," p. 805 (1871); Porritt, "Buckler's Larvæ," etc., ix., p. 357 (1901). **Stenoptilia,** Stphs., "Illus. Haust.," iv., p. 374 (1834). **Amblyptilia,** Hb., "Verz.," p. 430 (1825); Stphs., "Illus. Haust.," iv., app. p. 424 (1834). **Mimaeseoptilus,** Staud. and Wocke, "Cat.," 2nd ed., p. 343 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 793 (1877); Frey, "Lep. Schweiz," p. 430 (1880); South, "Ent.," xvi., p. 75 (1883); Leech, "Brit. Pyral.," p. 59 (1886); Tutt, "Young Nat.," x., p. 164 (1889). **Mimaesioptilus,** Barrt., "Lep. Brit. Isles," p. 373, pl. 415, figs. 4-4*b* (1904).

The genus *Marasmarcha*, as we have already noted (*anteà*, p. 385), was created by Meyrick for *phaeodactyla*, Hb. (*lunaedactyla*, Haw.), and *liophanes*, Meyr., a species from Réunion (*Trans. Ent. Soc. London*, 1886, p. 11). His diagnosis reads :—

Forehead with projecting tuft of scales. Antennæ of ♂ ciliated. Palpi moderate, ascending, slender, terminal joint moderate, pointed. Tibiæ simple. Forewings bifid, cleft from before two-thirds, 2 from near angle, 3 and 4 from point of angle or stalked, 5 and 6 short, 7 from near below angle, 8 and 9 stalked, 10 absent, 11 from near angle. Hindwings trifid, 3rd segment without black scales in cilia; 2 from before middle of cell, 3 and 4 short-stalked, 5 and 6 very short, 7 and 8 divergent from beyond cleft—*phaeodactyla*, Hb., *liophanes*, Meyr.

In 1890, he gave a slightly modified diagnosis (*op. cit.*, p. 488) which reads thus :—

Face with more or less projecting tuft; ocelli obsolete; tongue developed. Antennæ two-thirds, in ♂ ciliated (one-third). Labial palpi moderate, ascending, slender, terminal joint moderate, pointed. Maxillary palpi obsolete. Tibiæ simple, outer spurs nearly equal inner. Forewings bifid, cleft from before two-thirds; vein 2 from near angle, 3 and 4 from a point or stalked, 5 and 6 short, 7 from near 8, 8 and 9 stalked, 10 absent, 11 from near angle. Hindwings trifid, 3rd segment without black scales in dorsal cilia; vein 2 from before middle of cell, 3 absent, 5 and 6 very short, 7 and 8 divergent from beyond cleft—*ehrenbergiana*, Zell., *agrorum*, H.-Sch., *rhypodactyla*, Staud., *trimmatodactyla*, Christ., *phaeodactyla*, Hb., *cinnamomea*, Staud., *microdactyla*, Hb.

The inclusion of *microdactyla*, Hb., in the genus made it so heterotypical that, in 1892, we thought it advisable to restrict the genus to *lunaedactyla* (*Brit. Nat.*, ii., p. 61). In his *Handbook of Brit. Lepidoptera*, p. 437, he still maintained the genus for these two isolated

* Characterised by the extension of the white markings along the disc of the wing to (nearly) the base, and the general very pale coloration (see *Ent. Rec.*, vol. xviii., p. 178).

species, but Hofmann (*Die Deutsch Pteroph.*, pp. 91-92) rightly restricted the genus to its present limits, and diagnosed it as follows:

The scales of the crown, directed downwards between the antennæ, form, with those of the forehead, an obtuse, very unstable, tuft. Palpi small and thin, 1st joint below rough-scaled, 2nd and 3rd smooth-scaled, rather ascending, 3rd joint rather drooping. Antennæ of the ♂ extremely shortly ciliated. Fore and middle tibiæ at the end, and hind tibiæ in the middle, and at the end, very moderately thickened with dark scales. Forewings cleft to one-third; upper segment without anal angle, obliquely pointed; lower segment with distinct anal angle and elongated apex. The 1st and 2nd segments (of hindwings) of the same shape as the upper and lower segment of the forewings. The 3rd segment linear, without dark scaling on the inner margin. When at rest the forewings are not folded, at the most the inner margin of the lower segment is bent downwards. The neuration differs from that of the genera already noticed in so far that II_2 (branch 10, HS.) is entirely absent from the forewings. The common stem of II_3 and II_4 arises from the upper angle of the median cell, II_5 from the very weakly indicated discocellular which runs rather vertically. Stem IV has three branches on the forewings and hindwings. According to Meyrick, branch 3 of the hindwings, representing our IV_1, is said to be absent, which, however, at least in *M. phaeodactyla* is not the case. The typical markings, as well as the characteristics of the larva and pupa, may be gathered from the description of the only German species. The typical markings of the forewings approach those of *rhododactyla*.

Rebel, who follows Meyrick very strangely in many details, separates (*Cat.*, 3rd ed., p. 75) *microdactyla* from the true Marasmarchids, and uses *Marasmarcha* for *lunaedactyla*, Haw. (*phaeodactyla*, Hb.), *ehrenbergiana*, Zell., *agrorum*, H.-Sch., *rhypodactyla*, Staud., *trimmatodactyla*, Chr., and *fauna*, Mill.

The following larval and pupal characters of the genus may be noted:

Larva.—The depression of the prothoracic scutellum inconspicuous, unpigmented (in this respect inclining to Oxyptilines); skin-spicules small, spiny, closely set, with chitinous bases; the secondary skin-hairs markedly knobbed at the tips, with basal joint well-developed but not perfect, variable in size, some being quite as large as the primary tubercular hairs; the primary hairs on a well-defined base, smooth, with blunt tips; the warts developed almost as in *Stenoptilia*; tubercles i and ii conjoined into a single wart on the thorax, on the abdomen trapezoidal, well apart; iv and v on the abdominal segment united into a wart; both accessory postspiraculars present, but weakly developed; vi forms a small wart.

Pupa.—No definite nose-spine; setæ long, well-developed (less so than in *Eucnemidophorinae*); halberd-shaped dorsal processes very like those of *Amblyptiliinae*, but also with processes dorsal to these (suggesting alliance with Oxyptilines).

In the larva the secondary hairs are large on the warts. The warts of the Amblyptiliines may easily be regarded as simple tubercular setæ with a few attendant secondary hairs; in *Marasmarchinae* the secondary hairs are so much on the same plate as the primary setæ that the tubercles can hardly be refused the name of warts.

The almost identical appearance of the Marasmarchine and Amblyptiliine pupæ shows that the groups are very closely related, whilst the differences between them are sufficient to throw the former much nearer the Oxyptilines than would otherwise be the case. With the Stenoptiliines, *Marasmarcha* has no very close relationship, although it was long placed in the same genus with them. Of this, Hofmann says (*Die Deutsch. Pteroph.*, p. 92), "The separation of the genus from *Mimaeseoptilus*, Wallgr. (*Stenoptilia*, Hb.), is perfectly justified by the quite different formation of the palpi, the absence of the frontal cone, and the different shape of the upper segment of the forewing and the first segment of the hindwing, and, finally, by the absence of branch II_2 of the forewings." Chapman's discovery of Alucitine characters in the structure of the ♂ genitalia of some of the species in this group is most important, as these characters have no parallel in any other group on the Platyptiliid side of the "plume" stirps.

Marasmarcha lunædactyla, Haworth.

Synonymy.—Species: **Lunædactyla,** Haw., "Lep. Brit.," p. 477 (1811). **Lunædactylus,** Sam., "Ent. Usef. Comp.," p. 409 (1819); Curt., "Brit., Ent.," fo. 161 (1827); Stphs., "Illus. Haust.," iv., p. 374 (1834). **Phæodactyla**, Hb., "Schmett. Eur.," Aluc. ix., figs. 14-15 (*circ.* 1819); "Verz.," p. 430 (1825); Treits., "Die Schmett.," ix., p. 240 (1833); Stphs., "Illus. Haust.," iv., app. p. 424 (1834); Tutt, "Ent. Rec.," i., p. 92 (1890); "Brit. Nat.," ii., p. 63 (1892); "Pter. Brit.," p. 82 (1895); Meyr., "Trans. Ent. Soc. Lond.," p. 488 (1890); "Handbook," p. 438 (1895); Hofmn., "Deutsch. Pter.," p. 93 (1895); Staud. and Reb., "Cat.," 3rd ed., p. 75 (1901). **Phæodactylus,** Curt., "Brit. Ent.," fo. 161 (1827); Dup., "Hist. Nat.," xi., p. 657, pl. 313, fig. 10 (1838); Zell., "Isis," p. 834 (1841); Dup., "Cat. Méth.," p. 382 (1844); Zell., "Linn. Ent.," vi., p. 356 (1852); H.-Sch., "Sys. Bearb.," v., p. 378 (1855); Frey, "Tin. Pter. Schweiz," p. 410 (1856); Sta., "Man.," ii., p. 442 (1859); Jord., "Ent. Mo. Mag.," vi., p. 124 (1869); Staud. and Wocke, "Cat.," 2nd ed., p. 343 (1871); Nolck., "Lep. Faun. Est.," p. 805 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 793 (1877); Frey, "Lep. Schweiz," p. 430 (1880); South, "Ent.," xvi., p. 75, pl. ii., figs. 3-3*c* (1883); Leech, "Brit. Pyr.," p. 59, pl. xvii., fig. 4 (1886); Tutt, "Young Nat.," x., p. 164 (1889); Porritt, "Buckler's Larvæ," ix., p. 357 (1901); Barr., "Lep. Brit. Isles," ix., p. 373, pl. 415, figs. 4-4*b* (1904). **Lunadactylus,** Wood, "Ind. Ent.," 1st ed., p. 236, pl. li., fig. 1640 (♂) (1839). **Pallidactylus,** Wood, "Ind. Ent.," p. 236, pl. li., fig. 1641 (♀ pale) (1839).

Original description.—*Alucita lunaedactyla* (The crescent Plume). Alis anticis fusco-brunneis lunula postica albida. Habitat in Cantio prope Darn Wood Graminosis, at infrequens. Expansio alarum 11 lin. Descriptio: Alæ anticæ bifidæ sordide brunneæ immaculatæ, fascia lunulæformi seu paululum arcuata ad fissuram albo-flavicante. Posticæ tripartitæ fuscæ (Haworth, *Lepidoptera Britannica*, pp. 477-478).

Imago.—18mm.-20mm. in expanse. Anterior wings, with the two lobes almost pointed, of a dark cinnamon-brown colour, darker on the costa; a pale lunar mark extending from the costa to the inner margin just before the fissure, and continued into the fringe; a pale transverse line crossing the upper and lower lobes, commencing from apex; the discal area streaked longitudinally with pale ochreous; the inner margin also pale ochreous, markedly so towards the base; fringes rather darker than the ground colour of the wing, with a pale dash at apex of upper lobe, and pale latticings in lower lobe. The posterior wings glossy golden-brown, the plumules narrow, the lower border of each plumule narrowly ochreous; fringes dark grey; a bright brown patch of cilia at apex of each plumule.

Sexual dimorphism.—There is a very marked distinction in the colour of the sexes; the ♂ s being much darker brown, the ♀ s paler, more ochreous. This is accompanied by a stumpier build in the ♀, which has a particularly heavy body when freshly emerged from the pupa.

Male genitalia.—The male genitalia are very peculiar (*Deutsch. Pteroph.*, taf. iii., fig. 7). The 9th dorsal plate is narrow, divided in the centre, laterally rather produced downwards. Instead of the uncus (10th dorsal plate), there is here a roundish process to be noticed, springing from a broad base, pointed behind, hollow below, which is furnished outwardly, on both sides, with a tuft of bristles. Below this 10th dorsal plate, and below the anus, there is here, in contrast with the genera hitherto noticed, where this structure is absent, a second small chitinous plate, domed above, and terminating on the hind-margin in two short thick pointed processes; under this lies the short, stout, straight penis. The prensors are hollowed like a spoon, furnished thickly with stiff bristles in the interior, and exhibit at the base a round recess, in which is hidden a double chitinous structure rolled round as a watch spring, posteriorly ending in two points. The 9th ventral plate is very small and narrow (Hofmann).

Variation.—Besides the sexual difference in colour noted above, there is considerable variation in the amount and brightness of the ochreous mottling and markings present. Reutti notes that at Carlsruhe, in Baden, a pale specimen with more extended yellow markings was captured, that might almost be taken for *ehrenbergianus*, Zell. Bankes observes that each sex shows an appreciable amount of variation in the depth of the ground-colour, and that, although the females average decidedly paler than the opposite sex, his lengthy series of bred Purbeck specimens includes females quite as dark as the average male, though a trifle lighter than the very darkest males.

Egglaying.—The eggs are laid chiefly on the underside of a leaf of the foodplant, usually singly, but sometimes two or three not far removed from one another. Bankes notes, of eggs laid in confinement, that a ♀, caged with a shoot of *Ononis arvensis*, laid a number of ova on the undersides of the leaves during the night of July 11th, 1904. Bacot observes that the eggs thus laid were very numerous, placed in all conceivable positions, one little lot being placed in a mass, a feature which appears not to take place in nature, when the eggs are much more scattered. We received, on July 10th, 1899, a considerable number of eggs that had been laid in a chip box; although of the flat type, many were laid on one end, with the micropyle at apex, some, however, quite normally with the long axis horizontal, whilst others were inclined at angles varying from about 30° to 90°. The eggs hatched on July 11th and 12th, 1899. Chapman observes that the eggs are laid singly on stems, leaves, and leaf-stalks of *Ononis*. Nolcken observes that, on July 3rd, he enclosed a number of moths in a cage with a branch of *Ononis* in bloom; he observed moths *in copulâ* the next morning, and, on the 5th, a number of eggs were observed mostly laid singly on the underside of the leaves, but occasionally two near together; several also were laid on the stem, and, when this was so, they were usually placed in small groups; some were also laid on the walls of the cage; the earliest larvæ appeared on July 17th, *i.e.*, the egg-stage lasted twelve days.

Ovum.—When first laid, pale greenish-yellow in colour (Bankes, July 12th, 1904). In shape oval or ovoid, the sides flattened, but not depressed, colour bright yellow-green, with a semitransparent, highly-varnished appearance; the surface roughly and irregularly sculptured, or faceted, but the facets crude and vague, not at all clear-cut or sharp, yet much plainer than in other plume ova examined up to date of observation. Length ·550mm.-·575mm., width ·35mm.-·4mm., thickness slightly over ·2mm. (Bacot, July 18th, 1904, ova received from Bankes on July 13th). Egg of flat type, oval in outline, noticeably depressed on upper surface; shell much wrinkled, evidently very delicate, but no trace (under low power) of any regular sculpturing.

Length about ·55mm., breadth nearly ·4mm. Colour entirely yellow, surface exceedingly shiny; when near hatching, the yellow colour still remains, but the micropylar area is occupied with a comparatively large black-brown spot, which is exceedingly conspicuous (the head of embryo). When hatched, the eggshell is colourless and perfectly transparent, so that colour is derived from embryo. [Eggs laid in a chip box, commenced to hatch July 11th, 1899, directly after description was made] (Tutt). A large oval egg, with a faint suspicion of flattening at one end. Length 0·60mm., width 0·35mm., height 0·24mm. The sculpturing is of cells of about 0·024mm. diameter, roughly hexagonal, without well-marked demarcations, rather as if each cell were a flattening, as by a hammer, than that any raised ribs separated them (in this respect very like the egg of *Merrifieldia tridactyla* (*tetradactyla*) (Chapman). The egg is light greenish-yellow when laid, but, before it is hatched, a dark spot appears towards the apex (Nolcken).

Habits of larva.—The newly-hatched yellow larva is exceedingly active, crawling quickly and restlessly. What happens to it between the time that it hatches and the following spring is unknown. (One suspects that it mines, like the Stenoptiliids, into its foodplant, hybernates therein in its second instar, and comes out to feed openly the following May.) Chapman says (*in litt.*): "Where the larva goes, as soon as hatched, has not been discovered. Analogy would suggest that it fed somewhere, fed up till it was well-grown in its second instar, and then hybernated. No trace of it, or its hybernaculum, has, however, yet been found, after several searches, both on pot plants and in the field. In the spring, larvæ were found; the smallest of these was presumably in the third instar, *i.e.*, one moult beyond the second instar (hybernating stage), and, as there were two further moults, this would give the larva five instars. A careful measurement of the head, however, upsets any such inference, and shows the smallest spring larvæ to be in the second instar, and, if they have moulted once since hybernating, the larva must hybernate in first instar. The question then, not only as to how they hybernate, but at what stage they hybernate, remains unsolved. The sizes of the heads of the larva at the four stages is as follows :—

Marasmarcha lunædactyla.	Measured.		Calculated at ratio ⅗rds.	
	Length of head.	Width.	Length.	Width.
First stadium.. ..	0·105mm.	0·165mm.	0·108mm.	0·180mm.
Second stadium (first spring instar)	0·180 ,,	0·300 ,,	0·180 ,,	0·300 ,,
Third stadium ..	0·300 ,,	0·480 ,,	0·300 ,,	0·500 ,,
Fourth stadium ..	0·540 ,,	0·820 ,,	0·500 ,,	0·820 ,,

Comparing this with similar measurements of *Amblyptilia cosmodactyla*, Hb., in which we know there are only four instars, and using ⅗rds the same multiplier), we get :—

Amblyptilia cosmodactyla.	Measured.		Calculated.	
	length.	width.	length.	width.
First instar	0·15mm.	0·21mm.	0·14mm.	0·21mm.
Second instar.. ..	0·24 ,,	0·36 ,,	0·23 ,,	0·36 ,,
Third instar	0·39 ,,	0·57 ,,	0·38 ,,	0·59 ,,
Fourth instar.. ..	0·63 ,,	0·99 ,,	0·63 ,,	0·99 ,,

These are all, in fact, more accordant than we have any right to expect, allowing for the fact that the measurements are made by taking nearest mm. on camera outlines, made from specimens in which the heads (on microscopic slides) are often a good deal distorted. In late May, the larvæ are first to be noticed on the young leaves, near the centre of a shoot, but they grow rapidly, and soon spread over the plant, and, by mid-June, are often fullgrown; at that time, however, there is considerable difference in the size of various larvæ, and some are not full-fed till well towards the end of the month, or even until the end of July; they feed, in their later stadia, fully exposed, and, on a warm sunny afternoon in mid-June, may usually be taken in considerable numbers, their colour, however, harmonising remarkably well with the tint of the foliage of their foodplants. Bankes notes that, "when very young, they feed on the tenderest leaves in the heart of the shoot, and afterwards generally on the more expanded leaves of *Ononis arvensis*, either eating out portions of them from the margins inwards, or sometimes gnawing holes through them; they may be found in almost any position on the plant. The well-grown larva, in nature as well as in confinement, is also very fond of biting through the stout shoot-stalk (completely detaching the upper part of it) in order to feed on the lower remaining portion of the stalk itself. Sitting upright along this, it devours its whole substance, rind and all, from above downwards for a short distance, and then, apparently, often moves on to attack a fresh stem in the same manner. I have not tried the larvæ with growing plants, but have found them extremely difficult to rear indoors on cut shoots of *Ononis*, however often renewed, hardly any, out of large numbers, except those almost fullfed when collected, having reached the pupal state, all the rest gradually pining away and dying. Perhaps they require sunshine, or, when collected close to the sea, as has been the case with all my larvæ, it may be essential to their welfare that their food, if gathered inland, should be sprayed with salt water." Chapman writes (*in litt.*): "The fashion the larva has in the last instar of gnawing through the stem a little below the top, or occasionally the petiole of a large leaf, is precisely like that described about *Capperia heterodactyla* on *Teucrium*. It seems to do much imbibition of sap, as well as eating. My experience of the larva in confinement is the same as that reported by Mr. Bankes. I think the plant has much to do with this; it is one that withers rapidly, and must become unwholesome if kept succulent artificially. I brought home some of the larvæ of the closely allied *M. fauna* this spring (1906). One lot had already all but perished, another was beginning to suffer, but to a great extent recovered, and some finally pupated satisfactorily on being put on a growing plant of *Ononis arvensis*, though its foodplant is another species, very like

Ononis arvensis in the young shoots, but later more woody and spinose, and like our *O. spinosa*. On May 16th, 1906, I brought home some branches of *Ononis arvensis*; some of these had a couple of inches of the portion of the stem that often occurs between the branch above ground and the great root-stock. Thinking they might prove useful later, I potted them, hoping they would strike. To assist them I covered the pot with a glass. They were potted on May 18th. On May 20th, looking to see how they were going on, I saw on them two young larvæ of *M. lunaedactyla*, that were probably not there on the 17th. Examining them more carefully, I found three larvæ, all in the supposed second skin, one quite small, the other two a good deal larger. I put these on slides, and carefully examined the portions of plant they were on. One larger one was on one plant, and the other two, and a (beetle ?) larva very like the small one, on the other. In neither case could I find a hibernaculum, though, in both cases, the central stem was abortive, with a dead and partly destroyed end, and the branches were two or three lateral ones, about two inches long (the weather had been cold and dry, and most plants were only a few inches long, only a few favoured ones being over six inches). Still, I think it tolerably certain that, at least the smallest larva was brought home in its hibernaculum, and left it after the plants were potted, as, before gathering them, I searched the patch of *Ononis* carefully for minute larvæ, and could not see a trace of one. The size of the smallest larva certainly suggested that it was not in the skin in which it had hybernated, *i.e.*, it seemed to have only recently moulted, being much smaller than the other two larvæ that were certainly in the same instar. This would suggest that the larva hybernates in the first instar, and moults on, or before, leaving the hibernaculum." Ovenden notes that, in 1904, the larvæ were very small in early June at Cuxton, and each then rested in the middle of a leaf of *Ononis*, choosing either the upper- or underside, the larvæ not restricting themselves to either side; when older, the larva seems to eat a shoot from its apex, going downwards for two or three joints, and, when the lowest harder material is reached, the larvæ bury their heads in the centre of a shoot until they are only half exposed. Barrett observes that the larva rests on the leaves of restharrow, to which, from its colour and downy appearance, it bears an accurate resemblance. South notes that it feeds on the terminal leaves of *Ononis*, but is difficult to see owing to the similarity in colour to the leaves, and is best beaten, if the situation be favourable. Bacot observes that, on August 3rd and 4th, 1904, he found two larvæ resting on leaves of the foodplant, that they were weak-looking, and that their bodies looked knotted and unhealthy, sluggish crawlers, though somewhat restless. In Hesse, the larvæ are to be found throughout May, June, and July, living gregariously, and feeding on the leaves and tender stems of *Ononis spinosa* and *O. repens* (Rössler); near Ratisbon, the larvæ are to be found sometimes in numbers, mostly on the terminal twigs of the foodplants, the tender stems being often eaten through (Schmidt); lives in June, and early July, on *Ononis repens* and other species of *Ononis*, mostly on the terminal shoots of the plants, the tender stalks of which are often eaten through; Zeiler states that the larvæ eat the flowers (Hofmann). Larvæ are noted as occurring on July 9th, 1848, near Rhoden (Speyer); June 3rd-July 3rd, 1866, at Cölljall (Nolcken); June 26th, 1886, at Bookham (Briggs);

abundant on June 24th, 1890, at Dursley (Griffiths); also at Dursley, May 9th-22nd, 1893, and June 3rd, 1895 (Bartlett), June 11th, 1898, at Reigate (Adkin); larvæ and pupæ, at Benfleet, July 1st, 1900 (Whittle); June 11th-14th, 1903, at Dover (Tutt); some very small on June 4th, 1904, others fullgrown (and with a few pupæ) on June 22nd, in the Isle of Purbeck (Bankes); also on June 5th, 1904, at Cuxton (Ovenden); June 8th, 1904, at Benfleet (Whittle); June, 1905, a fullgrown larva found feeding on one of the plants over which moths were enclosed to lay their eggs the previous July (Chapman).

Larva.—*First instar* (newly-hatched): Barely 1mm. in length, nearly colourless; head very slightly tinted with black eye-spots; without skin-points, tubercular setæ in usual positions, but vi absent; spiracles very prominent, as hemispherical projections. Tubercles all separate, each with one hair—i with a short porrected hair about 0·02mm. long; ii with a long hair directed backwards, 0·07mm. long (*i.e.*, about width of a segment); iii with a rather longer hair, 0·08mm., directed outwards and forwards; iv very long, about 0·09mm., directed outwards; v short, well above and in front of iv, length about 0·03mm. Prothorax with the three front hairs of plate about 0·05mm. long, the central back one very long, 0·08mm., two others quite minute; one long hair, 0·08mm. long, in prespiracular set, one (perhaps two) minute ones with it, two at base of legs. The meso- and metathorax, with the usual four pairs of hairs, except that the second hair of the third pair is not made out. The true legs not dark, long, with long, slender, sharp claws. The prolegs long, slender, delicate, apparently with two hooks, but the whole so delicate and colourless that most specimens look as if only a fleshy pad existed; claspers with apparently three hooks. Hairs all smooth and sharp-pointed. A very long hair on the 9th abdominal (? seta on ii). *Second instar* [stadium preceding penultimate moult (see *anteà*, p. 391)]: Length, 3·3mm. Greyish in tint, really white, with numerous black skin-points. Head black; prothoracic and anal plates also black, but not so densely so as not to become translucent on magnification. The prothoracic plate with three hairs on either side of front margin, and three others at each side, one at middle of posterior margin, and a smaller one on either side of this, and a little forward of it; the outer at outer margin of plate; in front of, and a little below, the pale rufous projecting spiracle, is an angular tubercle with three (?) hairs. All the tubercular plates appear black (but magnified are seen to be translucent); the hairs nearly white. On the meso- and metathorax, the usual double-haired tubercles occur, with a small accessory behind the third pair. On the abdominal segments tubercle i has a short porrect hair; ii has a longer hair directed inwards and backwards; on abdominal segments 1-6, ii has a secondary hair outside, and behind this one; in all cases, the base extends in this direction; iii has a long hair directed upwards and backwards, and there is a faint indication of a secondary hair behind it (actually developed in one or two instances, *e.g.*, on the 5th abdominal); iv and v each carry one hair, the front one (v) forwards, and slightly higher than the other (iv), which is directed backwards; vi has a short solitary hair, directed slightly backwards; the marginal tubercle, vii, has the three usual hairs. On the 9th abdominal segment, i and ii are conjoined. The anal plate carries five hairs on each side. The hairs are nearly all rather swollen at the extremities, but not spiculated. Prolegs moderate in length, with the usual chitinous tube forming the "prop"; crochets, three in number. There is nowhere any trace of secondary skin-hairs (Chapman, June 8th, 1904). *Third instar* (stadium preceding last moult): Length, 5mm. Shape cylindrical, of fairly even thickness, tapering at the thoracic segments (chiefly the prothorax) towards the medium-sized, polished, black head, and, at the posterior segments suddenly to the blunt anus. The larva, as usual, well raised on tall prolegs, the anal pair set backwards as in that of *Stenoptilia pterodactyla*, giving it a straddling appearance. The segmentation is distinct, but the sub-segmentation much less so on the abdominal segments, where the only division, *viz.*, that between i and ii, is only slightly apparent. On the thoracic segments the subsegmentation is much clearer, and consists of three subsegments, *viz.*, small anterior and posterior, and a large central one, which bears the dorsal warts. The spiracles are large and raised, but not tubed, as in the larva of *Ovendenia septodactyla* (*lienigianus*), those on the prothorax and the 8th abdominal segment being larger than any of the others, although that on the 1st abdominal is also slightly larger than usual; in colour, they are pale brown. The skin bears a very noticeable coat of coarse, black, spicules, or skin-points, rather large gaps occurring in this coat where the primary and accessory tubercles arise. There are no secondary hairs in this skin unassociated with the primary or accessory tubercles. The primary hairs on tubercles ii, iii, and v are very long, and either taper, or are blunt-ended, but on i and iv they are shorter, and are slightly expanded at the tips. The secondary hairs, associated with the primary hairs, are considerably shorter, and have expanded or trumpet-shaped tops. While the accessory postspiracular tubercles bear single hairs of this character, most of the primary ones have one or more secondary hairs associated with the long primary ones, but iii and iv, on the meso- and metathorax, are exceptions to this general rule. All the hairs are white, and the long ones minutely thorned. Head black and polished, and bears a few weak hairs, some of which are dark-coloured. The prothoracic and anal plates are plain and well-developed, but not distinctively coloured. The primary hairs are mounted on large chitinous bases, and these, together with the associated secondaries, are mounted on raised skin-areas, forming primitive warts. Tubercles i and ii are remote, iv and v approximated as usual. On the thoracic segments, i and ii are on the same wart, and the secondary groups on the posterior subdivisions of these segments are represented by two slightly separated hairs behind each group (Bacot, June 12th, 1904). *Same instar* (lying up for last moult): Length, 6mm.; very like larva when lain up for previous moult, but looks a little greener. The skin is covered with black skin-points, but there are no hairs on general surface. The tubercles are larger than in last skin, and have various secondary hairs. The prothorax is much the same, but, on the meso-thorax, the first and third pairs of tubercles each have one secondary hair in addition. The little tubercle behind ii and iii has two hairs (one above the other); immediately behind i is a tubercle with two hairs (one above the other); and behind ii is a hair that may be called a tubercle, or a secondary hair simply; its base is hardly tubercular. On the metathorax, the same changes have taken place, except that the tubercle behind i is a single hair, like that behind ii, and without base.

On the abdominal segments, i, ii, iii, and iv + v have each two secondary hairs varying to one, or three in some cases; iii has most frequently only one; vi has one; vii usually the three ordinary hairs (on one plate); there is an accessory hair like a secondary behind the spiracle, but, except this, there are no secondary skin-hairs on the abdominal segments. The secondary hairs on the meso- and metathorax are those already noted on the first and third paired tubercles, a small one on the accessory tubercle behind the third pair, and three that are skin-hairs (or accessories), two behind the first double tubercle, one above the other, and a third, also posterior, a good way below the third paired tubercles; none of these seem quite constant as to presence, or position, except one of those behind the first tubercle; the props of the prolegs are tubes of dark chitin; there are five black crochets to each. The primary hairs are all somewhat thickened at end, and the secondaries are markedly so (Chapman, June 8th, 1904). *Fourth instar:* 9mm.-10mm. long; build, rather long and slender, tapering gradually to head and anus. The warts much more developed, yellow in colour; the raised skin-areas, which carry them, bear no spicules, so that the warts stand out in marked contrast with the dark green skin, and its dense coat of small dark spicules; a few scattered skin-surface secondary hairs now present, and there is a structural (caused by the absence of spicules) mediodorsal line extending forwards across the meta- and part of mesothorax. The head black, mottled with very pale brown. A depression on either side of the prothoracic scutellar plate, in the same position as in *Stenoptilia* (*pterodactyla*), but the depressions unpigmented. The secondary hairs (accompanying primary setæ) on the warts much more numerous than in preceding instar. The skin-surface is of a bright and vivid green, but, to a general view, it appears a dull green, owing, I take it, to the dulling effect of the hairs, and the coat of black spicules. There are many secondary hairs present, in addition to the tubercular hairs, all the secondary, and some of the tubercular, hairs, being bulbed at tip. A darker green mediodorsal line is present on all segments. The 1st to 7th abdominal segments have a slight circular pit, or depression, in the centre of dorsum. On the 3rd abdominal segment there is a small black spot, or wart, in the centre of the depression. Head very small, smooth, and shiny, with longish hairs; partially retractile; in colour green, with a good deal of black mottling on face and down cheeks. Body stout, tapering at either end; segments very distinct. Certain parts of the mediodorsal line on thoracic segments are shiny, the skin-surface being bare of spicules at these points. The tubercles are not nearly so prominent as in the Alucitine species (*Porrittia galactodactyla*, *Alucita pentadactyla*, *Ovendenia septodactyla* (*lienigianus*), and *Oidaematophorus lithodactyla*. The spiracles are low, with walls but slightly raised above skin-surface; the chitinous rims are pale brown. The prolegs long and slender, as in other species. Tubercles i and ii are in trapezoidal position, well apart in comparison with their position in *Porrittia galactodactyla*, but near in comparison with *Adactylus bennetii*, ii slightly larger than i [although on the meso- and metathorax i is very large and ? ii is reduced (so far as I can judge, owing to the confusing secondary hairs) to a single hair]; iii is large and directly above spiracle; iv and v form a conjoined wart below the spiracle, situated on lateral ridge; both the posterior secondary warts observed in *Oidaematophorus* *lithodactyla*, the upper in line behind iii, and the lower behind iv and v, are represented by large single-haired tubercles; vi and vii are also present. If the dark ring round the base of the large central hairs on each wart may be taken as a proof that it is identifiable with the primitive setæ, around which the large wart, bearing numerous secondary hairs, has developed, and I think that such an assumption is not unwarranted, we have, in this species, an excellent clue to the identification of the primary from the secondary warts in the other species. Tubercles i and ii, on abdominal segments, both bear one large, central, dark-based hair; iii also bears one, and the large oval subspiracular bears two; iv and v, separate as regards their bases, both form members of one large group mounted on a single wart; vi has one, and vii (the marginal) three, black-based, hairs. The secondary hairs above referred to are not black-based, while, on the meso- and metathorax, there are two black-based hairs on each of the anterior tubercles described above as i. This points to the probability of the smaller posterior wart on the other species being secondary warts, the anterior containing both the primary hairs within its limits. One would, of course, prefer to see all the larvæ in their first skins before considering this point as definitely settled (Bacot, June 18th, 1899). *Fullgrown:* Deep apple-green in colour, with a dirty look, due to the dark hairs, and especially the dark skin-points; 10mm.-12mm. long, or more if stretched, tapering at each end. Secondary hairs are abundant, but, when examined, skin-hairs are found not to be so plentiful as at first glance appeared. The tubercles have very large primary hairs, *e.g.*, that on ii, on the forward abdominal segments, is 2mm. long, and the tubercles have well-developed basal plates. The primary hairs are always very distinct, then there are one or two large secondary hairs well up on the plate, from 0·5mm.-0·7mm. long, and then, more towards the margin of the plate, three or four smaller hairs; then, beyond the plate, are often two or three skin-hairs that are still smaller, but look rather as if they were dependants of the tubercle or wart rather than independent skin-hairs. Then there are the two secondary or skin-hairs behind the spiracle (one a little above spiracle, one a little below iv+v) that must be differentiated from skin-hairs, so that there remain, as genuine skin-hairs, about sixteen across the dorsum of an abdominal segment from spiracle to spiracle. The hairs of iv, vi, and vii are still pointed; the remainder (of the primaries) are all expanded at tips. The secondaries are all markedly expanded apically, the smallest, down to 0·12mm. or even 0·1mm. in length, being as markedly so as any. The hairs are nearly all pale, the tubercular base dark. On the prothoracic plate are only the six usual hairs, no secondaries, and the dark patch towards outer end; the spiracle large, conical; three long hairs on tubercle in front, and two on that above spiracle; there are three or four very small skin-hairs behind plate, and as many more below spiracle. On the mesothorax, all the tubercles have secondary hairs (as noted above); the accessory, behind the third pair, has one secondary hair; there are three hairs in something of a row, behind the first tubercles, these are large (0·5mm.), and must represent the accessory tubercles so usual here in Alucitids. There is a much less regular group of small secondaries, on the same point of metathorax, that are obviously more than ordinary scattered skin-hairs. These segments have about eighteen skin-hairs on either side, apart from those already alluded to. The skin-points are very abundant and quite black, even under considerable magnification. The prolegs are much as in last skin, apparently with only five crochets (the claspers with seven). The head, previously black, has now pale markings. There is some difficulty as to the determination of the tubercles. The tubercles, however, are black, and, if the rule may be taken that black points are true tubercles, the following may be made out on the abdominal segments: i and ii as trapezoidals, i rather nearer median line than ii, in their usual positions; iii also in its usual position; i and iii on the 1st, and ii on 2nd, subsegment. These tubercles are black, with a long pale hair, and a circle of shorter pale hairs round it on the general surface, but quite as close to the tubercle as are the groups of hairs forming warts on the larva of *Porrittia galactodactyla*. Below the spiracle is a raised boss, green in colour, with two black points (iv and v); this is placed rather above the flange, which is marked by a yellow line; the larger of these points is a little in front of spiracle in position, the smaller in front of, and slightly above, the larger. In the centre of the space between this and the prolegs is a single black point, and, at the bases of the prolegs, three points, placed triangularly, the largest being above, and posterior to, the others. Ventrally, there is one minute tubercle on either side of the medioventral line, where there are no prolegs. The abdominal prolegs carry five short brown hooks, the anal bear six hooks (Chapman). South describes the larva (*Entom.*, xvi., pp. 75-76). Buckler figured (*Larvae*, etc., pl. clxiii., fig. 8) a larva of this species, after its final moult, on May 31st, 1870; imagines from this and other larvæ were bred June 21st-24th, 1870.

Foodplants.—*Ononis repens* (Frey), *Ononis hircina* (Nolcken), *Ononis spinosa* (Rössler), *O. arvensis* (Barrett).

Parasites.—*Ischnus thoracicus*, Grv., bred from a pupa (Kaltenbach).

Puparium.—The larva appears to prefer a leaf of its foodplant, to which to attach itself for pupation, rather than any other part of the plant. Barrett says that it "attaches itself by the tail to the surface of a leaf," to which South adds "generally on one of the terminal leaves." Bankes observes that, of four pupæ and one pupating larva, found on June 22nd, 1904, in the Isle of Purbeck, two only were on the uppersides, while the remaining three were on the undersides, of leaves of *Ononis arvensis*. Hofmann says that the larvæ prefer the stems of the foodplant for pupation, but Speyer notes that, near Rhoden, he found the pupæ on the leaves of *O. repens*; Nolcken also says that they are usually placed on the undersides of the leaves, at the angles of the stem, or in similar places, and attached to silken webs.

Pupa.—Varies from 8mm.-10mm. in length, the average between 8mm. and 9mm.; diameter of a large example, at 4th-5th abdominal segments, about 2mm., of a small one about 1·5mm.-1·75mm. The pupa is much more cylindrical than most "plume" pupæ, a section would be nearly circular, whilst it has many more primitive characters than those of most Alucitids [*Porrittia galactodactyla*, *Oidaematophorus lithodactyla*, or *Ovendenia septodactyla* (*lienigianus*)]. The pupa of this species, like that of *Eucnemidophorus rhododactyla*, shows a laterally constricted waist, when viewed ventrally, at about midway up the wing-cases. It is either pale green in colour, or very pale yellow-brown. The spiracles are prominent, but only slightly raised. The tubercles are primitive, single-haired, with black bases, as in the larva, but are, in some instances, raised on specialised horns, having apparently a skin, and not tubercular, origin, although, in some instances, they occur on the same area. A markedly specialised dorsal ridge is found in this species. A small, central, dorsal, horn-like process occurs on the abdominal segments 1-8, very small on the 1st and 8th, and reaching its greatest development on the 3rd or 4th abdominal; on the abdominal segments 2-8, this forms the centre of three dorsal horns, the other two being situated one on either side, and, except on the 1st and 8th abdominal segments, being very much larger than the central one; on the middle segments the outer horns have smaller tines at their bases. The central series above described is situated between the dorsal tubercles i and ii, which are, on most segments, rather close together but separated by a process developed from the skin-area between them; longitudinally, these processes form the outer dorsal ridges and rise in a double horn, the anterior and larger branch, or tine, bearing i on the front of its base, and the posterior and smaller bearing ii on the back of its base; on the 2nd, 3rd, and 4th abdominal segments these processes are very large, on the 3rd abdominal segment they are developed to an enormous size relatively to the other segments; on the 2nd abdominal the base of i is situated some distance up the front tine, ii being situated at the base of the posterior tine; on the 3rd abdominal, the processes remind one somewhat of a thick and heavy stag's-horn, the posterior tine being very much smaller than the anterior, and the bases of the tubercles well up on the horn; on the remaining abdominal segments, as far as the 8th, this arrangement holds good, but the size of the process is very greatly reduced; on the 4th abdominal it is only about one-third the size, and it gradually dwindles to the 8th abdominal. Tubercle iii is in normal position above the spiracle, and is not raised above the general level, and carries a single hair with black tubercles at base; iv and v beneath spiracle, v directly beneath, and iv slightly posterior to it but in the same horizontal plane; vi carries a single hair with black base, and vii carries two hairs, with their bases slightly apart. The hairs are rather short, stout, tapering, and slightly knobbed at tips, but not thorny. On the metathorax, only a pair of dorsal tubercles are in evidence, and these are set anteriorly on the segment; there are also two lateral tubercles above base of wing, iii and ? iv. On the mesothorax, two pairs of dorsal tubercles are present, placed trapezoidally, the anterior pair, i, being considerably nearer in towards median line than ii, and the two pairs quite a considerable distance apart; on this segment also two lateral tubercles are present above bases of wings; one, I suppose, is undoubtedly iii, but I am doubtful of the other. Can it be iv moved up? Theoretically, only iii should be present, as the wing springs from the spiracular area. Quail has suggested to me that, in *Cossus*, what is iv (subspiracular) on the abdominal segments becomes the second hair of iii on the thoracic segments; if this be so, it would account for the fact that iv of the abdominals is missing on the thoracic segments (2nd and 3rd) in the Sphingids and ? other groups. (Bacot, June 29th, 1899. Compared with empty pupa-cases, December 12th, 1903). Bright green in colour, with various darker markings, sometimes a bright green pupa, with various darker markings, sometimes the latter are so abundant that the pupa might rather be called black, sometimes quite wanting; along with the dark markings, the green colour sometimes becomes much darker; one specimen, apparently healthy, is of a pale terra-cotta colour, almost reddish, with no dark markings. Length, 9·0mm.-9·5mm.; thickness, 2·0mm.-2·2mm., very slightly thickening to 4th abdominal segment, thence tapering; there is practically no "sphinx" curvature, but the face is not at all, or inappreciably, flattened, so that the pupa is of circular section nearly throughout. The dark markings are those of the antennæ and appendages, wings, dorsal flanges, and spines; dark shadings on the segments, in front of, and between, ii and spiracle, and below iv+v. There are no hairs on the appendages, but the legs, antennæ, and wing-veins are nodulated, as if they ought to have a hair on each nodule. The median vein terminates abruptly at a cross-vein, and beyond, two veins arise and coalesce, in a way not seen in any other (non-plume) pupa that I have seen. Of hairs, the prothorax has them on i, ii, and iii; the mesothorax has a dorsal pair, and a wing-basal pair (first two pairs of larval hairs?); the metathorax has one on i (single), and two hairs on anterior outer corner (second pair of larval hairs?); the 1st abdominal segment, on i, ii, iii, the 2nd abdominal on i, ii, iii, iv, and v. Nearly all these hairs are white, and about 0·3mm.-0·5mm. long; tubercles i and ii well separate; iv and v separate, but rather close, well behind the spiracle, and very nearly on a level; they are much the same on the other abdominal segments; vi is directed backwards; vii has two hairs at a level—equal, short, and well separate, nothing more ventral. The chief feature of the pupa (with that of *Amblyptilia cosmodactyla*), is the remarkable development of processes in connection with the dorsal flange and the tubercles. The dorsal flange exists on the thorax, and on the 1st, 2nd, and 3rd abdominal segments (as in *Platyptilia*); on the 3rd abdominal, it is faintly marked from i to front border of segment. The largest of these spines is a large halbert-shaped process on the 3rd abdominal segment. This spine projects dorsally, about 0·6mm., in line with the dorsal flange on either side; it is a little flattened laterally and twisted; it projects directly upwards (*i.e.*, dorsally), being just twisted a little forward on its base, for about half its length, it then gives off forwards a boss which carries the hair of i; then it slopes backwards, and, after narrowing suddenly, curves forwards, and ends in a rather sharp point; behind it, quite separate, but from some points of view seeming to be part of it, is a sharp conical spine of about half the length, and carrying ii near its base, on the outer posterior aspect. On this same segment is, behind iii, a short beehive-shaped conical eminence, a variation apparently of the secondary hair, existing here in the larva; it has an obsoletely-spiculated, ringed, aspect. It is obscure on the 1st and 2nd abdominal segments, but, on the 4th and following ones, is much as on the 3rd abdominal; a trace of a similar process exists between iv and v; also on the 3rd, there are, dorsally—(1) Two horns that are in line, across the back, with ii, and dividing the space into three equal parts, curved backwards, ringed, and obsoletely-spiculated, rather more than half as long as the horn of ii. (2) In front of these, in the middle line, is a similar very short one, much like the one behind iii. (3) These three are hardly represented on the 1st and 2nd abdominal segments, but are well-marked on the 4th and following segments; they are green with faint black shading, not dense black like the flange processes. Tubercles i and ii carry similar horns on all the other abdominal segments, very small on the 1st abdominal, larger on the 2nd, those on the 4th three-fourths the size of those no the 3rd, that on ii being almost as large; they are still quite pronounced on the 8th, but are wanting on the 9th, abdominal. Along the mesothorax is a pale mediodorsal sutural line; the flanges on each side are nodulated in front, but, posteriorly, at highest point of ridges, carry two black flattened processes, with a small white one behind, and a large flat white one in front. Those further forward, seen in profile, look like a serrated alpine ridge covered with snow. The surface-sculpturing, as in most of these "plumes," is, firstly, a series of fine parallel transverse ridges, too large for sculpturing proper, too small and numerous for subsegmentation. There are, for instance, twelve or thirteen on the 3rd abdominal segment in front of spine. This skin-sculpturing is most elaborate and elegant. Across the segment, in lieu of the principal processes and tubercles; the surface is nearly smooth and structureless. In front of this are eight or nine transverse ridges (on 5th abdominal, taken as a sample), of which six or seven are very pronounced; they are narrow and straight, and without any waving or side valleys. The whole surface in the valleys, up the slopes of the ridges, and where the tops of the ridges are wide enough, is covered with fine acuminate skin-points, rather pointing backwards, and arranged alternating in rows (not with absolute regularity). This sculpturing is all round the segments, but is somewhat smoothed down in spiracular region. Behind the tubercular and spinous zone is the intersegmental zone, with beautiful tessellated pavement, each lozenge of which carries, centrally, a fine skin-spicule, pointing backwards; this has a most unusual effect, and one of most orderly regularity. It may be noted that, in a dark pupa, met with in examining these structures, the spines of tubercles i and ii (most frequently separate), are closely conjoined on all the segments. The cremaster is very like that of *Amblyptilia cosmodactyla*, Hb., with a forward portion on the bosses of the 9th abdominal segment, each side with about 36 hooks, and a posterior portion confined to the ventral side of the cremastral spine, each side with about 60 or 70 hooks. The hooks are about 0·2mm. long, and have a slightly different ending to those of *A. cosmodactyla*. It is, as if, before the hook of *A. cosmodactyla* was quite finished, a further, half-turn was given to the end. The eyepiece carries two hairs, and is attached to the dorsal headpiece, which is itself indeterminable, except that it sometimes carries two (nearly always one) hairs, but is otherwise a colourless membrane, indistinguishable from the rest of the inner membrane, connecting the eyepiece to the prothorax. The spiracle-cover on the mesothorax is a short arch, with a hairy or spiculate surface, much like that of *A. cosmodactyla*. The hindwings end at posterior border of the 2nd abdominal segment. The forewings show three inner veins, and the cubital, with its three branches, very distinctly; the colouring in dark pupæ is enhanced by rows of slight nodosities, in pale ones the veins forward of these are not so distinguishable. The face carries four hairs (two each side), the clypeus one each side, and the labrum two on each side. The arrangement of appendages seems otherwise much the same as in *A. cosmodactyla* (Chapman, June 27th, 1904).

Time of appearance.—Single-brooded, usually occurring from end of June until early August, but varying a little in different years according to the season. In France, we note July, near Léry (Dupont); in Belgium, June and July, at Namur, etc. (Lambillion); but July and August at Rochefort (Crombrugghe); in the Channel Islands, several captured, June, 1891, near Gouffre (Luff); in the Baltic Provinces it occurs in July, abundant July 3rd-15th, 1896, at Cölljäll, near Massa Krug (Nolcken); in Germany at the same time as in England, *viz.*, end of June in the Crefeld district (Stollwerck); late June to August, about Wiesbaden (Rössler); end of June to mid-August, in Waldeck, larvæ, pupæ, and imagines, July 9th, 1848, at Rhoden (Speyer); June to August, at Ratisbon (Hofmann and Herrich-Schäffer); June and July, in the lowlands of Baden, August, at higher elevations (Meess and Spuler). British records: Imagines, August 3rd, 1862, at Sanderstead (Sang); July 7th-20th, 1870, abundant at the Lizard (Marshall); imagines, August 5th, 1879, at Folkestone (Sang); July 19th, 1881, in the Isle of Portland (Bankes); early July, 1883, common at Dover (Coverdale); June 26th, 1884, common at Cuxton; June 29th, 1884, a few imagines at Lee (Bower); July 4th, 1884, July 16th-August 3rd, 1885, bred July 22nd-25th, 1885, from pupæ obtained July 16th, all in the Isle of Purbeck (Bankes); July 17th, 1885, in the Warren, Folkestone (Briggs); July 1st and August 7th, 1887, at Portland (Richardson); July 24th, 1887, at the South Foreland (Tutt); July 11th, 1889, July 23rd-25th, in the Isle of Portland (Bankes); July 7th, 1889, at Leatherhead (Briggs); June 25th and July 11th, 1890, at Portland (Richardson); late July and early August, 1890, at St. Margaret's Bay (Tutt); abundant, July 20th-August 13th, 1891, at Torquay (Fox); July 20th, 1891, at St. Margaret's Bay (Fenn); July 22nd, 1892, at Cuxton (Tutt); July 23rd, 1892, at Riddlesdown (Sheldon); July 1st, 1893, just commencing to emerge at Cuxton (Tutt); emerged June 19th and 24th, 1895, from larvæ found at Dursley, June 3rd, 1895 (Bartlett); July 1st, 1895, an imago at Bexley (Bower); July 7th, 1895, at Cuxton (Tutt); June 27th, 1896, at Middleyards Coppice (Edwards); July 2nd, 1896, at Benfleet (Whittle); July 21st-28th, 1896, at Cuxton (Tutt); September 2nd, 1898, at Sidmouth (Raynor); July 9th-16th, 1899, very abundant at Marlow (A. H. Clarke); July 19th, 1899, common at Sidmouth (Studd); thirteen netted at Benfleet, July 1st, 1900, imagines bred July 2nd-17th, 1900, from larvæ and pupæ found at Benfleet (Whittle); August 1st, 1902, at Starcross (James); July 25th and 26th, 1903, at Tring (Barraud); July 16th, 1904, imagines at Drayton Beauchamp (Rothschild); bred June 26th-30th, 1904, from larvæ collected June 4th, 1904, others bred July 4th-11th, 1904, from larvæ and pupæ collected June 22nd, 1904, in the Isle of Purbeck (Bankes); June 24th, 1905, at Reigate (Turner).

Habits.—The insect is a true dusk-flier, although it is disturbed readily during the afternoon. It rarely quits the immediate neighbourhood of its foodplant, on the lower part of which it hangs during the day, coming up in the afternoon to the higher shoots, and flying nimbly over the tops thereof as soon as evening has set in. The moths appear to pair at this time, and remain paired most of the night. Barrett observes that this species "hides during the day in the thick masses of restharrow, flying lazily to a distance of a few feet if disturbed in hot sunshine, hardly moving when it is chilly; it flies over this plant at dusk." Almost everyone who knows the insect gives similar data, although Bower notes having observed it on a fence at Bexley. Bankes observes that the insect seems very irregular as to the time of day at which it emerges from the pupa. Of 26 specimens, on which more or less exact observations were made, 10 emerged between 10.45 p.m. and 7 a.m., while the remaining 16 did so between 7 a.m. and 6.30 p.m.; of the latter, 8 appeared between 7 a.m. and 11.45 a.m., and of these, 7 emerged before 10 a.m. Many observers note its restriction to the neighbourhood of its foodplant; thus we have it recorded "Every patch of *Ononis*, no matter how small, seems to harbour the insect at Marlow" (A. H. Clarke), only among *Ononis* at Sidmouth (Raynor), disturbed from among *Ononis* at Cuxton (Bower), common among restharrow at Riddlesdown (Sheldon), and at Benfleet (Whittle). Of the pairing habits, Bankes notes that a ♂ and ♀, enclosed together in a breeding-cage on the evening of July 10th, 1904, had not paired by 10.45 p.m. They were found, *in cop.*, however, at 7 a.m., on July 11th, and remained so until about 1 p.m. Speyer observes that, near Rhoden, this plume flies abundantly round the bushy plants of *Ononis repens*, imagines, larvæ, and pupæ occurring in early July at the same time; the imagines are restricted to the neighbourhood of their foodplant, and are easily disturbed during the day, being usually much more active than *Wheeleria migadactyla* (*spilodactyla*) that occurs on the same ground. Nolcken observes that, near Cölljäll, in the Baltic Provinces, the moths could be readily disturbed by day as well as in the evening; they rarely flew freely, kept low down, never going far from their foodplant, or flying at all rapidly, and were usually to be taken whilst sitting on the plant.

Habitats.—Open sloping chalk slopes, inland, in Kent and Surrey, as well as the chalk cliffs along the coast between Folkestone and Deal and near Brighton, particularly in sheltered hollows, are favourite haunts of this species, and not very similar to the dry sun-baked slopes at the back of Pré St. Didier (leading up to the little tunnel), where what we have hitherto considered to be this species, but which Chapman now says (*Ent. Rec.*, xviii., p. 178) is a form of *M. agrorum*, is equally abundant, localised, however, to the clumps of its foodplant. Bankes notes that, in Dorset, although *Ononis arvensis* is generally distributed and plentiful, the species is exceedingly local, and found chiefly on the cliffs and undercliffs of the chalk and limestone portions of the coastline, though occurring in one inland locality on the chalk; in its chosen haunts, however, it is usually common or abundant. South says that it is never met with off the chalk, and appears to be absent in many places where *Ononis* grows luxuriantly in Devon and Middlesex; but Barrett observes that, though occurring on the slopes of chalkhills, and chalky banks and commons, it is also found in sandy spots on the coast. Many observers note its occurrence in coast districts, *e.g.*, on the cliffs near Le Gouffre (Luff), abundant in a cove by the sea in the Lizard district (Marshall), on the cliffs at Sidmouth (Studd), although our list of "British localities" shows it is not at all confined to such. South notes it as abundant on a long strip of its foodplant, growing on an overhanging bank by a roadside, at Ventnor. In France, Dupont says that it occurs on dry arid lands at Léry, in the Pont de l'Arche district, and Bruand that it haunts rocky and woody slopes in the Doubs dept. Speyer says that, in the neighbourhood of Wildungen, it occurs amongst the bushy plants of *Ononis repens*, which grow abundantly on the slaty and shaly rocks of the mountains; in the neighbourhood of Rhoden it chooses bare and sterile places, that are found on the borders of an area rich in herbage, and covered with wild flowers, where grow *Ononis repens* and *Marrubium vulgare*. Here it lives with *Wheeleria migadactyla* (*spilodactyla*), each strictly confined to its own particular foodplant. Nolcken observes that, in the Baltic Provinces, it occurs on dry calcareous ground, formerly under cultivation, and near Cölljäll (not far from Massa Krug), appears by the roadside where *Ononis hircina* grows in quantity. Crombrugghe, too, observes that it is locally abundant at Rochefort, in Belgium, but here also it appears to be confined to calcareous soils.

British localities.—Very local, and apparently almost confined to the southern and midland counties of England. Berks: Reading (Porritt), Basildon, Streatley, Bradfield (Young), Newbury (Chorley). Bucks: Marlow (A. H. Clarke), Drayton Beauchamp (N. C. Rothschild). Cambridge: Cambridge (Stainton). Cornwall: the Lizard (Marshall). Denbigh: the Leet (Arkle). Devon: Sidmouth (Raynor), Torquay (Fox), Starcross (James), Exmouth, Teignmouth (*teste* Leech). Dorset: Purbeck district (Bankes), Bloxworth (Cambridge), Charmouth, Lyme Regis, Lulworth (C. W. Dale), Isle of Portland (Richardson). Essex: Benfleet (Whittle), Witham (Cansdale). Gloucester: Dursley (Bartlett), Painswick district (Watkins). Hants: Isle of Wight, coast districts—Ventnor (South). Hereford: Leominster (Hutchinson), Tarrington (J. H. Wood). Herts: Tring (Barraud), Sandridge (Griffith). Kent: Cuxton, Lee, Bexley (Bower), Folkestone, St. Margaret's Bay, Dover (Tutt), near Darenth Wood and Greenhithe (Stephens), Alkham (Stainton), Folkestone (Sang), Maidstone (*teste* Leech). Norfolk: Hunstanton (Atmore). Oxford (Barrett). Surrey: Oxted, Riddlesdown (Sheldon), Reigate (Gill), Box Hill (Machin), Mickleham, common (Stainton), Sanderstead (Sang), Leatherhead, Bookham (C. A. Briggs), Dorking (Barrett), Croydon, Caterham Valley, Epsom (C. A. Briggs). Sussex: Brighton downs (Vine). Wilts (Barrett). Worcester: Middleyards Coppice, Bredon (Edwards), Tenbury (Digby). [York: Huddersfield (Hobkirk) [Porritt notes (*Supp. List Yorks Lep.*, p. 260) that this is almost certainly an error].]

Distribution.—Central Europe, Livonia, southeast France, Italy, Greece, southeast Russia (Rebel). Austro-Hungary: Bohemia (Nickerl), upper Austria (Mann), Styria (Treitschke), Galicia (Garbowski), Budapest district (Aigner), Tyrol district — Bozen (Mann). Belgium: Rochefort, common, Liège (Crombrugghe), Namur, Dinant, common (Lambillion). Channel Isles: Guernsey—Le Gouffre (Luff). France: Aube (Jourdheuille), Saône-et-Loire (Constant), Pont de l'Arche district—Léry (Dupont), Fôret de Bondy (Bégrand), Doubs—Maison Rouge (Bruand), Auvergne—Gravenoire (Sand). Germany: Hanover—Hanover (Reinhold), Rhine Provinces—Crefeld district, Traar, Trier, Aix, Cologne (Stollwerck), Bonn (Jordan), Hesse-Nassau—Wiesbaden, Mombach (Rössler), Frankfort-on-Main, Flörsheim (Koch), Cassel (Ebert), Waldeck—Wildungen, Korbach, Rhoden (Speyer), Thuringia—Jena (Knapp), Saxony—Erfurt (Keferstein and Werneburg), Weissenfels (Hofmann), Halle (Stange), Dessau (Richter), Mühlhausen, Sömmerda (Jordan), [Silesia—Görlitz (Möschler),] Bavaria—Regensburg, on the Winzerbergen, near Weinting, Gebraching (Hofmann and Herrich-Schäffer), Württemberg (Steudel and Hofmann), Baden—near Freiburg, Carlsruhe (Reutti), Kaiserstuhl, Bärenthal (Feldberg), Mahlberg, Lahr, Ettlingen, Durlach, Tauberbischofsheim, Speier (Meess and Spuler), Alsace—Colmar (Peyerimhoff), Rhine Palatinate (Bertram). [Italy: Piedmont valleys—Pré St. Didier (Tutt).] Netherlands: Limburg—near Maastricht (Snellen). Russia: Baltic Provinces—Cölljäll (Nolcken), Volga district, rare (Eversmann). Switzerland: rare—Zürich, Schloss-Kyburg, near Winterthur (Frey).

Subfamily: Oxyptilinæ.

This subfamily, included by Hübner (*Verzeichniss*, p. 430) among the *Amblyptiliae*, was separated therefrom by Zeller, in 1841 (*Isis*, p. 765), who included the typical Amblyptiliids as a section of his

Platyptilus, and created *Oxyptilus* for the group we are now considering. This grouping he maintained in 1852 (*Linn. Ent.*, vi., p. 342), and in this was followed by Herrich-Schäffer, who, after giving a detailed description of the group (*Sys. Bearb.*, v., p. 373), diagnosed the species known to him as follows:—

1. Alarum posteriorum lobus interior parte tertia media alba, apicali utrinque nigro-squamata—*trichodactylus*, Hüb.
2. Alarum posteriorum lobus interior ferrugineus, parte quarta apicali utrinque subæqualiter nigro-squamata—*ericetorum*, Zell.
3. Alarum posteriorum lobus interior ferrugineus aut fuscus, parte tertia apicali nigro-squamata; squamis marginis interioris longioribus.
   - A. Laete cinnamomeus, alis latioribus, ciliis lobi interioris anteriorum basi acute albis—*hieracii*, Zell.
   - B. Fusco-cinnamomeus, alis angustioribus, ciliis lobi interioris anteriorum basi dilutius albis—*pilosellae*, Zell.
   - C. Fuscus, alis latioribus, ciliis lobi interioris anteriorum versus angulum ani longitudinaliter albo sectis—*obscurus*, Zell., *marginellus*, Zell., *laetus*, Zell.
4. Alarum posteriorum lobus interior concolor, ciliis marginis interioris nigris usque versus medium productis.
   - A. Ciliis lobi interioris anteriorum fuscis, in apice et angulo anali albo sectis—*tristis*, Zell.
   - B. Ciliis lobi interioris anteriorum fuscis basi albis, versus angulum analem latius—*distans*, Zell.
5. Alarum posteriorum lobus interior dimidio basali albidus, ciliis marginis interioris nigris paullo pone medium denticulum formantibus, alarum anteriorum angulo anali obsoletissimo—*kollari*, Mann.

Wallengren, like Herrich-Schäffer, recognised that the Oxyptilids did not form a single homogeneous generic group, and described the whole subfamily under the name *Oxyptilus*, diagnosing the group (*Skand. Fjaderm.*, p. 14) as follows:—

Antennæ of both sexes with very short cilia. The forehead obtuse, wanting the tuft or cone entirely. The palpi longer than the head, thick, laterally compressed, ascending, the middle joint tufted at its apex, the last joint longer than the tuft, slender, pointed. Legs long and slender, the posterior tibiæ thickened with scales at the middle, and at the apex. The first pair of spines in the posterior tibiæ almost equal, the second pair shorter than the shortest spine of the first pair. The anterior wings cleft more than the third part of their length. The segments slender, the anterior segment with no posterior angle, the posterior segment with the angle distinct. The segments of the posterior wings slender, the third segment linear, and with no anal angle. The anterior wings flat, when at rest covering the posterior; the inner margin of the anterior wings not toothed; the fringe of the third segment in the posterior wings with some black scales near the apex. Veins of the anterior wings eight in number, the first and second separate, springing from the base, the third from he posterior margin of the cell, the fourth dividing into two branches, running from the posterior angle of the cell to the posterior segment, the fifth coming out near the anterior angle of the cell and running to the posterior margin of the anterior segment, the sixth, either two- or three-branched, running from the anterior angle of the cell to the apex of the anterior segment, the seventh from the anterior side of the cell, and the eighth from the base. The cell distinct, closed, the transverse vein very slender, somewhat arched. The veins of the posterior wings three, the first, two-branched, running to the first segment, the second, also two-branched, running into the second segment, the third simply running into the third segment. No cell.

Wallengren followed Zeller, and the earlier authors, in using his genera in the modern sense of tribes, but he clearly understood that the species grouped themselves into smaller (modern generic) sections of his main division. He, however, did not name the sections, which he described as follows:—

I. Forewings with white markings on the upperside. Hindwings with the underside of the first plumule furnished with a white spot at the apex.

α. The tips of the cilia, on the hinder margin of the first lobe of the forewings, dusky—*O. pilosellae*, Zell., *O. hieracii*, Zell., *O. ericetorum*, Zell., *O. obscurus*, Zell.

β. The tips of the cilia on the hinder margin of the first lobe of the forewings white—*O. didactyla*, Linn.

II. Forewings with dull yellowish markings on the upperside. Hindwings with the underside of the first plumule unspotted at the tip—*O. bohemanni*, Wallgrn.

The lepidopterists (Jordan, Wocke, Meyrick) who followed Wallengren, in dealing with the plumes, were quite unable to act on his indications, being apparently ignorant of the early stages, and, on the strength of a subfamily diagnosis, Meyrick (*Trans. Ent. Soc. Lond.*, 1886, p. 8) includes them all in the genus *Oxyptilus*, following the same course in 1890 (*op. cit.*, p. 485), his inclusive diagnosis reading as follows:—

Face rounded, smooth, or with small tuft; ocelli obsolete; tongue developed. Antennæ two-thirds, in ♂ filiform, simple or ciliated ($\frac{1}{4}-\frac{1}{2}$). Labial palpi moderate, ascending, second joint with appressed or projecting scales beneath, sometimes forming a short angular apical tuft, terminal joint moderate, filiform, tolerably acute. Maxillary palpi obsolete. Tibiæ thickened with scales on origin of spurs, outer spurs nearly equal inner. Forewings bifid, cleft from about middle; vein 2 from a point with 4, 3 and 4 stalked, 5 and 6 very short, 7 from below 8, long, 9 and 10 out of 8, 11 from near 8. Hindwings trifid, third segment with a well-developed tooth of black scales in dorsal cilia; vein 2 from middle of cell, 3 from near angle, very short, 5 and 6 very short, 7 to apex—*laetus*, Zell., *distans*, Zell., *tristis*, Zell., *kollari*, Stn., *pilosellae*, Zell., *hofmannseggii*, Mösch., *parvidactylus*, Haw., *bohemanni*, Wallgrn., *marginellus*, Zell., *ericetorum*, Zell., *maculatus*, Const., *hieracii*, Zell., *teucrii*, Greening, *didactylus*, Linn. (? *brunneodactylus*, Mill.)

In 1895, however, Hofmann published his work thereon, and gave a most illuminating study of the group, subdividing it into its constituent parts on characters connected with the imago, without, however, carrying out this division to its logical conclusion by naming the sections as separate genera. He divides the Oxyptilines into two main sections, diagnosing the group as a whole, and its two main sections as follows:—

The lobes of the forewings with two pale transverse bands; feathers of hindwings similarly shaped. Forewings cleft to $\frac{1}{2}$; lobes of forewings differently shaped, upper one pointed, lower with obtuse anal angle, or of similar shape, and then both pointed.

α. Vein II of forewings with five branches.* In the cilia of the costa and inner margin of the 3rd plumule differently-shaped accumulations of black scales .. .. *Oxyptilus*, Zell.

β. Vein II of forewings with four branches, as branch II_1 is wanting. In the cilia of the inner margin of the 3rd plumule, not any, or only a very insignificant, accumulation of black scales.. *Trichoptilus*, Walsm.

His first group, *Oxyptilus*, comprises our two tribes *Capperiidi* and *Oxyptilidi*, and his latter, *Trichoptilus*, our tribe *Buckleriidi* (*Ent. Rec.*, xvii., p. 37). Our separation of the first two was based largely on details of the larval and pupal characters, both showing, in *Capperia* (as exemplified in *heterodactyla*), an inclination to Alucitine characters. Chapman considers now that the larval and pupal characters that separate *Capperia* from *Oxyptilus*, although apparently so great, are possibly not structurally of tribal value, and hence he is inclined to sink *Capperiidi* as falling within the limits of *Oxyptilidi*. Hofmann's detailed account of *Oxyptilus* (=*Oxyptilidi* and *Capperiidi*) (*Die Deutsch. Pteroph.*, pp. 95-102) reads as follows:—

* Exceptionally, there are only four branches of vein II present, but then II_2 is always absent, not II_1 (Hofmann).

Imago.—Forehead without cone. Antennæ in both sexes very shortly ciliated; palpi longer than the head, more or less laterally compressed, porrected, or somewhat ascending; the second joint in most species with a terminal projecting pointed scale-tuft (in *Oxyptilus didactylus*, *O. leonuri*, and *O. teucrii* it is absent); the third joint longer than this tuft, slender and pointed, often somewhat drooping, and, in that case, lying on the scale-tuft of the second joint, so that this may then be easily overlooked. Legs long and thin, the anterior and middle tibiæ at the ends, and the posterior at the end and in the middle thickened with scales. In one portion of the species (Division I = our *Oxyptilidi*) the end of the abdomen is furnished, in the male, with a short anal tuft divided on the upper and lower sides, while in another portion (Division II = our *Capperiidi*) it is simple, acuminate, and laterally somewhat compressed at the point. The abdomen of the female is, at the end, laterally compressed, posteriorly, straightly or obliquely terminated. Forewings fissured to beyond one-third, the upper segment running to a point, the lower segment with a broad prominent point, and more or less distinct anal angle. Segments of the hindwings narrow and pointed, the third linear without anal angle. Neuration: The neuration shows a deviation from the genera hitherto noticed (*Platyptiliinae*, *Eucnemidophorinae*, *Amblyptiliinae*, and *Stenoptiliinae*) in so far that, on the forewings, II_1 arises from the upper corner of the median cell, very close to the common stem of II_2, II_3, and II_4, but it only reaches to a little beyond the point where II_2 branches off (*O. hieracii*) [taf. ii., fig. 5]. In another species (*O. didactylus*), II_1, on the contrary, extends beyond the branching point of II_3, while II_2 is either absent or concurrent with II_1. In both cases II_5 arises from the very weak, somewhat inwardly bent, discocellular, and runs parallel with II_4 along the inner margin of the upper segment. In other respects the neuration is normal. Stem IV has three branches on both the fore- and hindwing. Typical markings: The ground colour is nearly always brown, differently tinted by the more or less richly sprinkled yellow and dark, to almost black, scales, from cinnamon-brown, or red-brown, to a more or less dark grey-brown. The spot on the inner margin and the discoidal spot are generally present, commonly, posteriorly, more or less heightened with white scaling, now and then in the form of small white strigæ. Behind the insignificant plical spots, which are sometimes combined in a transverse line, the base of the fissure is nearly always bordered with white. The costa usually marked with a narrow darker stripe is sometimes more, sometimes less, sprinkled with white scales. Over both segments run two whitish transverse lines, the anterior mostly broader, running obliquely inwards from the costa, and more or less distinctly continued beyond the fissure on the lower segment, cutting the fringes of both segments on the costa and inner margin; the posterior is much narrower, on the upper segment straight or little oblique, sometimes angulated, on the lower segment very oblique, parallel with the margin, cutting the fringes of the upper segments on the costa and inner margin, those of the lower segment only on the costa. The costal fringes of the upper segment are dark, from the posterior transverse line up to the apex white. The inner marginal fringes of the upper segment, and the outer marginal and inner marginal fringes of the lower segment, are, in their basal halves, several times cut by snow-white scales, which mostly border on more or less deep black spaces, so that the fringes often present a rich variegated appearance. In some species, the concave outer margin of the lower segment is marked by a fine white or, at any rate, pale basal line in the fringe; in others the fringes are, immediately before the anal angle, for their whole length barred with white, or, at least, with pale colour, in greater or less breadth. Hindwings unicolorous; in the fringes of the 3rd segment on the costa, as well as on the inner margin, there are tufts of thick black scales, which, in the individual species, are very different as to their form and position—nearer or further from the apex. Between these scale-tufts and the base of the segment there are, at the base of the fringes, single thick black and white scales. On the underside of the upper segment both transverse lines are visible, but only the posterior on the lower segment. The first segment of the hindwing exhibits, usually, two white spots, rarely only one; the third segment in front of the scale-tuft is white to a larger or smaller extent, the second segments always without markings, The head, respectively forehead and crown, is of the same colour as the forewings, bordered finely with white on the sides above the eyes, antennæ spotted with white and brown, white beneath at the base. Pro- and mesothorax unicolorous dark, the latter bordered on the posterior margin with a straight pale line; patagia usually pale coloured; metathorax above with two dark whitish, or yellowish, bordered lateral triangles, in the centre dark. Coxa brown, widened at the apex by rough hairs, and edged with white. Femur brown, exteriorly finely bordered with white, interior white. Middle and hind tibiæ relatively white below and brown above, the hind tibiæ brown, broadly white at the base and beyond the first pair of spurs. Spurs, inner side white, outer brown, brown at the apex. Tarsi white, at the extremities of the joints more or less broadly dark brown or black, on the front legs beneath mostly quite white. The 1st abdominal segment is bordered, on both sides, broadly with shining whitish or yellowish; over the remaining segments run two more or less distinct fine white interrupted lines along the dorsum, those on the 1st and 2nd run parallel, on the 3rd and 4th, where they are very distinct, and on the remaining segments, where they are less expressed, they diverge posteriorly. The posterior margins of the segments, especially those of the middle ones, and the lateral ridge of the body, show white scaling; on the venter there are a fine central and two lateral longitudinal lines, composed of thick white spots situated on the hind margins of the segments. Between these white spots, on the hind margins of the segments, in several of the species, lie deep black scales. The abdomen often exhibits quite a spotted appearance through these markings. Genitalia: In the male genitalia there are several types to be distinguished. The species of Division I (of the table that follows) are distinguished in that the 9th dorsal plate is split into two strong parallel processes, hook-like at the end, bent inwardly or downwardly, while the small three-cornered 10th dorsal plate lies between the processes of the 9th; an uncus is quite absent. The penis is long and slender, rather thickened behind. The prensors are short, rounded at the end, and particularly distinguished by the soft lancet-like skinny appendage with strong sensory hairs. The 9th ventral plate is small, and consists of two little chitinous plates, in the different species differently shaped, oval or elongated, running to a point with the inner margins meeting (taf. iii., fig. 8). The species of Division II agree in that the 9th and 10th dorsal plates are simple skinny forms, sometimes broader, and truncated on the hind margin, sometimes narrower, running to a point behind; in several species (the *O. teucrii* group) the 10th dorsal plate is very small, pointed, and hidden under the 9th dorsal plate. The 9th ventral plate is, however, in these species, very strongly developed, as long as the prensors, convex below, concave above, split terminally in two tips or points. The prensors are very long and narrow, hollow inside, and very strongly furnished with bristles, without the appendages of the previous Division. The penis is shaped in *O. didactylus* as in the species of Division I; in the species of the *O. teucrii* group, however, it is highly peculiar, namely, strongly bent downwards before and behind, and terminating often in two strong points, a shorter and a longer (taf. iii., fig. 9). Habits: The moths fly in summer from the end of May to July and August; some species have two broods (*O. tristis*, *O. parvidactylus*, *O. teucrii*)*. At rest, the forewings are spread out flatly, and the plumules of the hindwings, folded over one another, are hidden beneath them as far as the scale-tuft of the third plumule.

Larva: The larvæ differ much according to their mode of living; those living exposed are rather swollen, becoming more slender anteriorly and posteriorly; the skin is spiculated and beset sparsely with white bristles, dilated knob-like at the apices; tubercles large, darkly-coloured, mostly furnished with several hairs or bristles; the dorsal tubercles approach very closely, so that they form double tubercles; ventral prolegs long, stilt-like, with a semicircle of brown hooklets on the planta. Those larvæ which live in the shoots of plants are, on the contrary, whitish or yellowish, maggot-like, hardish to the touch, and have small tubercles furnished with a single long hair; true legs and ventral prolegs short, the latter with a few brown hooklets on the planta. The foodplants, as far as is yet known, are solely the *Labiatae* and *Compositae*; those of certain species are found in early spring (*Oxyptilus parvidactylus*), manifestly hibernated; most of them appear first in May or June, or even later.

Pupa: The pupæ of the exposed feeders have strongly-developed dorsal keels, which reach as far as the 4th abdominal segment, and bear strong thorns beset with bristles. These thorns are continued also on the dorsum of the remaining abdominal segments, which are also furnished with rows of bristle-bearing tubercles. The wing-cases reach to the hind margin of the 4th abdominal segment, the leg-cases up to the hind margin of the 5th abdominal segment, often beyond; the former have bristly ribs in some of the species. The cremaster bears the usual hooked bristles at the apex and on the ventral side. In *O. pilosellae*, which pupates in a cocoon, that is to say in the fluff of the leaf, the dorsal keels

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* This is very doubtful. Certainly, in Britain, neither *parvidactyla* nor *teucrii* (*heterodactyla*) is double-brooded.

are only poorly-developed and the dorsal thorns altogether absent; the tubercles of the abdominal segments are small, the hooked bristles of the cremaster are only scattered. A position intermediate between the two forms is taken by the pupa of *O. parvidactylus*, which is distinguished by the remarkable form of the cremaster.

This subfamily agrees in its general characters with the other subfamilies on the Platpytiliid side of the "plume" stirps. It has, for example, the characteristic structure of the discoidal cell of the forewings, the single spina to the ♀ frenulum, the black scale-tufts on the third plumule of the hindwings, and other general characters. It is, however, in certain characters, somewhat removed from the *Platyptiliinae*, and its nearest relatives appear to be found in the *Amblyptiliinae* and *Marasmarchinae*. In the Oxyptilines, the lobes of the forewings differ in shape, the upper one being pointed, and the lower one showing, at most, an ill-developed obtuse anal angle, whilst the plumules of the hindwings are somewhat similarly shaped. Hofmann states that, normally, as in the Stenoptiliids and Platyptiliids, there are five branches to nervure II of the forewings, although, occasionally, there are only four, a specialisation that has become characteristic of *Marasmarcha*, in which II_2 is the nervure always absent. In *Buckleria* it is II_1 that is wanting. In the ♂ genital organs there is considerable variation, and the main points of difference appear to characterise our two larger sections, "*Capperiidi*" and "*Oxyptilidi*," although, in this particular, *Geina* is distinctly Oxyptilid rather than Capperiid..

The Oxyptiline pupæ are very remarkable in their structure, and show not only marked variation within the limits of the subfamily, but also suggest alliance with other subfamilies on both sides of the "plume" stirps, with the Amblyptiliines and Marasmarchines on the Platyptiliid side, and with the Leioptilines on the Alucitid side. Thus the pupa of *Oxyptilus* is rather inclined to the Platyptiliine side, whilst that of *Capperia* is inclined to the Leioptiline. Comparing the pupal structure of *Capperia* with those with which it has real and apparent alliance, Chapman notes that "the pupa of *Capperia* (*heterodactyla*) has, on the abdominal segments, a double spine on either side, internal to i and ii; single spines occur in the same positions in the pupæ of *Alucita* (*pentadactyla*) and *Oidaematophorus* (*lithodactyla*). In *Crombrugghia* (*distans*), there is a spine in this position, not, however, on each side, but a central unpaired one. Again, in its general appearance the pupa of *Capperia* (*heterodactyla*) bears a great superficial resemblance to that of *Ovendenia* (*septodactyla*), yet the structure of the former agrees essentially with that of the pupæ of the other Oxyptilid genera. Without pressing the definition too far, the pupa of *Ovendenia* (*septodactyla*) may be described as an Alucitine pupa, tending to have, like the Alucitine larva, many secondary hairs that are practically indistinguishable from the primaries. The pupa of *Capperia* (*heterodactyla*) is of the Platyptiliine type, with no secondary hairs, whilst the secondary hairs of the larva are always obviously secondary. What definite distinction can be drawn between the hairs along the wing-nervures in the pupa of *Ovendenia* (*septodactyla*) and those of *Capperia* (*heterodactyla*) is uncertain; perhaps there is none. The lepidopterous pupa, as a rule, refuses to have hairs on any of the appendages (antennæ, legs, wings, etc.). In the pupa of *Capperia*, the hairs on the wings, when carefully examined, appear to be pupal processes rather than hairs, similar to those on the dorsum centrally, and associated with tubercles i and ii; and, taking into account the rarity of hairs on the wings of lepidopterous pupæ, it would seem probable that the hairs on the pupal wings of the Alucitines are similarly spines and not hairs. On the other hand, although they have no articulated bases, they are spiculated just like the other hairs. Leaving this part of the question for the moment, it is certain that the fans in line of i and ii on the pupa of *Capperia heterodactyla* presenting five, six, and seven hairs, are strictly homologous with the dorsal spines of the Oxyptilids, that only two of the apparent hairs are the hairs i and ii, and that the others are the branches of the dorsal spines. Besides the two hairs, these horns or spines present two points in *Amblyptilia* and *Marasmarcha*, in some others, *e.g.*, *Crombrugghia distans* there are three, and here in *Capperia heterodactyla*, are also three on the 6th and 7th abdominals, two on the 8th, and four or five on the 2nd, 3rd, 4th, and 5th abdominals. The only difference in them is that here these processes of the horn are comparatively long and slender, in their proportions very similar to hairs. It is curious that these horn-processes are rough, so as to look as if spiculated, the true hairs being quite smooth. Tubercle iii has the true hair curved forwards, and a horn or process, very like it in outline, curved backwards; there is a similar horn directed outwards between iv and v, the setæ on which are directed backward and forward; vi has a small hair in front of it; tubercle vii carries simply two hairs. There are also the mediodorsal horns; these are slender, and have much the appearance of hairs. Referring to the pupa of *M. lunaedactyla*, in which there are a central and two lateral mediodorsal horns, we find the central one in *Crombrugghia* (*distans*), whilst in *Capperia heterodactyla* the central one is wanting, and we have the two lateral ones. Across the dorsum, from one (i+ii) spine to the other, is a narrow ridge with wrinkled (but fairly level) top, and sharply-marked walls on either side. It exists on the 2nd, 3rd, 4th, 5th, 6th, and 7th abdominals, and divides the segment into two portions, a rather larger anterior ribbed portion, and a posterior (intersegmental subsegment), which has the sculpture of intersegmental membrane. This ridge is divided into three equal portions by the origin of these mediodorsal spines (really subdorsal here, but mediodorsal because internal to i). From a combined base two spines diverge, one forwards, one backwards, at an angle of about 100° to each other. The forward one is about 0·2mm. long, the posterior rather shorter. Their structure and texture seem to be identical with those of the dorsal spines (those of i+ii). This pupa further gives an interesting light on the cleft in the forewings. "Poulton's line" is well marked, and has, outside it, a very distinct band, differently sculptured, so that the area outside contrasts with that within. Now the cleft is also well marked; in front of it is a vein with hairs (?), and one without; behind it are three veins more or less haired, but these run up the cleft with a strip of the same texture as that outside "Poulton's line," of fairly uniform width, bounded on each side by a continuation inwards from the margin of "Poulton's line," which is met at top, where it crosses from one side to the other, by a short vein (5 and 6 ?) which starts just above from the transverse vein. The cleft is therefore an extension inwards of the hind margin, as, on thinking a moment, one sees it must be, and not, as one hastily supposes, a slit in the wing tissue healed round somehow. The sculpture consists of twelve, or so, transverse ridges or waves, very smooth in outline, with finer sculpture of small round pits. These seem to vary into spiculæ on the ventral surface, especially at anterior margin of segments.

The Oxyptiline larvæ also vary considerably. Those that are largely internal feeders are hardly, perhaps, Platyptiliine, but rather, perhaps, Stenoptiliine, in their general appearance and the character of their tubercular structure, whilst the largely external-feeding larvæ are extremely specialised, and the tubercles have become specialised into highly-developed warts. The variation in the larval wart structure, accompanied as it is by differences in pupal and imaginal structures, suggests that our subdivision into the two tribes, *Oxyptilidi* and *Capperiidi*, is well-founded, the former containing the more generalised, the latter the more specialised, species. Without here going into the detailed characters, our subdivisions work out as follows:—

Oxyptilidi—
- *Oxyptilus—pilosellae*, Zell., *hieracii*, Zell., *ericetorum*, Zell., *parvidactyla*, Haw.
- *Crombrugghia—kollari*, Stn., *tristis*, Zell., *distans*, Zell.

Capperiidi—
- *Geina—didactyla*, Linn.
- *Capperia—leonuri*, Stange, *heterodactyla*, Müll.

Dyar remarks (*Journ. New York Ent. Soc.*, iii., p. 21) that "the Oxyptilid larval characters are very uniform, the tubercles being converted into moderate-sized warts, with six to twelve long hairs; the body also rather sparsely covered with short secondary hairs with enlarged tips; i and ii entirely consolidated into a single wart, a single long seta behind iv+v; viii a single seta, other warts normal. Prolegs slender, the crotchets forming two-thirds of a circle on inner side." One suspects from this that Dyar's knowledge of the subject was limited. It is apparent that *periscelidactylus*, the species he here describes, is a member of the Capperiid section of the Oxyptilines.

One can accept, as an expression of ignorance, Meyrick's remark (*Trans. Ent. Soc. Lond.*, 1890, p. 485) that *Oxyptilus* (*sens. lat.*) "is especially characteristic of Europe, but stragglers have spread thence into the surrounding regions." The fact is, we know next to nothing about the "plumes" outside Europe; they have never been worked, and their distribution is a closed book. In the broad sense of the term, including the Buckleriids (*Trichoptilus*, *Buckleria*, etc.), we note that Staudinger and Rebel (*Cat.*, 3rd ed., pp. 70-72) note 15 species recorded from the Palæarctic region, whilst Dyar (*List Nth. Amer. Lep.*, pp. 441) records seven species from the Nearctic region. One suspects that the Oxyptilines are much more widely distributed in America than is at present supposed, and possibly there are as many Nearctic as Palæarctic species.

Tribe: Oxyptilidi.

The species of this tribe have already been differentiated by Hofmann on imaginal characters, and by Chapman on pupal and larval characters, from those of *Capperiidi*. Hofmann notes (*Die Deutsch. Pteroph.*, pp. 100-102) that the Oxyptilids (excluding *Buckleria*) can be divided by the characters of the ♂ genital organs, with which is correlated a difference in the palpi, into two rather large natural groups. These groups coincide with our sections *Oxyptilidi* and *Capperiidi*. His grouping of the species in the first tribe works out as follows:—

I. Palpi thick, rather straightly projecting, 2nd joint furnished with very long scales, which form, at its apex, a comparatively large pointed tuft of scales, 3rd joint slender, with appressed scales, as long as the 2nd.
  A. The scale-tuft of the inner margin of the 3rd feather is distant from the apex.
    1. The anal angle of the lower lobe very obtuse, the outer margin between this and the apex scarcely noticeably sinuate .. .. *kollari*, Stn.
    2. The anal angle of the lower lobe distinctly prominent, the outer margin, between this and the apex, concave.
      a. Dark grey-brown, with a white dash in the fringes of the anal angle of lower lobe *tristis*, Zell.
      b. Red-brown or yellow-brown, the fringes of the lower lobe with a narrow white dash at the anal angle, and a fine white basal line, mostly running up to the apex .. .. .. *distans*, Zell.
  B. The scale-tuft of the inner margin of the 3rd feather close to the apex, or surrounding it.
    1. The black scales of the 3rd feather shorter on the costa than on the inner margin.
      a. The black scales of 3rd feather run, neither on the costa nor on the inner margin, quite to the apex, which is white-scaled on both sides, and only bears, exceptionally, a few isolated downwards-directed black scales .. *pilosellae*, Zell.
      b. The black scales of the 3rd feather run, on the costa, almost or quite up to the apex, which bears, besides, also a small downwards-directed scale-tuft. On the inner margin, the black scales do not quite reach up to the apex, are longest towards the base, and become shorter towards the apex, so that the scaling, as a whole, assumes a tooth-like form .. .. *hieracii*, Zell.
    2. The black scales of the 3rd feather are, on the inner margin and costa, of equal length, and run, on both sides, to the very tip, which is sometimes, at this point, also furnished with some white scales.
      a. The fringes of the outer margin of the lower lobe with a white or pale basal line .. *ericetorum*, Zell.
      b. The fringes of the outer margin of the lower lobe with a white dash at the anal angle *parvidactylus*, Hw.

The pupal characters of this tribe exhibit an intermediate stage between the more normal Platyptiliid pupæ, and the more extreme form represented by *Capperia*. The pupa is, in the Oxyptilids (*sens. rest.*), free from warts, but has long, well-developed, primary hairs, without any trace of secondaries in connection with the tubercles, or on the skin-surface; the dorsal flanges are well-developed; but, although the pupa has a single median, unpaired, spine on the abdominal segments 1-8, it does not show the highly-specialised structure, of *Capperia* (*heterodactyla*), in which the pupa has, on the abdominal segments, a double spine on either side, internal to i and ii. [Single spines or hairs occur in certain pupæ on the Alucitid side of the stirps, *e.g.*, *Alucita* (*pentadactyla*), and *Oidaematophorus* (*lithodactyla*).]

It is, however, in the larval characters, that the *Oxyptilidi* differ most from the *Capperiidi*. The former are practically Platyptiliid in structure and habit; the larvæ being largely (if not entirely) internal feeders, whilst the latter are external feeders, this difference in habit being associated with a marked difference in structure, for, whilst the *Oxyptilidi* are essentially simple in their structure, with no indications of wart-structure, or at least none exceeding, or even reaching, that of the Stenoptiliids, the primary tubercles i and ii, as well as iv and v, being separate, and the accessory postspiraculars absent, whilst the *Capperiidi* have well-developed warts, i+ii united into a single many-haired wart on thorax and abdomen, iii forming a well-developed wart, whilst the accessory postspiraculars are also well-developed.

Genus: Oxyptilus, Zeller.

Synonymy.—Genus: **Oxyptilus,** Zell., "Isis," pp. 765, 789 (1841); "Linn. Ent.," vi., p. 345 (1852); Wallgrn., "Oefvers. K. V. A. Frr.," p. 220 (1852); H.-Sch., "Sys. Bearb.," v., p. 370 (1855); Wallgrn., "Skand. Fjäderm.," p. 14 (1862); Jord., "Ent. Mo. Mag.," vi., p. 121 (1869); Staud. and Wocke, "Cat.," 2nd ed., p. 342 (1871); Nolck., "Lep. Fn. Estl.," p. 803 (1871); Frey, "Lep. Schweiz," p. 429 (1880); Staud., "Hor. Soc. Ent. Ross.," xv., pp. 425-7 (1880); Jord., "Ent. Mo. Mag.," xviii., p. 122 (1881); Barr., "Ent. Mo. Mag.," xviii., p. 177 (1882); South, "Ent.," xv., p. 35 (1882); xvi., p. 73 (1883); Sorhgn., "Kleinschmett. Brandbg.," p. 3 (1886); Leech, "Brit. Pyr.," pp. 56, 57 (1886); Tutt, "Young Nat.," x., p. 164 (1889); South, "Ent.," xvii., pp. 32, 34, 102 (1889); Briggs, "Ent.," xxii., p. 139 (1889); Barr., "Ent. Mo. Mag.," xxv., p. 431 (1889); Meyr., "Trans. Ent. Soc. Lond.," p. 485 (1890); Tutt, "Brit. Nat.," i., pp. 182, 249 (1891); "Pter. Brit.," pp. 60, 66 (1895); Meyr., "Handbook," etc., p. 431 (1895); Hofmn., "Deutsch. Pteroph.," pp. 95, 107 (1895); "Illus. Zeits. für Ent.," iii., pp. 152, 307 (1898); Staud. and Reb., "Cat.," 3rd ed., p. 71 (1901); Barr., "Lep. Brit. Isles," ix., p. 362, pl. 414-415 (1904); Tutt, "Ent. Rec.," xvii., p. 37 (1905). **Alucita,** Haw., "Lep. Brit.," p. 479 (1811); Zett., "Ins. Lapp.," p. 1013 (1840). **Pterophorus,** Wood, "Ind. Ent.," 1st ed., p. 237 (1839); Zell., "Isis," p. 789 (1841); pp. 38, 902 (1847); Dup., "Cat. Méth.," p. 383 (1845); Tgstrm., "Finl. Fjär.," p. 155 (1847); Frey, "Tin. Pter. Schweiz," p. 408 (1856); Sta., "Syst. Cat.," p. 13 (1849); "Man.," ii., p. 441 (1859); Gregs., "Ent.," p. 298 (1867); Barr. and Buckl., "Ent. Mo. Mag.," viii., p. 155 (1871); Mason, "Ent. Mo. Mag.," xxv., p. 162 (1888). **Amblyptilia,** Stphs., "Illus. Haust.," iv., p. 377, *in part* (1834); app. p. 424, *in part* (1835). **Oxyptilia,** Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 790 (1877).

Until quite recently all the species of the *Oxyptilinae*, with the exception of those belonging to the genus *Buckleria*, have been placed in the genus *Oxyptilus*. This genus, created by Zeller (*Isis*, 1841, pp. 765-766) in order to separate the Oxyptilines from the Amblyptiliines, which Hübner had united in his genus *Amplyptilia* (recte *Amblyptilia*), was from the first restricted to the Oxyptiline species. The original description reads as follows:

The lobes extend to more than one-third of the wing-expanse, are narrow, and the upper wants the anal angle; the third plumule linear, before, or at the apex, with black scales in the fringes. Only the similarity of the markings and general appearance places this group here; a thorough consideration of the formation of the wings, would, without fail, place them in the third group. The lobes and the plumules are much narrower and longer than those of the first group; the upper lobe is very pointed, and its anal angle has disappeared; the lower lobe has a very elongated apex. In the hindwings, the first fissure runs to within the basal third of the wing, the second nearly up to the base. The linear plumules become gradually narrower from their commencement up to the apices; the third has no distinct anal angle, but has, not far from the apex, or at the apex itself, either in the fringes of both margins, or in those of the inner margin only, a crowded row of black scales. The wings are held, in rest, as in the preceding group, namely, the forewings are stretched out flat, and the hindwings, folded as in the first group, are all, except the scale-tuft, hidden beneath. The markings are, from the very near relationship of the species, much in agreement. Before the fissure lies a generally smaller, paler, dash, and before this, in the disc, another larger. Right across the lobes, more sharply defined on the upper, run obliquely two whitish, usually somewhat shining, transverse lines, between which the ground colour, as a rule, appears especially dark. These are also present on the underside; only the portion of the first transverse line is wanting on the lower lobe. The first plumule of the hindwings has, on the underside, two pale, yellow, transverse dashes, which lie in close neighbourhood to the transverse lines of the forewings. On the forewings, the fringes of the costa are white from the outer transverse line to the apex. The black scale-tuft at the mouth of the fissure, and on the inner margin, as in the first group. The legs have strong, dark, scale-tufts, long spurs, and pale and dark alternate rings like the antennæ. The interrupted, pale, longitudinal lines on the abdomen, give a strikingly variegated appearance. The larva lives in a shoot of the foodplant, spun together with silken threads, which it hollows out. The pupa is bristly, and has, on the upperside, rows of elevations, which, according to the species, develop more or less into branched prickles or spines. All the five species form a single natural group.

The five species included are *tristis*, Zell., *pilosellae*, Zell., *obscurus*, Zell., *hieracii*, Zell., and *trichodactylus*, Hb. We are inclined to maintain at least the middle three of these species in our limitation of the genus, although it is possible that *obscurus* = (*parvidactyla*) may have later to be separated from *pilosellae* as well as *hieracii*. In 1852 (*Linn. Ent.*, vi., p. 342) Zeller maintained the genus, but included a dozen species, and the genus was maintained by Herrich-Schäffer in 1852, Wallengren in 1862, and practically all succeeding authors. The differences exhibited in the imaginal structure (*anteà* p. 412) led Hofmann to subdivide the genus into two main groups (*Die Deutsch. Pteroph.*, pp. 100-102), with several other minor subdivisions, which the detailed structure of the larvæ and pupæ will probably prove to belong to quite distinct genera, and our hint above, that even *Oxyptilus*, as we use it, consists of two genera, is based on the belief that a greater knowledge of the early stages will place *pilosellae* and *hieracii* together in *Oxyptilus*, and separate them from *ericetorum* and *parvidactyla*. At present, however, our information is too little to enable us to make the separation. We therefore use *Oxyptilus* for the whole of Hofmann's Sect. I, subsect. B, and have already named (*Ent. Rec.*, xvii., p. 35) *pilosellae* the type of the genus. The characters of the larval and pupal stages are largely characterised by their suitability to the life of a borer and internal-feeder.

Oxyptilus parvidactyla, Haworth.

Synonymy.—Species: **Parvidactyla,** Haw., "Lep. Brit.," p. 480 (1811); Tutt, "Brit. Nat.," i., p. 249 (1891); "Pter. Brit.," p. 75 (1895); "Ent. Rec.," xvii., p. 37 (1905). **Microdactylus,** Sam., "Ent. Usef. Comp.," p. 409 (1819); Curt., "Brit. Ent.," fo. 161 (1827); Stphs., "Illus. Haust.," iv., p. 377 (1834); Wood, "Ind. Ent., 1st ed., p. 238, pl. li., fig. 1652 (1839). **Obscurus,** Zell., "Isis," p. 793 (1841); p. 38 (1847); "Linn. Ent.," vi., p. 354 (1852); Dup., "Hist. Nat.," supp. iv., pp. 503, 613, pl. 88, fig. 11 (1842); "Cat. Méth.," p. 383 (1844); Tgstrm., "Finl. Fjär.," p. 155 (1847); H.-Sch., "Sys. Bearb.," v., p. 372 (1855), supp. fig. 17 (1853); Frey, "Tin. Pter. Schweiz," p. 410 (1856); Wallgrn., "Skand. Fjäd.," p. 15 (1859); Jord., "Ent. Mo. Mag.," vi., p. 122 (1869); Nolck., "Lep. Fn. Estl.," p. 804 (1871); Frey, "Lep. Schweiz," p. 429 (1880). **Hemidactyla,** Sélys, "Mem. Soc. Roy. Sci. Liège," p. 29 (1845-6); [Zell., "Linn. Ent.," vi., p. 355 (1852).] **Parvidactylus,** Sta., "Man.," ii., p. 441 (1859); Staud. and Wocke, "Cat.," 2nd ed., p. 343 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 792 (1877); Staud., "Hor. Soc. Ent. Ross.," xv., pp. 425-7 (1880); Barr., "Ent. Mo. Mag.," xviii., p. 177 (1882); Sorh., "Kleinschmett. Brandbg.," p. 4 (1886); Leech, "Brit. Pyr.," p. 58, pl., xvii., fig. 3 (1886); Tutt, "Young Nat.," x., p. 164 (1889); South, "Ent.," xxii., p. 34 (1889); Barr., "Ent. Mo. Mag.," xxv., p. 431 (1889); Meyr., "Trans. Ent. Soc. Lond.," p. 485 (1890); "Handbook," etc., p. 432 (1895); Hofmn., "Deutsch. Pteroph.," p. 112 (1895); "Illus. Zeits. Ent.," iii., p. 307 (1898); Staud. and Reb., "Cat.," 3rd ed., p. 71 (1901); Barr., "Lep. Brit. Isles," ix., p. 363, pl. 414, fig. 6 (1904).

Original description.—*Alucita* (the small Plume) nana, alis patentibus fuscis, striga punctisque albis; anticis bifidis, posticis tripartitis. Habitat in Cantio, at rarissime. Expansio alarum

6-6½ lin. Obs.—This is the smallest of the Plume Moths, and it is also one of the rarest. Its characters are almost exactly the same as in the two preceding articles (*didactyla*, *heterodactyla*); yet its diminutive size, as a species, renders it very distinct (Haworth, *Lep. Britannica*, p. 480).

Imago.—13mm.-16mm. Forewings chocolate-brown, with a golden tinge; a white dot before the fissure, another further back; a white oblique, transverse line near the base of fissure crosses both lobes, broader on the lower lobe; nearer outer margin a second, narrower, white, transverse line, extending along costa of upper lobe to apex; cilia red-brown, interrupted with white; in the hollowed portion of the dorsal margin are short white fringes, with two small, black, oblique dashes. Hindwings pale golden-brown; the fringes dark smoky-brown; the scale-tuft of the 3rd plumule large, black, and triangular, edged with white.

Sexual dimorphism.—The males appear to me to average rather larger than the females, though I have examples of the former as small as any of the latter sex, and some of the females in my long series are as large as fair-sized males (Bankes).

Variation.—Although, in the bulk, a long series of this species appears to offer little variation, yet, examined in detail, there is considerable diversity in size, tint, and intensity of the markings, the differences, however, rarely leading to any striking aberration, although a note in the *Ent. Rec.*, ix., p. 41, mentions an "ochreous" specimen of this species that was in the "Briggs" collection at the time of its dispersal. The British examples are largely of two distinct colour forms: (1) A bright red- or golden-brown, the hindwings almost as brilliantly tinted as the forewings. (2) A much duller fuscous-brown, without the marked glossy sheen of the former, the hindwings of a deep fuscous-grey, with scarcely a tinge of red-brown. The former occasionally leads up, even in England, to a specimen that distantly approaches the bright, but paler, red-brown, or red-ochreous, forms of the south and east. Some, again, are much more speckled with white than others, presenting a white discal streak, sometimes conspicuous, which is even developed, in the best marked examples, into an oblique transverse shade, extending across the wing from costa to inner margin. Such examples have a well-developed white discal spot, well-marked white transverse lobal lines, white costal edge to the upper lobe, whilst the two white streaks in the outer fringes of the lower lobe, and the white scales on the inner margin of the forewing are exceedingly well-developed. In others, too, there is much difference in the development of the black scales, not only in the upper lobe, but more markedly in the fringe areas of the lower lobe, both on the outer and inner margins of the wing; in some, there are two quite distinct black spots near the anal angle of the lower lobe, and two others, smaller, further along the inner margin, towards the base of the wing, with which the white patches contrast strikingly; in others the fringes appear much more uniformly dark grey, neither the black nor white patches being distinctly and clearly developed. One observes in some of the brightest reddish specimens that the apex of the third plumule, before the scale-tuft, is white, and there are many white scales on the plumule, between the tuft and the base of the wing; in the fringes of the hindwing also, besides the recognised scale-tuft, there are a few short black scales placed in the long dark grey fringes, much nearer to the base of the wing, but only discernible in very fine specimens. One can, therefore, divide our British examples into the following groups:

1. Fuscous-brown with abundant white markings=ab. *variegata*, n. ab.

1*a*. Fuscous-brown with the white lobal lines and the fissural spot only=*parvidactyla*, Haw.

1*b*. Fuscous-brown with the fissural spot and lobal lines more or less obsolete =ab. *obsoleta*, n. ab.

2. Golden-brown (or chocolate-brown with a golden tinge) with abundant white markings=ab. *clara-variegata*, n. ab.

2*a*. Golden-brown (or chocolate-brown with a golden tinge) with the white lobal lines and the fissural spot only=ab. *clara*, n. ab.

2*b*. Golden-brown (or chocolate-brown with a golden tinge) with the fissural spot and lobal lines more or less obsolete=ab. *clara-obsoleta*, n. ab.

In size, we should call examples above 16mm. ab. *major*, n. ab., below 13mm. ab. *minor*, n. ab. One observes, in looking through the Frey collection, that there is considerable difference in size. The tint of the wings varies from brown, inclining to golden, to a deep fuscous-brown. Some slight variation in the obliquity of the two transverse lines across the upper lobe is noticeable; the inner one, often nearly vertical, is occasionally somewhat oblique, whilst now and again the outer one inclines to be of zigzag form; occasionally both these lines are inconspicuous, and inclined to approach the ground-colour in tint. The apical costal edge, sometimes white, is, at other times, ochreous; the white fissural dot is sometimes extended towards the costa, and the basal area is sometimes thinly scaled with white; the white dots on the marginal fringe vary considerably in intensity. An example from Vienna looks very like *pilosellae*. Snellen notes it as the smallest Oxyptilid species, also the darkest coloured, adding that some of the larger *pilosellae* approach nearly to *obscurus* in their dark colour, but have always a redder tint, whilst the scale-tuft on the 3rd plumule will always distinguish them. Zeller, in describing this species under the name of *obscurus*, says (*Linn. Ent.*, vi., p. 354) that, in size, it is like a small *P. tristis*, belonging, therefore, to the group of smallest species, although in the formation of the black scale-tuft of the 3rd plumule it agrees with *P. trichodactylus* and *P. ericetorum*; instead, however, of the whitish line, which, in these species, stretches into the fringe at the base of the second lobe, this presents an area of pure white. It is also browner, with less reddish-yellow in its tint. Its nearest relative is *P. marginellus*, from which it differs more markedly in the cleft of the forewings, which only extends over the outer third, and not right up to the centre, and in the white fringes of the front edge of the upper lobe being narrower, whilst those round the apex of the 3rd plumule of the hindwings are whiter, and have the white fringe-area more extended. In 1847, Zeller had already noted (*Isis*, xii., p. 793) a ♀ from Macri, a trifle worn and faded, so that its colour agreed with the lightest local (Glogau) specimens, from which it appeared only to differ in that—(1) The first transverse line of the upper lobe is broad, and continued on the lower lobe almost as distinctly as on the upper; it is not such a pure white, nor so sharply defined, as usual, and appears to be less slanting. (2) The second transverse line is also broader than in our *obscurus*, on the lower lobe with a larger dash in the fringes. (3) On the hindwings the centre of the 3rd plumule is whitish; on the front edge are several minute white scales, more numerous on the hinder edge; at both places, latticed with a couple of black scale-patches. As these small scale-areas are larger, he says, and of a purer white, than in our specimens, and must be even more conspicuous in fresh specimens, one suspects that the Asiatic specimens may possibly form a distinct species. Later, in 1852, Zeller (*Linn. Ent.*, vi., p. 355) referred this specimen to *marginellus*, as noted by Staudinger (*posteà*). Zeller also notes (*op. cit.*, p. 355) that a ♂ of *P. dentellus*, Mann, from Fiume, in which the black scale-tuft on the 3rd plumule of the hindwing is triangular, is not specifically distinct from *obscurus*; he says that examples of this kind occur among the ♂ s at Glogau. This specimen, he says, belongs to var. β, diagnosed as "digiti tertii medio albido." Of this form Snellen says: "The 3rd plumule is always paler before the black scale-tuft, but sometimes white, when it forms the var. β of Zeller." [Rössler says that the specimens from Lorch and the Dennelbachthal, near Wiesbaden, appear to belong to a different species; in size they sometimes approach that of *hieracii*, although usually smaller, and the grey colour is more like that of *tristis*; otherwise they agree with *obscurus*, except that they are distinguished by the black margins to all the white marks on their inner edge; the apex of the 3rd plumule, in comparison with that of *obscurus*, is beset to a greater extent, on both sides, with black scales; and they are certainly larger.] Zeller records it from Sicily, in May and July, Asia Minor, near Macri, and Brussa; the ♀ in Zeller's possession, from Brussa, was caught in July. Staudinger states (*Hor. Soc. Ent. Ross.*, xv., pp. 426-7) that, "on the strength of eleven specimens captured by him in 1875, from the beginning of May until after the middle of June, and found in great variety almost everywhere, in Amasia, and forwarded to Wocke, the latter determined nine to be *parvidactyla*, and the other two to be new species, one a specimen of a species allied to *obscurus*, the other to *hieracii*. In 1876, he (Wocke) determined seven more of the specimens as *marginellus*, Zell., but stated at the time that he considered the latter to be only a southern form of *parvidactyla*," and, in this, Staudinger considered him to be quite right. "Zeller, too," he says, "referred the specimen caught by Loew, near Macri [which he at first quoted with his Asia Minor examples as *obscurus* (*parvidactyla*)], later on, in his *Monograph*, to *marginellus*, and thus his two Asia Minor Oxyptilid species share the same fate as his two Asia Minor *Anchinia* (*Pleurota*) insects, in not being the species as quoted by him at first. I merely mention all this confusion to show the great uncertainty prevailing about these Oxyptilid species. Moeschler's *hoffmannseggi* is nothing else but *marginellus*, hardly a variety thereof. *Brunneodactylus*, Mill., like *didactylus*, and even *pilosellae*, *hieracii*, and *ericetorum*, appears to me to be far from having been proved a distinct species; *maculatus*, Const., too, also appears to be doubtful, as well as *teucrii* sent to me by Jordan; and *tristis* and *kollari* require very careful investigation, *e.g.*, there are, in Lederer's collection, examples of *marginellus* from Amasia amongst the *kollari*, as well as others from North Persia, also placed under *kollari*. Mann records *parvidactylus* as being taken at the end of April near Amasia, and in May not scarce near Brussa." Staudinger further notes that he "also received a somewhat small, typical specimen from Krüper, taken at Smyrna, which is referable to the small species described by Mann, or Zeller, as *dentellus*, but this cannot even be maintained as a variety, and the fact that Mann successively quotes *obscurus* (*parvidactylus*) and *dentellus* as two separate species, taken near Amasia, the latter at the commencement of June, shows that Mann was not over-critical in the enumeration of some species. All the distinctions that Zeller points out between *marginellus* and *parvidactylus* are vague and overlap. The tint of the spots, fringes, etc., is very variable, and in 38 specimens from Amasia, before me, great differences are apparent, *e.g.*, in one example, determined by Wocke as a new species, the hindmost feather of the hindwing is almost white, with only small back scale-tufts, that also occur in transitional stages up to typical *parvidactylus*. In others, also determined by Wocke as a separate species, the white spot on the outer edge of the lower lobe of the forewing breaks through the cleft, and forms almost a white transverse band. The fringes on the costa of the upper lobe are sometimes narrower, sometimes broader, at times apparently interrupted with white. The deeper cleft of the forewing, which is particularly supposed to separate *marginellus* from *parvidactylus*, is entirely unreliable, *e.g.*, I have Tyrolese alpine *parvidactylus* from Trafoi which have the cleft much deeper than any of my southern *marginellus*. I am unable to separate these insects, although I have 100 examples of the two forms before me—from Denmark, Germany, the Alps, Italy, France, Spain, Dalmatia, Greece, Macedonia, Smyrna, Amasia, North Persia and Saisan (in southwest Siberia). Of course, I readily admit that extreme examples from North Germany have a very different appearance from the lighter, more marked, southern specimens, especially those from Spain and North Persia. Some of my Amasian examples, and particularly those from Siberia, are very light brown. In other Amasian and Persian examples the second plumule of the hindwing has, in the hind-marginal fringes, before the tip, a pure white spot." Zeller remarks concerning *dentellus*, Mann (*suprà*), from Fiume, that he has a ♂ that scarcely differs from *parvidactylus;* the black scale-tuft on the third feather, however, forms almost a triangle, but adds that such specimens occur particularly among the ♂s. He further remarks that his example belongs to var. *b*. Having summarised the published facts relating to the supposed southern and eastern forms of this species, we give the descriptions of the doubtful forms, which are most probably referable to *parvidactyla*. These are:—

a. ab. *dentellus* (, Mann), Zell., "Linn. Ent.," vi., p., 355 (1852).—*P. dentellus*, Mann, from Fiume, one ♂, does not differ sufficiently from *P. obscurus* to consider it distinct. The black scale-tuft of the 3rd plumule is somewhat triangular-shaped, but such examples appear also with us, especially among the ♂s. My specimen belongs to var. *b* (Zeller).

This appears to be a MS. name of Mann's, at any rate we fail to trace any description by that lepidopterist. Var. *b*, to which Zeller refers it, is diagnosed as "digiti tertii medio albido." An example in the Frey collection is labelled "*P. dentellus*, Mann = *obscurus*, Zell. Croatica (Gröning)." It is rather small, brownish in tint, with two distinct transverse lobal lines; the outer one crossing both lobes; the costal edge from the second (inner) lobal line to apex, white; the inner marginal fringe well-marked, with light and dark latticings. The hindwings brownish-fuscous, the fringes a shade darker; the scale-tuft on the 3rd plumule rather long.

β. var. (*an* spec. dist.) *marginellus*, Zell., "Isis," 1847, p. 903 (1847); "Linn. Ent.," vi., p. 355 (1852); H.-Sch., "Sys. Bearb.," v., p. 372 (1855); Staud., "Hor. Soc. Ent. Ross.," xv., p. 425 (1880); Staud. and Reb., "Cat.," 3rd ed., p. 72 (1901). *Obscurus*, Zell., "Isis," p. 38 (1847).—Nearest related to *P. obscurus*, being of the same size, or only a trifle larger. The differences appear to be as follows: (1) The forewings split almost to the middle. (2) The upper lobe of the front wings narrower; consequently, the first white transverse line is somewhat shorter. (3) The costa, between the two white transverse lines, is edged with black. (4) Behind the second transverse line the fringes of the costa are more narrowly white, and internally edged by a fine black line, widening somewhat towards the apex (this character is also noticeable on the underside, where the apex is paler yellow-brown). (5) The white in the fringes of the lower lobe forms a larger, more complete, white spot towards the front. (6) Before, and at the tip of the 3rd plumule of the hindwing, are a number of equally long white scales, placed amongst the black ones; in the ♀, these are more abundant, marginally, between the black scale-tuft and the base of the plumule. I caught three ♀ s near Syracuse towards evening, on the grassy-slopes of the ancient Neapolis, on May 4th and 23rd; also a ♂ in good condition near Catania, on July 4th, in a cultivated field between lanes of lava. Loew's specimen from Macri, in Asia Minor, which, until now, I had considered, like the Sicilian examples, as *obscurus*, I now refer to *marginellus*, as the more marked distinguishing characters were either not well-marked, owing to the condition of the specimen, or misunderstood, on account of the larger upper lobe. This species seems to replace *P. obscurus* in the Mediterranean district (Zeller).

We have already noted Zeller's further remarks on the insect, and Staudinger's important and extended notes thereon have already been quoted in full (*anteà* pp. 416-417). Herrich-Schäffer observes (*Sys. Bearb.*, v., pp. 372-3) that the distinctions which Zeller quotes do not appear to warrant the setting up of *marginellus* as a distinct species, the characters appearing more or less in all the large and quite fresh examples of *obscurus*, particularly (1) the forewings being split almost to their middle, (2) the black edging to the costa between the two white transverse streaks, (3) the black edging to the white costal fringe of the apex (Herrich-Schäffer did not find that this white costal edge is narrower, nor the upper lobe smaller), (4) the expansion of the white longitudinal patch of fringe at the base of the lower lobe, (5) the white scales before, and at the apex of, the 3rd plumule of the hindwings, nor does the latter appear to have a blacker scale-tuft with more white scales. Herrich-Schäffer selected some of the larger of the Regensburg *obscurus*, and Zeller referred these to *marginellus*. Rebel writes (*Cat.* 3rd ed., p. 72): "Possibly a var. of *parvidactyla;* major, obscurior, etc. Sicily, Spain, Bithynia."

γ. var. (*an* syn. suprà) *hoffmannseggi*, Moesch., "Berl. Ent. Zeits.," x., p. 145 (1866).—18mm. Alis anticis pallide fuscis, laciniis albidostrigatis, ciliis dorsalibus in medio et ante apicem laciniæ posterioris linea albida. Alis posticis fuscis, digito tertio albido pulverulento, ante apicem utrinque atro-squamato. Subtus digito primo ante apicem albido. Antennæ black and white ringed. Palpi brown, at the apex and on the sides sparsely, beneath evenly, scaled with white. Head brown, at the base of the antennæ a single white spot. Thorax brown, sparingly scaled with white. Abdomen brown, each segment with two white dashes approaching each other anteriorly, the anal tuft brown, mixed with white; beneath each segment bordered with white, posteriorly divided in the centre by a longitudinal white stripe, sides with white scaling. Front and middle legs brown, with the tibiæ finely dusted with white, tarsi spotted with white. Hindlegs with almost white tibiæ, the tarsi brown, with four broad white rings. Forewings dark, dirty grey-brown, sparingly dusted with white. The upper lobe with two white transverse lines, the apex dark-brown in the middle, costa and inner margin white. The fringes of the inner margin from base of fissure to beyond first transverse line white, beyond this brown and only below the outer transverse line narrowly white. Base of fissure margined with white. The fringes of the costa of the lower lobe white at the base, both white transverse lines distinct, the first entering the fringes of the inner margin, the outer one hardly perceptibly separated from an elongated white spot in the fringes, the inner marginal fringes from the base of the fissure to the first transverse line whitish, some white scaling also at the apex, The three plumules of the hindwings dark red-brown, the third dusted with white, scaled with black and brown before the apex. Fringes grey-brown, white at the apex of third plumule. All the wings brown beneath, the spots pure white, the first plumule of hindwing broadly white before the apex, the fringes on both sides to the same extent whitish. The third plumule quite white before the apex with a broad spot of black-brown scales. This species is distinguished from all its relatives by its abnormal ground-colour; according to Dr. Wocke, it occurs also in the south of France, but is not yet described, and I name it after Graf von Hoffmannsegg.

Egglaying.—The eggs are laid singly, on the hairs on the upper surface of the leaves of *Hieracium pilosella*, about halfway up the hair, or a little higher. On June 24th, 1905, I took a ♀ of this species, and two or three ♂ s. They were swept from the short turf in places where *H. pilosella* was growing. The moths were sleeved over a plant of *H. pilosella* and a piece of thyme, and, on June 29th, at 4.15 p.m., I noticed that the moths, of which there were then only two left, were paired. The ♂ was hanging from the ♀ in the usual Alucitid manner, but was also clinging to the muslin of the sleeve. When I saw them again at 7.40 p.m. they had separated, and I fancy they must have been disturbed. On July 2nd, ova were found on the sleeved plant of *Hieracium*, but none on the thyme. The eggs were all attached to the long hairs (near the summit) which grow on the upper surface of the *Hieracium* leaves. These eggs subsequently proved infertile, but they showed the position and situation in which this species lays its eggs. Acting on the knowledge thus gained, I visited the moth's haunts, fortunately meeting with Dr. Chapman on the way. After some searching we found, in all, about a dozen ova on the *Hieracium* leaves in the position above described. This was on July 5th, and ten days later I took a few more ova in a different locality, but these were also laid in the same position. The egg, as already noted, is laid singly at the end of one of the hairs, on the upper surface of the leaf of *H. pilosella*. As a rule, only one egg is laid on one plant. It reminds the observer superficially of the egg of the Lacewing fly, which is laid at the summit of a long egg-stalk, but in this case the egg is not laid actually on the apex, but along the terminal portion of the hair, so that it stands well off the surface of the leaf, about 2mm. That portion of the hair to which the egg adheres seems to be of the same colour as the egg itself (? the effect of the gum), the rest of the hair is transparent. The egg rests with its longer axis parallel to the hair (Sich). On July 5th, 1905, a search was made with Mr. Sich, who had ascertained that the eggs were laid on the hairs of the leaves of *H. pilosella;* we both found several, and all were laid about midway up one of the long hairs on the upperside of the leaf; the hairs beneath may also have them, but they are not easily searched. Several eggs were pale, nearly white, the majority were orange; one was darker and already showed the black larval head, this egg hatched on July 6th. A ♀ taken on Reigate Hill only laid three eggs, one being ready to hatch on July 12th (Chapman). The following particulars of three ova observed closely may be interesting:

(1)

July 9th. Colour unchanged.
,, 11th. ,, ,,
,, 12th. Showing traces of deeper colour.
,, 13th. Hatched.

(2)

July 9th. Orange, head not yet showing.
July 11th. Still orange, no head showing yet.
,, 12th. Orange, dark head showing.
,, 13th. Hatched.

(3)

July 9th. Orange, dark head showing.
,, 10th. Hatched.

Other dates of hatching noted are:—July 7th (earliest), 9th (2), 22nd, 23rd (2) (latest). I presume the duration of the egg state lasts about ten days, but have no actual facts to go on (Sich).

Ovum.—A rather large egg, especially for so small a moth; the length is 0·48mm., the width 0·30mm., and the height 0·27mm., with a question as to whether the end view is not circular and the last two measures rather those of slightly different eggs. They are very pale orange-yellow when laid, and become brighter orange as they mature. The sculpture is in very irregular polygons, usually hexagons, but very far from regular ones; each cell about 0·025mm. in diameter, they appear quite flat, and the dividing ribs are of rectangular section, about $\frac{1}{8}$ of the diameter of a cell in width, and perhaps a third, or a quarter, of their width in height (Chapman, July 9th, 1905). Longer axis 0·53mm.; shorter axis 0·31mm. Shape ovoid, elongated as compared with some other Alucitid eggs, the poles rounded, scarcely any difference between them. It may be described as a short cylinder with rounded ends. The whole surface is covered with a network of more or less pentagonal cells, but the cells are not much raised above the general surface. The cells vary in size, but are usually about 0·02mm. or 0·03mm. in diameter. The micropylar area, measuring about 0·06mm. in diameter, lies on the upper pole of the ovum. The neat rosette appears to consist of a roundish cell with a prominence in its centre, and a circle of six similar cells around it. The colour of the newly-laid egg is pale ochreous, and the surface is very glossy. In some lights the egg appears of a greenish-grey tint. Later, it becomes deeper in colour, and before hatching assumes quite a deep orange (chrome-orange) colour. At this period the head of the larva is visible within the egg as a large dark spot (Sich).

Habits of larva.—When hatching, the larva bites a hole in the wall of the egg, usually just below the upper pole. It does not devour the egg-shell, which is left, fairly entire, upon the hair on which it was laid. On July 7th, 1905, just before midnight, I was fortunate enough to see a larva, newly-hatched, in the act of crawling down the hair on which the egg had been laid. It wandered to the edge of the leaf and back again to the centre, subsequently up to the apex, and finally down to the base of this outer leaf. It then climbed over a leaf nearer the centre of the plant, and at last disappeared between this leaf and the innermost, and youngest, leaf of the plant. This occupied one hour and thirty-five minutes. At 10 a.m. on the 8th, I could see no signs of the larva, but, on the day following, I noticed the fluff of the innermost leaf of the plant had been removed from a small space, and the substance of the leaf seemed to have been attacked. On July 10th, I took the larva out of its burrow; it had grown quite fat, and its body was as wide as its head, but it was still in the first instar, though $2\frac{1}{2}$ days old. July 13th, resting in the central shoot with head uppermost, but, after being slightly disturbed by my efforts to view it, the larva turned round and went head downwards into the shoot. Next day the larva had left its first burrow, and was now feeding at the base of the 3rd leaf from the centre of the plant, and had spun a slight web of silk, mixed with the hairs of the *Hieracium* and débris. I put it under the microscope ; it was still in the first instar—6½ days old. By this time several of the other eggs had hatched. In nearly all cases the larva finally made its way into the heart of the plant, and burrowed down, a little over its own length, at the base of the innermost leaf. In one or two cases, where the heart was a poor one, the larva lived on the upper surface of the youngest leaf, hiding in the still-rolled edge of the leaf. At first the larvæ scrape off the fluff, usually from the underside of a leaf at its base, and eat the green substance, but, afterwards, burrow downwards as already mentioned. Apparently it is only quite late during the 1st stadium that the larva spins any covering over its burrow, perhaps only when about to undergo ecdysis. The hairs of the plant and the fluff, however, hang about the dwelling. The only other outward sign of its presence is the brown excrement that clings to the part of the plant attacked. However, it must not be forgotten that, at this stage, the dwelling required by the larva is so small that it is practically invisible without a lens, as usually it is only the top of it that meets the observer's eye. On July 17th, the above-mentioned larva, at this time nine days old, had just passed through its first ecdysis and was therefore in its second stadium. Though the head is lighter in colour, the general appearance of the larva is not altered. I must have destroyed the silken covering of this larva's burrow in getting the larva out, as my next note concerning it states that, two days later, it had spun a new cover. A second larva, which hatched on July 10th, had assumed the second instar on the 21st of that month. A third example, which I had kept in a glass tube instead of sleeving it in a pot on the growing plants like the rest, changed its first skin on July 23rd. On July 27th, the plant in which the first-mentioned larva had been living, showing signs of failing, I took out the larva and placed it on a fresh plant. The vacated burrow showed that the larva had entered the stem of the plant at the base of the leaf, not that it had actually bored into the stem, but had eaten out a deep irregular groove running perpendicularly down the stem to the distance of about 3mm. My observations were now somewhat interrupted. On August 1st, I made a search for two of the larvæ which had been on plants in the same pot. I could not find either of them, and concluded that they had ceased feeding, and would hybernate in the second instar. The slow growth of the larvæ convinced me, even when they were in the first stadium, that none of them would yield August imagines. I searched again in another pot on August 6th, and then found No. 10 larva (hatched July 22nd). This was in a burrow similar to that just described in the second instar, and very stout. This was the last larva I saw in 1905. From time to time I searched the pots, but could not see either larvæ or any traces of them. The pots were plunged in earth in the garden, November 6th. The following notes may be of interest :

July 10th.—No. 3 larva still feeding at base of innermost leaf.

July 12th.—No. 3 not visible.

July 13th.—No. 3. After dissecting plant, found it at the base of one of the rather outer leaves. Transferred it to another plant.

July 14th.—No. 3 in heart of new plant, burrowing, head downwards, under a covering of silk, *Hieracium* hairs, and *débris*, *i.e.*, bits bitten off the plant.

July 13th.—No. 5 larva. The eggshell is empty. Larva invisible. Later, found it on the underside of a lower leaf, but lost it while endeavouring to transfer it to the heart of the plant.

July 14th.—No. 5 feeding in heart of plant, to which it has found its way since yesterday.

July 27th.—The plant in which larva No. 4 was living is dying, and I found the larva wandering over a leaf, evidently seeking a new plant.

Like most larvæ, these, when crawling, always spun a thread along which they could walk in safety. As they walk, the head is moved from side to side, and thus a sort of silk ladder is formed. The line thus traced by the spinneret generally contains a number of irregular figures of 8 and letters U (Sich). A larva left the egg on July 6th, 1905, at 9.30 a.m., and commenced to wander over the top of the leaf, shortly turning basewards, and then, reaching an edge of the leaf, went beneath it; then it travelled towards the tip, the leaf being a quite mature one; at 11 a.m., the larva was found after some search, apparently resting satisfied amongst the hairs close to the base, on the upper surface of a rather younger leaf, really quite in the centre of the plant; it was in the same position at 12 (noon), but at 1.20 p.m. could not be found; it was certainly not on either surface of a leaf, nor in any easily seen axillary position (Chapman, July 6th, 1905). Another larva, hatched July 12th, was isolated in a glass-tube on a leaf of its foodplant. When it hatched, it crawled about the leaf, and then was observed at the cut base of the leaf, where it was seen several times at a few hours' interval; it then wandered off on the glass of the tube. The leaf was a fresh one, put in at the time of placing the egg in the tube. The larva was then preserved, July 15th, 1905, on a slide in Farren's medium. It was then seen that the impression that it had eaten nothing was correct, although it was left two days in the tube (Chapman). On April 27th, 1906, I observed a patch of *Hieracium* amongst some fir-trees, near Guene Vieille (two miles from Ste. Maxime); the plant was very like my idea of *H. pilosella*, only the leaves (and the whole plant) are very decidedly larger than those of that species ordinarily are in England. The hairs on the leaves rather larger and stronger, white. The flower-bud just discoverable, 2mm. or 3mm. across in the centres of the most forward plants. On one of these I found a "plume" larva, but a long search, and destruction of a good many plants, afforded no more. Something suspicious about the centre of the plant attracted attention to it, and, pulling the youngest central leaf (about $\frac{3}{4}$in. long), it came away too readily. A closer look now showed a larva in the centre of the plant, under a sort of cocoon or tent. The larva was thick, short, stubby, and white, and much resembled a larva of some weevil. It was, however, lepidopterous; it had eaten the little central button, or heart, of the plant, and was continuing its attack on the central pith below. The "cocoon" was merely a slight felting of the white hairs of the central parts eaten, to a great extent leaving them where they would have been, had they been still attached to the young leaves and leaf-buds from the central eye of the plant. These, however, had disappeared, and the cavity so left was occupied by the larva. No other trace of larval attack was discovered on this or neighbouring plants. The larva itself is a white lethargic maggot, more like a coleopterous than lepidopterous larva in general aspect. Its method of feeding is clearly very similar to that of *Fredericina calodactyla* (*zetterstedtii*), but it has a more "internal feeding" facies than that larva, except that it has fairly well-developed hairs. I thought at first that the lethargy might be due to approaching pupation, but I observed, on the 29th, that the shortness and thickness were clearly due to sulkiness, as it was seen later to crawl, distinctly more stretched, on its foodplant, and is now ensconced in the old nest, which it has enclosed with hairs of the plant and frass, in a sort of cocoon, and is quite invisible (Chapman, April 27th-29th, 1906). On June 4th, 1906, I spent a couple of hours on the slopes of the chalk downs at Reigate, working for the larvæ of *O. parvidactyla.* Many hundred plants of *H. pilosella* were scrutinised; one of the first showed the central upstanding leaf to be somewhat limp, and it came away readily when pulled. On looking closely, the centre of the plant was seen to be occupied with some loose hairs of the plant, and some traces of dark frass entangled in them or some silk. On taking the plant up, and pushing aside this central *débris*, a larval tail was observed, white, with a dark anal plate. Some time after, a plant was found with the leaves a little stunted, and with yellowish and reddish tinting, and, in the centre, a slight dome of brown frass, apparently spun together, which included in its level a flower-bud (or the top of one). This covering of frass was about 6mm. × 5mm., the bud nearly 3mm. across. When opened, this was not the top of a cocoon, but had further frass packed under it, over a burrow, passing down into the root, and containing a larva, which, however, afterwards died. The search revealed nothing further, though furnishing frequent disappointment in plants showing the results of various accidents and injuries, which always proved to be caused by something that was not *parvidactyla.* The larva burrows into the centre or pith (?) of the plant, making a burrow apparently little more than twice its own length, and placing the frass on top, with the displaced hairs of the plant (they are very thickset on parts of the plant not yet expanded), and more silk, the whole being very inconspicuous or invisible, probably quite so until the larva is about fullfed. These larvæ were identical with that found at Ste. Maxime. They have, to an extreme, the aspect of internal feeders, something like *Hepialus*, as if a set of whitish fat-masses lay beneath a delicate colourless skin. The hairs are long and dark (Chapman, June 4th, 1906). Hofmann discovered the larva on June 2nd, 1897; it was then nearly fullfed, and had bored deeply into the heart of a plant of *Hieracium pilosella,* eating out this right down to the root, so that the small leaflets of the shoot had become withered, the only sign of the presence of the larva. [Frey says that he found larvæ in the main stem of *Stachys alpina*, well on in the second half of April, although Zeller bred it from *Hieracium pilosella* with *Oxyptilus pilosellae.* Leech says that the larva feeds, in April, in the young leaves of *Stachys alpina*, and in the autumn in the heads of *Marrubium.* This is, no doubt, merely copied from other authors without acknowledgment. We think the larva found by Frey certainly belonged to another species.]

Larva.—*First instar* (newly-hatched): Orange-yellow in colour, with some very decided orange material in the fore part of the alimentary canal. It is about 1mm. long, and has long hairs. The head is black, the prothoracic plate is of the same colour as the rest of larva, and is broad in the middle and narrow at the ends. The trapezoidals are well separated, ii having the longest hair; iii has a very long hair, nearly 0·25mm. long; iv and v, the anterior (v) much the higher, and with the shorter hair; long hairs also at posterior extremity. Later, it is still about 1mm. in length, with dark head, but otherwise only slightly, if at all, tinted with yellowish. It has long colourless hairs, that on tubercle ii on the last segment being about 0·3mm. long. The hair on i is comparatively short, about 0·05mm. long, straight, porrected, a little swollen, and perhaps inclined to be bifid at the tip; that on ii is directed upwards and backwards in a flowing curve, at least on the abdominal segments; that on iii is a long hair, directed outwards and slightly forwards, about 0·27mm. long; those on iv and v are shorter, the front one much higher than the posterior, and on a separate base, rather shorter than the posterior one, which is about 0·17mm. long, and is directed outwards (hardly backwards); the lower setæ are a short hair, and a very short one, apparently vii, at base of prolegs. The prothoracic and 8th abdominal spiracles are very large and prominent (Chapman, July 15th, 1905). The newly-hatched larva measures 1·2mm. in length. The body is fairly cylindrical, but tapers towards the anal extremity. Segmental divisions well-marked. The spiracles are large and elevated. The tubercles are also large, especially iii. The very long hairs are conspicuous, especially at the anal extremity. The head is large (width about 0·2mm.) and rather flat; shining brown with a strong ochreous tinge; the borders of the clypeus very dark brown. Body of the larva bright yellow-ochreous. The thoracic shield dark ochreous. A plate on the dorsum of the 9th abdominal segment, and the anal shield, very dark, almost black. The tubercles are dark, and the hairs grey (semitransparent). There are some dark ochreous markings in the dorsal and lateral areas. The legs are long, but the claspers are rather short, and have no crotchets except the anal pair, which has three, or sometimes only two, black ones on each clasper. *First instar* ($7\frac{1}{2}$ days old): Length about 1·6mm. Head dark brown, body stout, paler than when newly-hatched, and more maggot-like. The hairs much covered with dirt (? the dried juice of the *Hieracium*). The head carries two long hairs, one on each of the lobes near the clypeus, and a few shorter ones. The skin of the body is covered with spicules. The prothoracic shield has a front row of hairs, the two outermost being the longest, and there are two very long hairs on its posterior border. All the tubercles are simple and separate, but i and ii are close together, and so are iv and v. On the meso- and metathorax i, ii, and iii are more or less in a line. On the abdominal segments, i and ii are always very close together. All the hairs are smooth, i carries a short hair (0·06mm.), flattened at the tip and distinctly notched. This hair is directed forwards, even on the 8th abdominal segment, and therefore soon gets spoilt, or even broken, when the larva takes to burrowing. Most of the other hairs run to a fine point, ii carries a long hair, about 0·2mm., directed forwards on the thorax and backwards on the abdomen; iii carries also a long hair, about 0·2mm., and, on the meso- and metathorax, iii has a very small tubercle carrying a very short hair close behind it; iv and v are both subspiracular, the front one (v) having a short hair directed forwards, and the other (iv) a longer hair directed backwards. I believe vi to be absent, but vii is represented by one small tubercle with a very short hair, and, just behind it, a larger tubercle with a much longer hair. There are no properly so-called secondary hairs, but there are one or two hairs to each segment in the ventral area. The most striking point in the hairs of this instar is the extraordinary length of those of tubercle ii on the 8th and 9th abdominal segments; these hairs extend to a length of 0·4mm., nearly half the length of the newly-hatched larva. The hairs of the first instar are actually very little shorter than those of the second instar, and therefore very much longer in proportion to the size of the larva. *Second instar:* Width of head 0·3mm. Length of larva rather over 2mm. Rather stout and maggot-like. Head brown, suture, clypeal borders and ocelli dark brown. Body pale whitish-ochreous, much attenuated posteriorly, segmental divisions well-marked. Thoracic shield deep ochreous, with a faint pale line running down the centre. Anal shield also deep ochreous. Head smooth, shining, with a long hair on each side, not far from the clypeus, and several shorter hairs. Thoracic shield with a front row of six hairs, the two outermost much the longest, a pair of short hairs in the centre, and two very long hairs on its posterior border. The prothoracic spiracle is large and tall, dark-bordered; the abdominal spiracles are also large and elevated. The skin of the larva is very strongly, and rather coarsely, spiculated. No proper secondary hairs. The tubercles are single-haired, all quite separate, small, and little elevated, iii being the largest. On the meso- and metathorax, i, ii, and iii are nearly in line; iii has, just behind it, a very small tubercle with a very short hair. On the abdominal segments, i and ii are close together and fairly in the centre of the segment; i carries a short hair, about 0·07mm., flattened towards the apex, which is shallowly notched; ii has a long hair, about 0·2mm., running to a fine point. On the 9th and 10th abdominal segments, ii carries a very long hair, about 0·46mm. in length; iii bears a hair similar to that of ii; iv and v are quite separate, the front one, v, carries a short hair (0·06mm.) with blunt tip, and the other, iv, bears a longer hair with a pointed tip, about 0·15mm. in length. On the thoracic segments, this group consists of three tubercles; here v, instead of being above and in front of iv, appears to have dropped down to just below iv, while the third member of the group is close behind iv, and bears a very short bluntly-tipped hair about half as long as that of v. On the thoracic segments, some way below iv and v, is a pair of tubercles, the front one with a short hair, and the posterior with a hair double that of the front one. On the abdomen, vi is a small tubercle with a short hair; vii is a group of three tubercles, a moderate one with a hair about 0·07mm. and two small tubercles with very short hairs. The legs are rather long, but the ventral claspers are very short, and without any crochets, except the anal pair, which bears three very large crochets on each clasper; they are placed at about equal distances apart, and the hooked ends are directed forwards (Sich). *? Third instar* (after hybernation): 3mm. long; the head brown, darker on the posterior margin, prothoracic shield brown, shining, undivided; on the dorsum of the 9th abdominal segment is a brown, strongly chitinous, bristly, transverse plate; the horse-shoe-shaped depressions between the dorsal warts are absent; anal shield and warts as in the fullgrown larva (Hofmann. May 25th, 1898). *Penultimate instar:* 5mm. long; a brown thoracic shield, divided by a fine bright line; on the other hand, the brown transverse plate of the 9th abdominal segment has disappeared, and is replaced by the ordinary warts; all else as in the fullgrown larva (Hofmann. Same larva, June 28th, 1898). Length 5mm., thickness 2mm., diminishing to each end; the hairs on tubercle ii are nearly 1mm. long; that on i is short, and arises close to ii; that on iii is about 0·6mm. long. The spiracles are faintly rufous, iv and v are in usual positions, apparently on separate bases and a little way apart, v, about 0·7mm., directed outwards, iv shorter and directed forwards, vi is solitary, towards middle of segment, directed backwards. There are no secondary tubercular hairs, but, on the dorsum, are a good many secondary skin-hairs. The head is pale brownish, with darker markings at back and marginally. There are indications of dark longitudinal lines above vi, and along spiracles, forming a broadish mark at spiracles, wanting behind and narrowing forwards; a faint line through iii, and a similar one halfway between it and ii. Between i and ii, dorsally, is a small dark mark, somewhat horse-shoe-shaped, with convexity forwards; legs colourless; a few brownish marks on prothoracic plate. Other details want a better lens (Chapman. April 27th, 1906). *Final instar:* 6mm. long; sluggish, stouter than the larva of *O. pilosellae*, dirty yellow in tint (whilst that of *O. pilosellae* appears whitish-yellow); the skin is smooth, without the white knobbed bristles of *O. pilosellae* larva. Head bright brown, shining; prothoracic shield yellow, with two black spots on each side of the hind margin; both are strongly bristly. The very characteristic anal shield is large, semicircular, yellow, thickened with brown on the hind margin, and thickly covered with numerous, bristly, little tubercles; also numerous bristles are scattered over the surface of the claspers. The tubercles are brown on the back (i and ii), standing closely together, each with a strong brown hair; on the sides, on the other hand, the hairs of the tubercles are whitish, as in the larva of *O. pilosellae*. Between the dorsal tubercles on each segment, is a small horse-shoe-shaped depression, open posteriorly. Spiracles finely ringed with black. Thoracic legs small, light brown; abdominal prolegs very small, yellow, with few, or not any, hooklets on the sole. Anal claspers still more ill-developed (June 2nd, 1897. Hofmann). The setæ are long; those on tubercle ii, on the middle abdominal segments, being 1·75mm. long; slender, dark basally, but for the greater part of the length colourless. The prothoracic plate has the usual six hairs on each side, the end ones of the back row being the smallest, the longest about 0·8mm. The plate is rather square-ended, has a median pale suture, with some spots of clouding along it, especially at posterior margin, and a patch of dark in usual site of dark mark in Platyptiliids. Spiracle large, thimble-shaped, a group of three hairs in front of it, two front ones above each other, length about 0·4mm. No hairs at base of leg, about 0·26mm. This segment has four secondary hairs below spiracle, and four between legs and the two basal hairs. Mesothorax has the usual four pairs of hairs (the third pair with accessory), each pair on a plate of its own, no skin-points being between them, but the plate is weak and colourless—the 1st hair, with wide divided point, about 0·5mm., the 2nd about 1·4mm., 3rd with bifid point, 0·4mm., 4th 1·2mm., 5th 0·8mm., 6th 0·7mm., the accessory, with a bifid point, 0·3mm., on 7th and 8th 0·3mm. and 0·6mm. This segment (mesothorax) has about 29 secondary hairs on either side, not symmetrically arranged, but none on front half of segment, except close to tubercles. The metathorax appears to be identical, and has about 35 secondary hairs on each side. On the abdominal segments, i and v (the front one of subspiraculars) have widely divided ends, the rest end in more than usually long, flowing, slender filaments; i and ii are on a single plate, about 0·4mm. between these and those of opposite sides; on, say, the 4th abdominal segment, the seta on i is, in length, about 0·5mm., ii about 1·6mm., iii about 1·3mm., iv, 0·8mm., v, 0·35mm., vi, 0·35mm., of vii, the longest (the posterior) is about 0·5mm., the two front ones 0·35mm. and 0·15mm. respectively. The secondary hairs are, to some extent, grouped; some 20 or 25 form an oval on the dorsum, including i and ii of both sides, with centre clear, but one or two hairs inside the tubercular plate; 6 or 7 are grouped near iii, and 8 or 10 about iv+v, which are close together, apparently on one plate, immediately below spiracle; there are others about vi and vii, and 4 or 5 scattered separately along posterior portion of segment. On the abdominal segments 7 and 8 (with prolegs), vii is represented by two hairs only; three are present on the 1st and 2nd abdominals, and there is a ventral hair (about 0·14mm.) on all segments, on the 2nd-6th abdominal segments just inside proleg. There are here also a few secondary hairs. The hairs have the same arrangement on the 9th, except that vii appears to be absent. On the 10th abdominal segment there are no hairs, except ten on the bases of the claspers, and on the anal plate (which is large, 0·8mm. across, transverse in front, semicircular behind). The latter has six hairs on the outer border on each side, and two inside these in front. A number of (black) dark spots are scattered over the disc, larger centrally; there are six or eight similar spots centrally on the 9th, and one outside ii, three or four smaller on the 8th, and one or two on the 7th abdominal; these are similar to the dark spots on the prothoracic scutum. The secondary hairs are very short, and vary little in length, though a few of the shortest may be as short as 0·04mm., and the longest 0·08mm. They are broad, and widen equally towards bases and tips, the tips being usually darker, and terminating in two to four sharp points. The colourless skin-points are very inconspicuous; on the posterior portion of segments they are round nodules, but along the front they carry acute points directed backwards; these are especially strong, and slightly tinted on prothorax. The distinctions between front and back of segment hold throughout; even the front of the anal plate has sharp, and the posterior margin has rounded, points, but, on this segment, the sides, down to claspers, also have the points spiculated. The hooks on prolegs vary; in one specimen each has two, including claspers, in another they are 3,5; 4,4; 3,3; 4,5; claspers 3,4, and in another vary from 2 to 4. The true legs are brown, with a few fine bristles and a sharp claw. The spiracles are raised on short cones. The jaws have four teeth, or five if inner rounded one is counted. A central eye-spot, and five others in a semicircle round it, the middle one decidedly the largest. Labrum with two hairs on disc, and four round margin, on either side (Chapman. May 10th, 1906). [The head black, the body dusky pale green, with a black, divided, prothoracic plate. True legs black, abdominal prolegs of the colour of the body, with black hooks. On the dorsum of each segment are four similar black tubercles, which bear a stellate tuft of strong bristles; also a similar row of tubercles on the sides. The spiracles stand out conspicuously (Frey. From larva found towards end of

April in main stem of *Stachys alpina*). Apparently this has nothing to do with this species, although it is the description quoted in all our text-books.]

COMPARISON OF LARVÆ OF OXYPTILUS PARVIDACTYLA AND O. PILOSELLÆ. —The larva of *O. parvidactyla* is easily separated from that of *O. pilosellae*, as follows: (1) By the absence of the white, knobbed, bristles on the skin. (2) By the strong brown hairs of the dorsal tubercles. (3) By the strong characteristic anal shield (Hofmann).

PUPARIUM.—On examining the specimen (already described as larva) on May 15th, 1906, I found it had pupated. It is in the same cavity in which the larva fed, but this is extended upwards into a rather wider cavity, covered in chiefly with the leaf-hairs, etc., of the *Hieracium*, forming altogether a cavity twice as long, and twice as wide (rather more above), as the pupa. This is able, by some activity, to travel up and down in the cavity; in doing so it uses the ample supply of hooks it has at both extremities and dorsally, and makes lateral as well as dorso-ventral curves, but, dorso-ventrally, it shows no indication of the somersault movement of the pupæ of so many "plumes." This movement of travelling up and down in the puparium is similar to that possessed by "micros," but, there being a special set of implements for carrying it out, is obviously not a retained, but a reacquired, accomplishment, as in the case of *Macrothylacia rubi*, *Dimorpha versicolora*, and certain Sphinges (Chapman. May 15th, 1906.). The pupa of the species is also very remarkable, usually attached to the underside of a leaf of the foodplant, in the manner common to the Alucitids, among the loose torn-off down of the leaf (Hofmann). [The deep black* pupæ are to be found on the underside of the leaves of the foodplant (Frey). This observation apparently does not apply to the pupa of this species.]

FOODPLANTS.—*Hieracium pilosella* (Zeller), *H. laevigatum* (Crombrugghe de Picquendaele). [*Marrubium vulgare* (Frey, confirmed by Glitz, Steudel, and Hofmann), main stem of *Stachys alpina* (Frey), and *Thymus serpyllum* (Shuttleworth), still want confirmation]. Whether *Marrubium vulgare* is, or is not, a foodplant for this species appears to us to be open to question. It is, however, noticed by many German authors; among others, Glitz mentions larvæ as not rare at Herrenhausen in May, the imagines being bred in June; and the statement is accepted by Crombrugghe de Picquendaele, who, quoting Disqué, says (*Rev. Ent. Soc. Namur*), "*Hieracium laevigatum* and also *Marrubium vulgare*," but, in answer to a query by us, states (*in litt.*) that he himself has "never seen it on, or among, the latter plant." We cannot believe the larva and pupa described by Frey from *Stachys alpina* have anything to do with this species.

PUPA.—6·5mm. long; 1·3mm. broad at widest part. Seen laterally it is about the same width from mesothorax to the 5th abdominal segment. Thence it diminishes to about 0·7mm. or 0·6mm. at end of the 8th abdominal; the 9th abdominal is extended by ventral hooks; the 10th abdominal ends in a hook curled round and directed dorsally; on lateral view, this seems to range with hooks formed by i + ii on the preceding segments; it is, however, single and median. Out of its cocoon, the last pupal segments are curved forward, so that this hook points backward, *i.e.*, posteriorly; the wings

* The pupa is described as pale by Hofmann, Chapman, etc.

reach to the end of the 4th abdominal segment, and their prolonged apices, legs, etc., to the end of the 5th abdominal. The pupa is terra-cotta-coloured, with a dark shade down each side of dorsum, darkest on thorax, and some dark shading down antenna, and between veins of wings. Seen dorsally, the pupa is widest at mesothorax, tapers slightly to 5th abdominal, thence more rapidly. The head is rather bent forward, so that the wing-spines are level with the lower margin of eyes, and the front of pupa is rather blunt and truncate, the thickest part of the pupa being only 0·5mm. from extreme front. The first legs reach to end of wings, the maxilla disappearing under them at about two-thirds of their length; antenna rather shorter than first legs; wing-veins (some of them very obvious) 1*a*, 1*b*, 1, 2, 3, and two more costal, a line also of medio-cellular veins. There are certain hooks on the head that are especially to be remarked. Between the jaws and the maxillary bases is a diamond of labium; above these the labrum, and above this a square piece, the clypeus; immediately above this, on either side, are two minute sharp points, brown and chitinous, on a thicker pale base; they point directly ventrally; above and behind these, and external to them, are two very large hooks, curved, and with their dark, sharp, spines similarly pointed ventrally; just below, and in front of, the points, a long hair arises (pointing also ventrally), making the process, in some aspects, like a part of the process of the 3rd abdominal in *Marasmarcha*. Then, further out and further back, in line with outer margin of eye, is a third sharp point directed ventrally. These three pairs of hooks are so placed as to enable the pupa to secure a hold of anything suitable (like the silken lining of its cocoon), and to pull itself forwards, or at least hold, during further movements. There are also two pairs of minute hairs on (or near) the clypeus, and another large hair behind the largest hook. The two hairs on this hook seem to be the antennæ, basal pair, and the outer hook is on the antennal scape; there are minute sharp points to each of the first three joints of the flagellum. The thorax carries the usual two dorsal flanges, with three hairs, and there is a sharp point on it, at its highest position on mesothorax, directed backwards. There are several other hairs on the pro- and mesothorax, and one at front corner of metathorax. These are all 0·3mm. to 0·4mm. long. The hairs on the following abdominal segments are all short, 0·1mm., or shorter. The hindwing ends just below the spiracle of the 2nd abdominal. On the 3rd abdominal segment the hairs become longer again, and here i and ii have, between them, a sharp, dark, chitinous spine; i and ii rather close together, with a wide space between them and those of opposite side; iii is represented on the 1st and following abdominal segments; iv (0·2mm.) and v (0·3mm.) are first free from the wing on the 3rd abdominal; on the 4th and 5th abdominals, the dorsal spines are larger, and curved a little outwards, and more so on the 6th, 7th, and 8th abdominals; on the 9th abdominal, absent, or represented by a dark brown point beside the rather long hair (0·5mm.). The terminal (cremastral) hairs are long (0·4mm.), brown, about six in number, curved at the tips, but obviously too pliant and too little hooked to have any cremastral function. Tubercle v is on a slight elevation, greater on the posterior segments; the wing-spine is marked by a very minute, sharp, brown point; tubercle vi is well-marked as a strong hair on the 4th abdominal, and inwards by a hair directed backwards, rather thick and strong, about 0·35mm. long; on the 4th, 5th, 6th, 7th, and 8th abdominal segments, vii has a very long, strong, posterior hair, and a shorter forward one, the long one 0·5mm., the shorter 0·25mm., on the 8th abdominal only one shorter hair; the 9th abdominal possesses a similar hair, probably of same series. In place of the usual bosses, the 9th abdominal possesses two strong hooks, large basally, curved a little forwards, with sharp brown points; on each of these are four, long, cremastral hairs (functionless cremastrally), like those of apex. The dorsal hooks of the 6th, 7th, and 8th abdominals have the concavity forwards; the 9th and 10th abdominals carry several other long hairs. The anal scar is distinct, the ventral aspect of the cremastral spine (terminal) is finely grooved longitudinally. The end of the appendage-spine consists of maxillæ, the tarsal ends of the 2nd and 3rd legs, and tips of wing-process. The surface-sculpturing is fine pitting, not more than a faint indication of the frequent transverse ribbing is detected. [Imago emerged June 9th, 1906 (Chapman).] Slender; pale yellowish in colour; differs from pupæ of the closely-allied species, *O. hieracii* and *O. ericetorum*, by the absence of the spines on the thorax and on the first three abdominal segments, and especially by the cremaster. This terminates in a fine point, directed upwards, and has, on the venter, just before the hind-margin of the 9th abdominal segment, instead of the heap of hooked bristles usually present here in the Alucitids, two long processes, which, as well as the front of the cremaster, are furnished with long, stiff bristles, partly straight, and partly bent, hook-like at the end. Zeller has already accurately described and figured the remarkable formation of the pupa (*Isis*, 1841, p. 794, pl. iv., fig. 26) (Hofmann).

Time of appearance.—The species is absolutely single-brooded in Britain*. In very early seasons the moth is well out by the middle of June, but, in late seasons, does not appear much before the commencement of July, and then, occasionally, lasts until early August; the last fortnight of June, and the first two weeks of July, form, however, its average time of appearance. The same extended period appears to occur in Belgium (Crombrugghe de Picquendaele), in Switzerland (beginning of June to end of July, at Zürich, and the end of July at Samaden, at 6000ft. elevation) (Frey), and in Germany, where Speyer gives mid-June to the end of August for Waldeck; end of May to commencement of August in Brandenburg (Sorhagen); July in Mecklenburg (Gillmer); in Hamburg (Sauber), etc.; end of June in the Mombacher Wald (Rössler); commencement of July in the Dölauer Haide (Stange); end of July and August in Silesia (Möschler); end of June and commencement of July in the Kingdom of Saxony (Schütze); from end of May to beginning of July in Bavaria (Schmid); and June and July in Württemberg (Steudel and Hofmann). In Austro-Hungary, one notes May to commencement of August in Moravia (Gartner); May and June in the Vienna district, and in Carniola (Mann); whilst May 27th to June 4th are given for Flitsch, in Carinthia (Zeller). The end of June and July are noted for the Baltic Provinces (Nolcken); June for Bulgaria (Rebel); but as early as May near Brussa (Mann); and, in Roumania, it occurs in July near Varatic; in May and June

* We are quite unable to accept Sand's statement that it appears in June and again in September, in the Auvergne district, without confirmation.

near Tultscha (Caradja); whilst July 13th is recorded for Gothland (Dahlbom). Snellen gives May and July in the Netherlands, and erroneously notes it as double-brooded; Constant also makes it double-brooded, occurring in June and September in Saone-et-Loire. Actual dates of captures are as follows:—Continental records: June 23rd, 1867, at Zürichberg (Dietrich); June 19th to July 11th, 1869, at Meseritz (Zeller); July 5th, 30th, 1870, at Magnusholm; end of June at Dreyden (Nolcken); singly in June, near Slivno; July 23rd, 1903, at Lakab (Rebel); July 9th, 1904, at Velthem (Crombrugghe de Picquendaele). British records: June 19th, 1845, in Charlton sand-pit (Douglas); July 17th, 1862, at Castle Eden (Sang); June, 1868, at Witherslack (Hodgkinson); July, 1868, near Lewes (Jenner); July 13th-15th, 1869, at Witherslack; July 3rd, 1872, in very fine condition, at Witherslack (Hodgkinson); July 15th, 1878, at Witherslack (Sang); June 30th, 1883, at Witherslack (Shuttleworth); July 18th-26th, ? 1883, in the Isle of Purbeck (Digby); July 7th-9th, 1883, common at Dover (Coverdale); June 23rd, 1884, at Folkestone (T. H. Briggs); June 23rd, 1884, in the Isle of Purbeck (Bankes); imagines common, June 26th, 1884, at Cuxton (Bower); June 3rd-July 10th, 1885, in the Isle of Purbeck (Bankes); second week of July, 1885, at Witherslack (Hodgkinson); June 26th-July 13th, 1886, July 12th, 1887, in the Isle of Purbeck (Bankes); July 14th, 1888, on Box Hill (T. H. Briggs); July 21st, 1888, at Cuxton; August 6th, 1888, at Kingsdown; August 21st, 1888, at Folkestone; July 7th, 1889, at Kingsdown, (Tutt); June 22nd-July 13th, 1889; May 29th, 1890, in the Isle of Purbeck (Bankes); June 14th, 1890, at Oxted (Sheldon); late July and early August, 1890, at St. Margaret's Bay, and at Deal (Tutt); July 7th, 1890, at Horsley (Bishop); July 20th, 1891, at St. Margaret's Bay (Fenn); June 17th, 1891; June 10th-July 1st, 1892, in the Isle of Purbeck (Bankes); June 7th, 1893, near Carrickfergus (Watts); July 4th, 1893, at Shoreham, Kent (Bower); July 22nd, 1893, at Cuxton (Tutt); June 28th, 1894, at Shoreham, Kent; July 8th, 1895, at Shoreham (Bower); June 19th-July 7th, 1895, at Cuxton, June 14th-23rd, 1896, at Cuxton (Tutt); June 12th-16th, 1896, at Witherslack (Hodgkinson); July 12th, 16th, 21st, 1897, at Shoreham (Bower); June 3rd, 1898, at Chippenham Fen (N. C. Rothschild); July 12th-21st, 1898, at Shoreham, Kent (Bower); end of July, 1900, at Marlow (Clarke); July 8th, 1902, at Shoreham, Kent (Bower); July 16th, 1903, at Hesleden (Harrison); July 30th, 1904, at Cuxton and Halling (Ovenden); June 24th, 1905, at Reigate (Sich); June 25th, 1905, near Hartlepool (Bower); June 27th, 1905, in the Isle of Purbeck (Bankes); July 5th-12th, 1905, on Reigate Hill (Chapman); July 15th, 1905, at Clandon (Sich); June 24th, 1906, at Reigate (Turner); June 16th, 1906, near Box Hill; July 14th, 1906, at Horsley (Sich).

Habits.—This active little species, abundant on the chalk-downs running from Strood to Maidstone, from Kingsdown to Dover, from Folkestone to Dover, through Surrey, on the Reigate and Boxhill Downs, and similar places, is difficult to see, but, once recognised, can be followed up without trouble. It flits nimbly over the herbage, taking short flights, and then skipping rapidly off again, during the hot afternoon sun, when most of our captures have been made; it becomes, however, more abundant as the afternoon draws to a close, and one can, by keeping one's eyes well down on the ground, and covering the quarry with the net (so that they can fly up into it), obtain them in numbers. They hang warily on grass-culm, *Hieracium* stem, etc., but also settle down to feed on the thyme-blossom, with which, in England, they seem to be usually associated, skip up the net, when made captive, with remarkable agility, and are not to be driven down again, by blowing at them, without much expenditure of energy. Towards dusk the species is more readily observed, and can then sometimes be taken in considerable numbers; we have seen it quite abundant on the turf at the top of the cliffs near the South Foreland lighthouse, between 7 p.m. and 8 p.m., on a still evening in early July. Bankes says that, in the Isle of Purbeck, the insect flits over the short turf of the downs in the evening, is difficult to see, but, in his experience, can then be obtained most easily by sweeping the flowers of *Thymus serpyllum*, on which it delights to feed. Sich observes that, at Reigate, during the daytime, it is easily disturbed from the short herbage, but, owing to its small size and dark colour the moths are hard to follow. Studd records its capture when flying in the sun at Oxton, Devon, whilst Crombrugghe de Picquendaele records it as flying freely in the daytime among *Hieracium pilosella* at Velthem, between Brussels and Louvain. Barrett says that it may easily be disturbed by day, by the foot, from its hiding-place among the short herbage, but at sunset flies freely of its own accord. Zeller says he often captured specimens *in cop.* at Glogau, although he gives no information as to their habits at this time, but Sich observes that the ♂ hangs free from the ♀ in the usual Alucitid manner, although the one he had under observation (in confinement) was also clinging to the muslin of the sleeve.

HABITAT.—From Scandinavia to the Mediterranean district (Sicily, etc.), and from the sea-level to some 6000ft. elevation in the Alps of Central Europe, give a very considerable range for variety in the habitats of this little species. In the south of England it prefers the chalky and limestone downs that are so characteristic of the southern counties. At Halling, where it is exceptionally abundant, the chalk slopes are covered with an abundance of *Lotus corniculatus*, whilst thyme and the mouse-ear hawkweed appear to be much less abundant. In Ireland, it frequents the sandhills of Sligo and the railway-banks near Athlone. In Durham it occurs commonly on a dry railway-bank, close to Hesleden Dene, where there is no thyme, but where there is plenty of *Hieracium*; whilst it also occurs at Black Halls, where both thyme and *Hieracium* grow. In Gloucestershire it is not scarce on the slopes of Durdham Down (Bartlett), and occurs freely on the downs at Ventnor (South); it is found very locally, and rather sparingly, on the limestone downs of the Isle of Purbeck coast, but, except for a solitary specimen at Bloxworth, has not been found elsewhere in Dorset (Bankes). Barrett says that the species frequents the slopes of chalkhills and open downs, also any rough ground in chalk and limestone districts, and more especially haunts wild thyme and marjoram. In Switzerland, Frey has taken it at Samaden, at a height of 6000ft., and Jordan at a still higher elevation, *viz.*, in the hilly field half-way up the Riffel Alp, but, as a rule, it does not reach remarkably high elevations, being noted particularly by Weiler as not going much above 3000ft. in the Tyrolean Alps about Innsbruck, although Heller gives it as extending from the valleys to 6600ft. elevation in these same mountains. Dietrich records it as occurring among *Tussilago* at Zürichberg, but this must be merely due to this plant growing among its foodplant in its locality here. At Brussa it inhabits the mountain slopes and meadows (Mann). In Belgium it is little known, but Crombrugghe de Picquendaele finds it commonly among *Hieracium* by the roadside, at the cross-roads at Velthem, between Brussels and Louvain. Zeller observes that, at Meseritz, in Posen, it lives in dry sandy places where *Hieracium pilosella* grows abundantly; whilst near Glogau it is abundant, occurring, not infrequently, in company with *O. pilosellae*, at the end of June and in July, on somewhat dry but fertile spots, where its foodplant, *Hieracium pilosella*, grows commonly. Near Jena it occurs frequently in the mountains (Schläger); in Mecklenburg the species is found at the same time and in the same places as *O. pilosellae* (Stange); and in the Rhine Provinces with *O. pilosellae*, in dry sandy places (Stollwerck). In Roumania it occurs, rarely, on hillsides and high pastures (Caradja). In the Netherlands it usually frequents heaths, *e.g.*, at Soest (Snellen).

British localities.—Apparently widely distributed in England and Ireland, but greatly overlooked; not yet recorded from Scotland. Antrim: on Knockagh, near Carrickfergus, abundant (Watts). Bucks: Marlow (Clarke). Cambridge: Chippenham Fen (N. C. Rothschild). Devon (Stephens). Dorset: Isle of Purbeck (Bankes), Bloxworth (Cambridge). Durham: Castle Eden (Sang), Black Halls, Hesleden Dene (J. Gardner), near Hartlepool (Bower). Galway: Clonbrock (Dillon). Gloucester: not scarce, Durdham Down, near Woodchester, Almondsbury (Hudd), Bristol, common (Porritt), Painswick district (Watkins). Hants: Isle of Wight, abundant on coast (W. H. B. Fletcher)—Ventnor (South). Kent: Charlton sandpit (Douglas), Shoreham (Bower), Deal district (Vaughan), Cuxton, St. Margaret's Bay, Kingsdown, Folkestone (Tutt), Dover, common (Coverdale), Darenth (Stephens). Lancs: near Grange (Hodgkinson). Norfolk: very local, Croxton (H. Williams). Roscommon: Athlone district (King). Sligo: Knocknarea (Russ). Somerset: Leigh Down, Portishead (Hudd). Suffolk (Barrett). Surrey: Oxted (Sheldon), Clandon, Box Hill (Sich), Horsley (Bishop), Reigate Hill (Chapman), Dorking (T. H. Briggs). Sussex: widely distributed—Arundel Park, Ditchling Common, Shoreham Downs (W. H. B. Fletcher), Clapham Downs (T. B. Fletcher), near Lewes (Jenner). Westmeath: Athlone district (King). Westmorland: Whitbarrow (Hodgkinson), Witherslack (Shuttleworth). Yorks: near Scarborough (Stainton).

Distribution.—Europe (except polar region), northwest Persia, Asia Minor, Tarbagatai mountains (Staudinger and Rebel). Asia: Asia Minor—Amasia (with *marginellus*) (Staudinger), Brussa (Mann), the Tarbagatai (*teste* Rebel). Austro-Hungary: Bohemia (Nickerl), Moravia—near Brünn, near Karthaus (Gartner), Lower Austria—Hernstein district, also on the foothills (Rogenhofer), Vienna district (Mann), Tyrol, north, central, and southern alps to 6600 ft. (Heller), Bozen, Trient (Mann), near Innsbruck, Tratzberg, up the mountains to 3000 ft., Taufers Valley, near Taufers, Schlafhaus, Weissenbach (Weiler), Glockner district, near Schluderbach (Mann), Trafoi (Eppelsheim), Carniola—Nanos—Abhang, near Gradischa (Mann), Carinthia—Raibl and Preth district, Flitsch (Zeller), near Fiume (Mann), Croatia and Dalmatia (Mann), Galicia (Nowicki), Slavonia (Koca *teste* Rebel), Banat, Transsylvania (*teste* Rebel). Belgium: Liège (de Fré); Ixelles, Velthem, between Brussels and Louvain (Crombrugghe), [Francorchamps, near Spa (Sélys).] Bosnia and Hercegovina: Lakab, Mostar (Rebel). Bulgaria: Eastern Roumelia—near Slivno (Rebel). Channel Islands: Guernsey—Petit Bot Valley (Luff). Denmark (Bang-Haas). Finland (*teste* Zeller). France: Aube (Jourdheuille), Cher—St. Florent, Indre—Nohant (Sand), Saone-et-Loire (Constant); Var—Ste Maxime (Chapman). Germany: east and west Prussia (Tiedemann), near Dantzig (Speiser), Posen—near Meseritz (Zeller), Pomerania—near Stettin, Schrey, Wollin Island (Büttner), Mecklenburg—near Friedland (Stange), near Neustrelitz (Messing), near Parchim (Gillmer), Hamburg—near Bahrenfeld, in the Haake (Sauber), Hanover—near Hanover (Reinhold), Herrenhausen (Glitz), Rhine Provinces—near Aix, Uerdingen, near Cologne (Stollwerck), Neuenahr, Altenahr (Maassen), near Bonn (Jordan), Hesse—the Mombacher

Wald, near Dotzheim, Wiesbaden, Nassau (Rössler), Frankfort-on-Main, near Cassel (Koch), Waldeck—near Rhoden, Arolsen (Speyer), Thuringia—near Jena (Knapp), near Sömmerda (Jordan), Province of Saxony—Dölauer-Haide, near Nietleben, Halle-a.-S. (Stange), Brandenburg—near Berlin, Potsdam (Pfützner), Silesia, distributed (Wocke), Upper Lusatia, near Schönberg, Siegersdorf (Sommer), near Sommerau, Lower Friedersdorf, near Neusalza (700 ft.-800 ft.), Schafberg, near Baruth, Nisky (574 ft.) (Möschler), Kingdom of Saxony—Saxon Upper Lusatia, distributed (Schütze), Bavaria—near Regensburg, on the Keilstein, near Wörth (Hofmann and Herrich-Schäffer), Schwablweiserberge, Kleinprüfening, near Kelheim (Schmid), Württemberg—near Urach (Steudel and Hofmann), Baden, only in high mountains —near Ueberlingen, Lahr, Gengenbach, Herrenwies, Tauberbischofsheim, Friedrichsfeld (Meess and Spuler), Alsace, the Palatinate (Bertram). Italy: Sicily (Mann). Netherlands: North Holland (Kinker), Utrecht—on the heath at Soest (Snellen), Gelderland—near Arnhem (v. Medenbach de Rooy), Limburg—near Maastricht, North Brabant—near Breda and Rijen (Snellen). Roumania: Varatic (Caradja). Russia: Baltic Provinces — Magnusholm, Pichtendahl (Nolcken), Livonia (Zeller), Kokenhusen (Lienig), Grösen (Rosenberger), Treyden (Bienert). Scandinavia: Blekinge (Wallengren), Gothland (Dahlbom). Switzerland: up to 6000 ft. elevation—Zürich, Baden, Engadine — Samaden, at 6000 ft. (Frey), Bergun (Zeller), Riffel (Jordan), Zürichberg (Dietrich).

Oxyptilus pilosellæ, Zeller.

Synonymy.—Species: **Pilosellæ,** Zell., "Isis," p. 789, pl. iv., fig. 27 (1841); v. Tied., "Preuss. Provinzialblatt.," p. 539 (1845); Dup., "Cat. Méth.," p. 383 (1845); Lienig, "Isis," p. 300 (1846); Tgstrm., "Finl. Fjar.," p. 155 (1847); Koch, "Isis," p. 954 (1848); Sta., "Sys. Cat.," p. 13 (1849); Zell., "Linn. Ent.," vi., p. 349 (1852); Wallgrn., "Oefvers K. V. A. For.," p. 220 (1852); H.-Sch., "Sys. Bearb.," v., p. 372 (1855); supp. fig. 16 (1853); Frey, "Tin. Pter. Schw.," p. 408 (1856); Plötz, "Freyer's Neu. Beit.," vii., p. 131 (1858); Sta., "Man.," ii., p. 442 (1859); Wallgrn., "Skand. Fjäderm.," p. 14 (1862); Gartn., "Faun. Brünn," p. 250 (1866); Jord., "Ent. Mo. Mag.," vi., p. 122 (1869); Staud. and Wocke, "Cat.," 2nd ed., p. 342 (1871); Nolck., "Lep. Fn. Estl.," p. 803 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 790 (1877); Frey, "Lep. Schweiz," p. 429 (1880); Jord., "Ent. Mo. Mag.," xviii., p. 122 (1881); Snellen, "De Vlind.," ii., pt. 2, p. 1029 (1882); Sorhgn., "Kleinschm. Brandbg.," p. 3 (1886); Leech, "Brit. Pyr.," p. 57, pl. xvii., fig. 1 (1886); Tutt, "Young Nat.," x., p. 164 (1889); Barr., "Ent. Mo. Mag.," xxv., p. 431 (1889); South, "Ent.," xxii., p. 33 (1889); Meyr., "Trans. Ent. Soc. Lond.," p. 485 (1890); Tutt, "Brit. Nat.," i., p. 182 (1891); "Pter. Brit.," p. 66 (1895); Meyr., "Handbook," etc., p. 432 (1895); Hofmn., "Deutsch. Pteroph.," p. 107 (1895); Staud. and Reb., "Cat.," 3rd ed., p. 71 (1901); Barr., "Lep. Brit. Isles," ix., pp. 369-370, pl. 415, fig. 2 (1904). **Didactylus,** Stphs., "Illus. Haust.," iv., p. 377, *in part* (1834); Wood, "Ind. Ent.," 1st ed., p. 237, *in part*, pl. li., fig. 1650 (1839). **Trichodactyla,** Stphs., "Illus., Haust.," iv., p. 424, *in part* (1835). **Didactyla,** Zett., "Ins. Lapp.," p. 1013 (1840). **Hieracii,** Sta., "Cat.," p. 32 (1849); Tutt, "Brit. Nat.," i., p. 185, *in part* (1891); "Pter. Brit.," p. 69, *in part* (1895); Meyr., "Handbook," etc., p. 432 (1895); Barr., "Lep. Brit. Isles," ix., 367-368, *in part*, pl. 415, fig. 1 (1904).

Original description.—Alis anterioribus rufescenti-cinnamomeis, laciniis albido-bistrigatis, digito tertio cinnamomeo, paulo ante apicem utrinque atrosquamato. Forewings reddish cinnamon-brown with two whitish transverse lines across the lobes; the third plumule cinnamon-brown, shortly before the apex on both sides with deep black scaling (many ♂ s and ♀ s). This plume differs from *Pterophorus tristis* in its brighter colour and in the position of the scales in the fringes of the third plumule; from *P. obscurus* in the lighter ground-colour, in the absence of the black scales on the disc of the third plumule and in the differently marked fringes on the hind-margin of the lower lobe; from *P. hieracii* in its smaller size, in the pale, less chestnut-coloured, ground-colour, and in the less distinct white hind-marginal line of the lower lobe; finally, from *P. trichodactylus* in the unicolorous disc of the third plumule, and in the differently coloured hind-margin of the lobes. Size less than *P. tetradactylus*. Head orange-brown, with a white line above the eye, which runs into the red-brown basal joint of the white and black ringed antennæ. Palpi longer than the head, somewhat curved upwards, then porrected; the thin pointed terminal joint lies generally on the elongated hair-scales of the second joint; they are yellow-brown with white longitudinal lines, as in *P. tristis*. Dorsal shield and abdomen yellow-brown. Across the shield runs a transverse whitish-yellow line to the inner margins of the forewings. On the hind margin of the thorax are four longitudinal similarly-coloured lines, which are continued on the commencement of the abdomen; each segment of the abdomen has four, more or less distinct, white, longitudinal lines, which become thickened and divergent on the hind-margin. In the most distinct examples, usually females, the venter has three snow-white longitudinal lines thickened before the incisions, and between these a white spot in each ring. Legs with white lines on the femora and tibiæ on the side turned to the body, on the outer side with two reddish-brown longitudinal lines; the area at the base of the spurs and the apices of these reddish-brown; the tarsal joints snow-white with broad yellow-brown apices (the thickened portions at the spurs are stronger and the brown colour much brighter than in *P. tristis*). Forewings bright, reddish, cinnamon-brown, dotted with white on the dark costa, on the inner margin near the base, and also on the disc before the fissure, with yellowish and whitish scaling. The upper lobe is the darker, but lighter at the apex. Two whitish transverse lines, more oblique and more sharply margined than in *P. tristis*, run over both lobes. The fringes, from the second transverse line to the apex, on the costa of the upper lobe, are yellowish-white; on the lower lobe the whitish base of the fringes, between the apex and the second transverse line, forms a yellowish-white curved line as the boundary of the ground-colour. The fringes of the hind-margins brown-grey, especially dark in the space between the two transverse lines on the lower lobe, lighter brownish towards the base. Here and there are scattered black scales in the fringes of the inner margin. Hindwings grey-brown with grey fringes. The third plumule light reddish-brown, with a set of white scales on the hind-margin; the hind-margin has them longer, and more numerous, than the costa; this set does not, however, reach the whitish apex, where two black scales lie.* Underside darker cinnamon-brown; the white of the transverse lines and fringes more distinct than on the upperside. The forewings on the costa with scattered white scaling; the first transverse line is absent on the lower lobe. The first and third plumules paler than the second, and with a large whitish spot before the apex; on the third plumule one sees the black scales distinctly only on the hind margin. This species lives in many countries and is abundant; but I here only mention the following with certainty: Sweden (Zetterstedt); Mecklenburg-Strelitz (from examples from Messing); in the Mark of Brandenburg (round Berlin and Frankfort-on-Oder); Silesia, in the plain and in the mountains (round Glogau it is very common, rarer round Reinerz); Province of Posen (according to von Löw); Bohemia,

* This paragraph is queried in Zeller's copy of the *Isis* in Nat. Hist. Mus. library in his own handwriting. The description, however, is quite accurate, except that the whitish apex appears also often to carry the white scales. The black scales at the apex are very distinct in fine specimens.

round Nirdorf and Reichstadt (according to Fischer v. Röslerstamm's information) (Zeller).

Imago. — 17mm.-19mm. Forewings orange-brown or pale cinnamon in colour; an oblique white transverse band (or shade), sometimes very obscure before the middle; the base of the fissure edged by a whitish cloud; beyond this is a broad, sharply-defined, white stripe, crossing both lobes, and not strongly angulated; beyond this a slender similar stripe; the fringes of the upper lobe brown, blackish at anal angle, of the lower lobe, brown, with a pale ochreous patch in outer marginal hollow, and strikingly blackish between bases of lobal transverse lines. Hindwings with the plumules dark golden-brown, thickly sprinkled with minute dark scales, the fringes very dark smoky-brown, the third lobe with some white cilia towards the tip, but interrupted by a broad triangular brown-black tuft, the margin of this plumule with a series of isolated conspicuous black scales.

Sexual dimorphism.—The ♀, easily recognised by its wider and more pointed abdomen, is usually distinctly smaller than the ♂, tending to show more conspicuously the white abdominal dorsal streaks and chestnut-brown lateral markings (as noted by Zeller). The ground colour of ♀ is usually bright, the pale markings well-developed, both on the forewings and the 3rd plumule of the hindwings.

Variation.—One may look over a very fair number of British examples of this species and get the idea that this is not a variable species, and this appears to be accurate so far as there are no striking aberrations that attract notice. There is, however, some little minor variation observable in size, tint, and intensity of markings. In size, specimens in our own series vary from a little over 19mm., to not much over 16mm., the smallest, however, in almost all cases being ♀ s. In tint, the specimens are of a cinnamon-brown or pale chestnut colour, not far removed from the shade found in the darkest and brightest examples of *Marasmarcha lunaedactyla*, but with a redder tone, *i.e.*, distinctly more intense than in *Crombrugghia distans*, and without the tendency to chocolate so characteristic of *Capperia heterodactyla*. This brighter form appears to be Zeller's type, but occasional specimens are distinctly duller and greyer in hue (=ab. *suffusa*, n. ab.), and without the brightness of the form just noted; these duller-tinted individuals also usually have fewer and less strongly developed white dots and markings, those at the fissure, middle of the wing, and on the lower lobe, showing the greatest tendency to fail. The best marked of the brighter brown specimens are considerably variegated and show conspicuously a short longitudinal shade of white scales above the base of the median nervure; three short longitudinal white streaks, or shades, on the disc and inner margin, one below the other (the remnant of a transverse band), a patch of white scales at the end of the fissure, internally edged with the darker discal lunular-mark; the first lobal transverse line broad, crossing both lobes, widening and occupying considerable space on the lower lobe; the second lobal transverse line narrow, and continued over both lobes, but not extending into the fringes; the costa from the second lobal line to apex white, with sundry white scales scattered over the lobes and the costa between the discal shade and first lobal transverse line. This is Zeller's typical form. Other examples of the brighter orange-brown or cinnamon form are less distinctly marked, the white basal and discal streaks failing, also, in part, the transverse lines on the lower lobe, whilst the white costal scales to a great extent also fail =ab. *paupera*, n. ab. There is also some variation in the amount of white and black scaling on the lower margin of the 3rd plumule, and the distinctness of the white at the apex of this plumule. The specimens in our collection of ab. *suffusa* are particularly noticeable as being without the usual quantity of white on the 3rd plumule. We do not observe a tendency in the white markings in our least-marked British examples to become ochreous and blend with the ground colour, but they remain white, however reduced in size the scale patches become. Barrett's description (*Lep. Brit. Isles*, ix., p. 369) appears to be faulty, in that it makes the outer lobal transverse line branch in each lobe to the apex, the cilia of the second lobe white, etc. (naked eye appearances, not borne out under a good lens). In the Frey collection there are the same two distinct shades in the ground-colour of the specimens exhibited, one of a bright brown (the type), the other of quite a dull tint of brown. There is great difference in the clearness of the markings, some examples having the lobal transverse lines snowy-white, but the others dull ochreous and inclined to blend with the ground-colour. Both the lobal lines usually cross both the upper and lower lobes. The white fissural spot is sometimes conspicuous, at others almost obsolete, whilst the faint transverse shade between cleft and base is sometimes increased into a well-developed transverse line. Two examples from Frankfort and one from Munich are of a very pale brownish-ochreous ground-colour, with feeble, pale (ochreous, rather than white) markings. One of Zeller's examples in the "Frey coll.," from Glogau, has the ground-colour very bright, the space between the two transverse lines on the upper lobe very dark, almost banded. Our British examples frequently show this dark band, and have the colour on the outside pale, but, as the ground colour of the discal and basal parts of the wing are of almost the same dark orange-brown tint as that between the two lobal lines, the banded appearance does not become conspicuous.

Comparison of Oxyptilus pilosellæ with its allies.—Generally smaller than *P. hieracii*, to which it is most closely allied, it differs in the less dark ground-colour, less sharply white transverse lines, and, in particular, by the faint appearance of the whitish line, which edges the hind-margin of the lower lobe of the forewings. Both species have a less deep cleft than *P. caffer*. *P. pilosellae* differs from *P. obscurus* (1) by its larger size, (2) by its brighter (lighter) colour, (3) by the less sharply marked white line which edges the costal fringe at the apex of the upper lobe, (4) by the triangular scale-tuft which does not reach the apex of the third plumule. This last character *P. marginellus*, *P. ericetorum*, and *P. trichodactylus* also possess (Zeller). Webb compares the Dover examples with *Capperia heterodactyla*, and notes (*in litt.*) of the former: "Some of the reddish-brown examples are quite indistinguishable from the old Mickleham specimens. When freshly-emerged they are nearer the colour of *heterodactyla* (*teucrii*), but the colour, tuft, and silveriness of the markings all vary in individuals, the most constant characters being:—(1) The pale ochreous fringes of the second lobe. (2) The absence of any white scale-patches (best seen in *heterodactyla*) on the inner margin of the first lobe. (3) The absence of the two minute black tufts on the inner margin opposite the fissure. (4) The tuft on the third plumule of the hindwing not extending on both sides of the shaft. (5) The wings markedly narrower than those of *heterodactyla*. (6) The first fascia crossing the lobes of the forewings always composed of a line, not a blotch, as is frequently the case in *heterodactyla*. (7) The contrast in colour between the fore- and hindwings, *heterodactyla* having them almost identical in hue. (8) The underside of the first plumule of the hindwings not so mottled as in *heterodactyla*, but with a much more elongate and distinct white spot near the apex." Comparing the Dover examples with *Crombrugghia distans*, Webb notes (*in litt.*): "*Pilosellae* is not so pale in colour, nor so coarsely scaled as *distans*, but comes nearer to it in the width of the wing; some specimens come, indeed, very near *distans*, but there are no hoary scales along the inner margin, and the tuft, of course, is different; in the nearest examples they can be separated by a glance at the underside. The fasciæ crossing the lobes of the forewings are parallel in *pilosellae*, and the outer one makes a continuous line; in *distans* this outer one is not a continuous line, but the parts in the first and second lobes enclose an obtuse angle; in *distans*, too, the pale fringes surround the first lobe, and another pale line runs from the centre of the fascia to the tip; in *pilosellae* the fringes are only pale on the costa." Barrett gives (*Ent. Mo. Mag.*, xxv., p. 431) a comparative summary of the British Oxyptilines and *hieracii*. This reads as follows:—

Pilosellae.—The costal margin much arched beyond the middle, so that the apex is long, pointed, and drooping. The two pale fasciæ (which, in all these species, cross the lobes of the forewings) yellowish-white, oblique, not very narrow, nor well-defined. The third feather of the hindwing with a large brown tuft of scales near the tip.

Hieracii.—Of the same size, but with the costal margin less arched, and the apex more blunt and squared; the fasciæ more perpendicular, narrower, and more sharply defined. The tuft on the third feather of the hindwing is brown, and is situated just beyond the middle.

Parvidactyla.—Considerably smaller, of the colour of *pilosellae*, and with oblique fasciæ, but these are narrow, bright, and sharply defined; the costal margin much less arched, and the tips less produced, though hardly so blunt as in *hieracii*. The dark tuft on the third feather of the hindwing is large, and placed nearly at the tip.

Distans.—Of a paler duller colour than the three foregoing, and its pale fasciæ so placed as to resemble crescents, especially when the insect is alive and at rest. Its shape and size are similar to those of *hieracii*, and the tuft on the third feather of the hindwing is similarly placed, though small and inconspicuous, but the species is at once distinguished by its broad, ill-defined, pale fasciæ.

Heterodactyla.—Perhaps the largest of the group; its wings decidedly broader, and, from its dark colour and bright white markings, it is by far the most handsome. The costal margin much rounded, the tips long and drooping, the fasciæ fairly broad and brightly defined, and the inner (dorsal) margin of the forewings edged with bright white cilia, in which are three black dashes. The third feather of the hindwing has a large blackish tuft, and the anterior portion of the feather is white, with numerous black dots.

Bankes, commenting (*Ent. Rec.*, xviii., p. 46) on the above, suggests that Barrett cannot have had the true *hieracii*, Zell., before him, for he says that the dorsal scale-tooth ("tuft") of the third feather of the hindwing is situated "just beyond the middle," whereas Zeller himself says that it lies "a little before the apex." It would appear that Barrett could not have based this remark on the specimens in his collection received from Zeller, and which are now in Chapman's possession and under observation as we write, since they show the scale-tuft near the apex, as in *pilosellae*, and as Zeller describes it (Tutt). Speaking of *hieracii*, Zeller writes (*Linn. Ent.*, vi., pp. 350-351): "This species is generally larger than *P. pilosellae*, darker yellow-brown in colour, with somewhat brighter and, as a rule, narrower, transverse lines across the lobes of the forewings, and with a distinct, bent, white line at the base of the fringe before the apex of the second lobe. The black scale-tooth also, on the 3rd plumule of the hindwing, is larger in *hieracii*. The nearest relative to the latter is *ericetorum*, which has the same dark, almost chestnut-brown, ground colour, and the same marking of the hind lobe. These two species, however, differ from each other in that the scale-tuft on the 3rd plumule of the hindwing, which, in *hieracii*, does not reach the apex of the plumule, and in which the costal (upper marginal) scales in the neighbourhood of this tuft form only a narrow line, which contributes little to the size of the tuft, in *ericetorum* reaches the apex of the plumule, and forms with the broad costal row of scales a large roundish spot, which covers the entire apex." Hofmann writes (*Die Deutsch. Pteroph.*, p. 107): "*Pilosellae* is very close to *O. hieracii*, smaller, more cinnamon-red; the outer marginal fringes of the lower lobe have a dull white, or more yellowish, basal line. The best distinguishing character is formed by the black scales of the 3rd plumule. These are similar to those of *O. hieracii*, but weaker and shorter, especially on the inner margin; on the costa they do not run quite up to the apex, which bears *whitish* scales on *both sides*, and only has a few black scales at the extreme end of the inner margin; on the costa, however, they run towards the base somewhat further than on the inner margin. In *O. hieracii*, on the contrary, the black scales of the costa run up to the apex of the plumule, so that only a very few white scales remain among the rest, while the black scales do not run further towards the base than on the inner margin. With worn specimens these characters are, of course, easily lost. Palpi as in *O. hieracii*." Writing of *O. hieracii* (*op. cit.*, p. 108), he further says that this species is "usually somewhat larger (expanse 11mm.) than *O. pilosellae*, dark red-brown, almost chestnut-brown, with pure white, somewhat shining, markings. The basal line of the outer marginal fringes of the lower lobe is usually sharp and pure white, occasionally, however, somewhat tinged with yellow, and, in many examples, becoming obsolete on reaching the centre of the outer margin. The black scales of the third plumule of the hindwing are shorter on the costa and placed very obliquely, on the inner margin almost vertical, very long towards the base, becoming gradually shorter towards the apex, so that they form a tooth-like projection; they extend along the costa up to the apex, but towards the base not further than the scales on the inner margin. At the apex of the plumule there are only a few little scales, and one pair of thick deep black scales directed downwards, which are usually closely in touch with the scales of the costa, but separated from those of the inner margin by a short interval in which the fringes are whitish-coloured at the base. Palpi brown, edged with white below, with a distinct tuft of hairs on the second joint."

[ORIGINAL DESCRIPTION OF OXYPTILUS HIERACII, ZELLER.—*Pterophorus hieracii*. Alis anterioribus brunneis, laciniis niveo-bistrigatis, ciliis costæ ante apicem exalbidis, arcu laciniæ posterioris marginali albido; digiti tertii dorso ante apicem atro-squamato.* Forewings

* Forewings red-brown; lobes with two snowy strigæ; cilia of the costa before the apex yellowish-white; a whitish bow on the margin of the lower lobe; the fringe of the 3rd plumule black-scaled before the apex.

dark brown-red; on the black costa, from the base to the cleft, dotted with snow-white; on the disc near the incision lie, behind a dark mark, crowded white scales, as well as some on the division. Over both the lobes, in the usual positions, are two snow-white, somewhat shining, transverse lines, those on the second lobe not reaching the inner edge; the first one thick, oblique from behind forwards, going into the fringe; the second one very thin, often on the first lobe broken to an angle, not reaching the fringe. From this second line to apex the costal fringes yellowish, and ending in this colour at a long black streak; the posterior border of the second lobe has, behind a black marginal line, a whitish-yellow, concave, darker, emarginate line on the fringe. The fringes blackish, in the incision paler; on the inner margin of the wing yellowish, with a few black scales, which are easily lost, but are firmest behind the middle of the incision. Hindwings clear red-brown, with black fringes; the 3rd plumule has, before the yellowish-fringed apex, on both sides deep, black, crowded scales, of which those on the hind border are rather the longer and form a sort of tooth, becoming gradually shorter towards the tip (Zeller, *Isis*, 1841, p. 827).]

Egglaying.—Nothing appears to be known of the egg-laying or egg of *O. pilosellae*. Nolcken observes that he captured a pair, *in cop.*, in the Riga district, August 7th, 1870, that eggs were laid, and that, from these, young larvæ emerged on August 22nd.

Ovum.—Undescribed.

Larval habits.—As the foodplant, *Hieracium pilosella*, grows in patches, there are always several larvæ near together, though only one lives in each plant. The plant tenanted by a larva has no flower-stalk, and is easily recognisable by the loose white fluff over the central shoot, by which a kind of roof is formed for the larva. This fluff is scraped off the underside of the leaves, and mixed with a few hairs from the upperside. Under this poorly-protecting roof the maggot-like larva, deeply boring, eats out the heart, and often gnaws the tender leaves of the shoot from the margin up to the midrib. As a rule, it is not satisfied with a single plant; I have found deserted dwellings, and, in neighbouring plants, well-grown larvæ, which were just commencing to form their roofs, and, therefore, could not have dwelt there from their youth upwards. The larvæ are full-grown at very uneven periods, and still very young larvæ occur, when others have already pupated. The excrement is pale yellowish, not in great quantity, and dry. The larvæ can let themselves down by a thread. In its chosen habitats, the larva is to be found, often in abundance, in June (Zeller). In Baden, the larvæ are found in stems of *Hieracium pilosella* (Reutti). The larva lives among the lower leaves of *H. pilosella*, where it makes a flattish roof, beneath which it burrows into the innermost part of the plant, and sometimes devours even the leaves themselves, after which it will go to another plant; the plants thus attacked do not produce flowers (Wallengren). The larvæ are to be found in Brünn, at the end of May, on *H. pilosella*, the central shoots of which are, at this time, clothed with a cottony- or woolly-like bunch, beneath which the larvæ spin flimsy webs, in which they can be found of all ages; but, although imagines are to be taken by June 20th, half-grown larvæ may also be found at the same time in nature (Gartner). Freyer observes that Plötz first found larvæ on the underside of the lower leaves of *Hieracium*, but later obtained them more abundantly on the upper central parts of the plants, where they concealed themselves by drawing the nearest portions of the plant around them. Hofmann says that the larva lives in May and June on *H. pilosella*, under a loose web of white fluff, spun over the central shoot. This fluff is scraped off from the underside of the leaves, and mixed with a few hairs from the upperside. The maggot-like larva under this web bores deep down into the heart of the plant. Pupation takes place either in the larval dwelling, or on the underside of a leaf, where the fluff is scraped off and formed into a longish cocoon that hangs loosely together.

Larva.—Larva brevipes setulis minutis capitatis tecta, exalbida: capite melleo; seriebus duabus dorsalibus pilorum ternatorum; foveolis lateralibus supra seriem pilorum solitariorum. (Larva with short legs, with very short, knobbed, setæ, yellowish-white; with pale yellow head; two rows of triple hairs along the back; a row of depressions above a lateral row of single hairs.) Length somewhat under half-an-inch. The small head shortly oval, pale honey-yellow, with dark jaws and blackish ocelli, little shining, like the thoracic shield, and drawn halfway into the prothorax. The ground colour of the body, which is somewhat stout and attenuated at each extremity, is, both in the old and young larvæ, pale yellowish-white, yellower towards the venter; the last two segments greyish-blue, from the excrement showing through. The surface is everywhere clothed with quite short, knobbed, bristles. A mediodorsal line is wanting, as well as every other marking; each segment exhibits, in the centre of the dorsum, a very shallow depression, forming a posteriorly-open horse-shoe. The middle segments have, near this, three hairs, one behind the other, near together, diverging above, the central the longest, the last directed obliquely backwards. Further down on the side, below a distinct indentation, stands a long hair, below which, on the lateral flange, is a separated, horizontal, diverging, double hair. The spiracles, which must lie above the lateral flange, I was not able to recognise. Segments clearly divided; the skin falls in transverse folds when the larva contracts itself. The very short ventral claspers cylindrical, with a slightly incomplete brown circle of hooklets. The thoracic legs, also, are of noteworthy shortness. The larva is rather hard to the touch, but not so much so as that of *P. scarodactylus* (Zeller). The larva is spindle-shaped, without markings, and of a dull greenish-yellow colour, with fine whitish hairs (Plötz *teste* Freyer). The fullgrown larva is yellowish-white, transversely wrinkled, with distinct lateral flange, feels hard to the touch, but not so hard as that of *Leioptilus scarodactylus*, without markings, beset all over with quite short, white, knobbed, bristles, rising singly. Tubercles small, bearing single long white bristles. On the back, there is, on each segment, between the dorsal tubercles, a small shallow depression, in which four dark, roundish, spots, forming a square, may be seen with a strong lens. Laterally, each segment bears another small, roundish, depression, with a single-haired tubercle below, then the small spiracle margined with pale brown, and below this, on the lateral flange, a tubercle bearing two divergent bristles. Head small, retractile, pale honey-yellow, with dark brown mouthparts, and two brownish spots on the posterior margin, and, like the yellow thoracic shield, hardly shining. Anal flap yellowish, with brownish spots. Thoracic legs short, pale brown ; abdominal claspers short, with few brown hooks (five to six) on the sole, some of which exhibit, at the base, a second hooklet, scarcely half so long (Hofmann). The larva is yellowish-white in colour, with long white hairs ; the small, heart-shaped head flattened, with two dark eye-points, and pale reddish-brown mouth, deeply drawn in ; no thoracic or anal shield. Body thickened in the centre. The points of the legs, and the soles of the ventral claspers, reddish-brown, otherwise, like the venter, white. Movements slow (Gartner).

Comparison of larva of O. pilosellæ with that of O. hieracii.—*O. pilosellae* :—The larva of *O. pilosellae* is yellowish-white, without markings, and the ventral prolegs are short, with few brown hooklets on the planta. It bores into the heart of *Hieracium pilosella*, and pupates either in the larval dwelling, or on the underside of a leaf of the foodplant under a web. *O. hieracii* :—The larva of *O. hieracii* is of some shade of green, the dorsal tubercles are brownish, or brownish-red, bordered on each side with red or brown elongated spots. The dorsal vessel is blackish, or dark green, or even blood-red, sometimes also bordered with pale yellowish lines. The ventral prolegs long, stilt-like. It lives in the shoots of *Hieracium umbellatum*, eating the inner leaves, and pupates on the stem or on the upperside of a leaf near the midrib (*cf.* Hofmann, *Die Deutsch. Pteroph.*, pp. 107-109).

Foodplants.—*Hieracium pilosella* (Zeller), *H. umbellatum* (Frey), [*Inula* (Schmid).] [It is to be noted that *Hieracium umbellatum* is the food of *Oxyptilus hieracii*. We have no further indication concerning Schmid's unexpected record of *Inula* as a foodplant, and particulars of every kind—species, etc.—appear to be wanting.]

Puparium.—Pupation takes place either in the larval dwelling, or on the underside of a leaf, where the fluff is scraped off and formed into a cocoon, elongate, and loosely hanging together. On the third day, the larva becomes a very slender whitish-yellow pupa. The female pupa is somewhat shorter and stouter. If disturbed it lashes strongly around and over itself, and is hard to the touch. The pale-reddish, backward-directed, dark-hooked prickles on the venter do not appear to be used for anchoring the pupa ; only those on the anal point seem to be used as a holdfast (Zeller). The pupa is fixed in the larval nest, or on the back of a leaf, on which a thin oblong web is prepared, and into which the gnawed-off fluff, etc., is spun (Wallengren). For pupation, the larva chooses the underside of a leaf of its foodplant, and settles down among the woolly covering; the pupal stage lasting 14 days (Gartner). The fullfed larva, in mid-June, betakes itself to the underside of a leaf, bites off the hairs from a small area, and spins there for itself a slight transparent web, wherein it fastens itself by its cremaster to the leaf, before changing to an ivory-coloured pupa; the pupal stage lasting from 14-17 days (Plötz *teste* Freyer).

Pupa.—Chrysalis albida, fronte bicorni, carina duplici abbreviata setigera in abdominis dorso; fovearum lateralium serie simplici; segmenti penultimi ventre glochidibus instructo. (Pupa whitish, with two frontal horns and two bristly keels on the dorsum of the first three abdominal segments ; a series of indentations on the side of the abdomen ; the penultimate segment with supporting hooks on the bare ventral area.) The anterior dorsum, towards the head, which has at the base of each antenna a pointed hump terminating in a spike, is obliquely swollen, and has, on its uppermost part, two whitish, outwardly curved, longitudinal keels. From the union of these on the middle of the back run two narrow little-raised keels over the first three segments of the abdomen; they disappear on the middle segments and rise again on the hindmost, and bear, on each segment, on a little elevation anteriorly, a very short, and behind, a long, backwardly-curved, bristle. Further down, in the centre of each segment, is a little elevation with a bristle, and below it a depression, in front of which lies the scarcely recognisable spiracle. Below the depression, on a raised longitudinal line, two very short bristles are placed, more towards the venter, and, in the centre of the segment, a longer bristle, and quite below two more, one behind the other. The bristles are clear, directed posteriorly, those of the thorax, however, directed forwards. The whole of the upper surface is very finely and closely wrinkled, most deeply on the centre of the back. On the wing-cases the nervures are raised and white in colour. On the venter, at the commencement of the penultimate segment, is a number of pale-reddish prickles, directed backwards with dark-hooked terminations; they are shorter than the anal bristles, and I have never found the pupa anchored with them. On the anal point there are many such prickles, which, however, but little strike the eye from above; these alone I saw hooked into the silk and used as a holdfast. In about fourteen days the moth appears (Zeller, *Isis*, 1841, pp. 789-793). The pupa is whitish, with two projecting nosehorns, and two dorsal ridges, with bristles, on the first three abdominal segments; on each side of the abdomen is a row of hollows, and the penultimate and anal segments have dorsal hooks, by which it is attached (Wallengren). The pupa is whitish with two frontal elevations and two ledges (dorsal keels) on the back of the first four abdominal segments; on the sides of the abdomen there is a small shallow dimple on each segment. On the wing-cases the nervures are raised and white. It differs essentially from the pupa of *O. hieracii* in that the bristly dorsal keels disappear on the middle segments, and only rise again on the hindmost segments (Hofmann). The lively pupa is slender, bone-yellow, with two points on the head; thorax humped; anal end pointed; wing- and leg-cases leave two segments free, and are reddish-brown at their terminations; the segments bear single hairs directed backwards (Gartner).

Comparison of the pupa of O. pilosellæ with that of O. hieracii.—*O. pilosellae*:—The pupa of *O. pilosellae* is whitish, with two elevations with radiating bristles, and two bristly dorsal keels on the dorsum of the first four abdominal segments; on the lateral area of each segment of the abdomen is a small shallow depression. On the wing-cases the nervures are white and raised. From the pupa of *O. hieracii* it essentially differs, in that the bristly dorsal keels disappear on the middle segments of the abdomen, and only rise again on the terminal segments. *O. hieracii*:—The pupa of *O. hieracii* has, on the dorsum of each segment of the abdomen, laterally compressed elevations, these are largest on the 4th abdominal segment, and decrease in size towards both extremities. The colour of the pupa is bright green with reddish and brown markings, and a dark, whitish-bordered, medio-dorsal line (*cf.* Hofmann, *Die Deutsch. Pteroph.*, pp. 107-109).

[Lifehistory of Oxyptilus hieracii.—As *O. hieracii* has, for many years, been erroneously quoted as a British species, and, as there is nothing in the foodplant, habitat, or distribution of the species which should forbid its occurrence in Britain, we add Hofmann's lifehistory of the species (as known in Germany). This reads as follows:—LARVA: 9mm. long; yellowish-green, pale green, or yellowish; dorsal tubercles pale brownish to brown-red, on both sides bordered with rose-red, or blood-red, or even brown-red, elongate spots. The dorsal vessel beneath the skin appears blackish, or dark green, though sometimes even blood-red, sometimes edged on each side by a pale yellowish longitudinal line. The small heart-shaped head is brown previously to the last ecdysis; afterwards clear honey-colour with dark mouth-parts, sometimes also green. The prothoracic shield, shining brownish before the last ecdysis, sometimes made up of three spots, disappears afterwards; spiracles ringed with brown; anal shield bright brownish-yellow, dark brown on the sides; all the legs of the general colour of the body; ventral claspers long, stilt-like. HABITS OF LARVA: It lives at the end of May and in June in the terminal shoots of *Hieracium umbellatum*, which are spun up in longish bunches, in which the larva eats the innermost leaves and deposits its excrement; [the larva also occurs on *Picris hieracoides** and *Teucrium scorodonia** (according to Sorhagen, p. 4), unless, with regard to the latter plant, a mistake has been made with another species, perhaps *O. teucrii*.] Dr. Steudel, of Stuttgart, once bred an example, probably of this species (on account of the crippling of the hindwings not exactly identified), on July 25th from the flowers of *Hieracium boreale*. PUPATION: The pupation takes place on a stalk, or on the upperside of the leaf, beside the midrib, etc. PUPA: 9mm. long, anteriorly bluntly rounded, with very short, blunt, frontal prominence, and slight dorsal keels; these are furnished, on the metathorax, each with three small teeth directed forwards; on the dorsum of the abdomen there are laterally compressed elevations terminating in one point on the first and last segment but one, and in two points on the remaining segments; they carry, at their bases, a white bristle directed forwards and another directed backwards; the elevations are largest on the 4th abdominal segment, where the dorsal keels terminate, and from here, anteriorly, as posteriorly, they decrease in size. The sides of the abdomen are furnished with four rows of white tubercles lying one above another (one tubercle in each row to a segment), each bearing a white bristle directed backwards, but the second row carries two divergent bristles. The leg- and wing-cases reach to the posterior margin of the 5th abdominal segment. Nervures of the wing-cases without bristles. The pupa is a lively green in colour, brown between the reddish dorsal keels and elevations, with the dark dorsal vessel showing beneath the skin. The dark dorsal vessel is bordered outwardly with whitish. TIME OF APPEARANCE AND DISTRIBUTION: Imago emerges from the end of June till August. *O. hieracii* is distributed throughout Germany and Austria, and occurs also in many places in Switzerland—Zürich, Baden, St. Gallen, etc.]

TIME OF APPEARANCE.—In Britain, *O. pilosellae* occurs in July and August (Stainton). [We have a note to the effect that Farn captured it in the Painswick district, between July 1st-16th, 1894.] The statement of Blackmore, that he captured the species the last week of July, 1864, in the Isle of Portland, and that of Wormald, that he took it on July 27th, 1867, in a swamp at West Wickham, require confirmation.

* *Picris hieracoides* is one of the foodplants of *Crombrugghia distans*, and *Teucrium scorodonia* the foodplant of *Capperia heterodactyla*, the latter species referred to by Sorhagen as *hieracii*, Greening.

Zeller says that, in Posen, it commences to fly after mid-June, and is at its maximum in early July, disappearing at the end of the month; belated examples, however, occur later, even into September, and, on October 2nd, a single worn example was captured, probably from an egg of the year. In Germany, it was just appearing June 19th, 1869, abundant on July 11th, 1869, at Meseritz (Zeller); it is noted in July in Anhalt, near Dessau (Gillmer), near Potsdam, Berlin, etc. (Pfützner), and Frankfurt-on-Oder (Kretschmer); it is recorded in June and July, in Vorpomerania (Paul and Plötz), the Rhine Provinces (Stollwerck), in Hanover (Glitz), in Upper Lusatia (Möschler), in the kingdom of Saxony (Schütze), and near Regensburg (Hofmann and Herrich-Schäffer); in Württemberg it is noted as occurring from June to August (Steudel and Hofmann), and near Friedland (Stange), also near Munich (Hartmann), and in Baden (Meess and Spuler); whilst at Wiesbaden only the end of June is recorded (Rössler). In Austria, it is recorded for the last half of June and early July, in Moravia (Gartner); in May and June in the Vienna district (Mann); and from June to August in the Salzburg (Fritsch); we captured it between August 5th-12th, 1895, at Cortina. It is recorded for July 4th-29th in Scania, etc. (Zetterstedt); in June and July, and even as late as September, in southern and central Sweden (Wallengren); in June and July near Helsingfors and Hollola, and at Walamo on July 23rd (Tengström); July 13th-August 17th, 1870, in the Riga district (Nolcken). In Switzerland it occurs in July and August (Frey). In France, we captured the insect between July 31st and August 5th, 1898, at Bourg St. Maurice; August 5th-12th, 1896, at La Grave; June 23rd-30th, 1897, in the forest of Fontainebleau; August 6th-12th, 1902, at Megève; August 16th, 1902, at Chamonix; August 8th, 1906, at Beauvézer, in the Basses-Alpes, the dates suggesting that the altitude influences its time of appearance considerably. In Italy, also, we found it between July 31st and August 3rd, 1894, at Courmayeur, August 9th-18th, 1901, at Bobbie, and August 20th, 1901, at Au Pra. In Belgium it is recorded as being common, and occurring in June, July, and August (Crombrugghe).

Habits.—This species loves a dry sunny spot, and, flitting from one *Hieracium* stem to another, hangs like a dried scrap from the stalk, to which it clings with its front legs; or it bustles busily among the herbage at the end of the afternoon, when it is not so easily seen as Zeller would suggest. At La Grave the species was disturbed during the daytime, but was more active, naturally, at the end of the afternoon and in the early evening. At Bobbie, the imagines could be disturbed during the afternoon, but they flew naturally later, and were easily put up as one walked among the herbage; at Megève, too, they were most abundant in the late afternoon, flying quite freely between 5.30 p.m. and 6.30 p.m., on still, sunny afternoons. At Courmayeur, Bourg St. Maurice, Chamonix, Cortina, and Au Pra, odd specimens were occasionally disturbed as one walked through the herbage, amongst which they were no doubt hiding. At Fontainebleau they could, apparently, only be induced to fly at all freely quite late in the afternoon, but Zeller notes that, at Meseritz, in Posen, they were easily seen and captured in the twilight. He says that the species commences to fly after the middle of June, and is usually over by the end of July. Wallengren observes that it is more frequently on the move in the daytime than most members of the family

Habitat.—In Britain, it is very local, and confined practically to the chalk. Formerly, it used to be exceedingly abundant on the chalkhills at Mickleham and Box Hill, in Surrey, and on the chalkhills in the neighbourhood of the Devil's Dyke, Newmarket. Of late years, however, these localities have produced few, if any, specimens, but this by no means proves the absence of the species there. More recently, however, the neighbourhood of Folkestone and Dover has been more prolific in specimens, and one suspects that it is a much-overlooked species. Leech says that the insect is excessively local, occurring in a few places on the chalkhills and adjacent greensand. [Blackmore reports that he captured the species in July, 1864, in the Isle of Portland, but both this, and Wormald's record that he captured it on July 27th, 1867, in a swamp at West Wickham, want confirmation (see *infrà*).] Zeller says that its habitats are open, dry, sunny places, in which the foodplant, *Hieracium pilosella*, grows freely; it is, therefore, most frequently found in pine woods, especially on sheltered, gently-sloping, hillocks, and, in such situations, in places where few cattle are reared, the species is abundant enough; he says that it is pretty abundant throughout Germany on well-drained soils where its foodplant grows. In Posen, Zeller observes it as abundant at Meseritz, on dry sandy tracts, where *Gnaphalium arenarium*, *Artemisia campestris*, etc., grows abundantly, the imagines being easily seen and captured in the twilight. Zetterstedt observes that, in southern Scandinavia, it is found almost everywhere in fields, pastures, and pine forests. We found the species fairly commonly in a very restricted area in Fontainebleau Forest, not far from one of the main drives passing through it, and amongst rather sparse herbage, under, so far as we can remember, pine-trees; at Bourg St. Maurice, it occurred rarely on the lovely flower-covered banks above the bridge, as well as those much higher up the torrent; at Courmayeur, in Piedmont, on the other side of the Little St. Bernard Pass, the species also haunted the flowery slopes, lying directly behind the village at the foot of Mont Courmet, that lead up to the pine-forests that cover its steep sides; here the insect was taken at an elevation of more than 5000 ft. At Chamonix, odd specimens only were taken, one, on the flowery banks below Lavancher, which are again capped by pine-woods, the other in one of the openings among the bushes and boulders that cover the lower slopes of the Brévent. At Cortina, in the Tyrol, again, a single specimen was captured on the flower-covered banks at the foot of the Croda di Lago, where grassy openings lead up into the woods of the lower slopes. On other occasions we have found the species at considerable elevations, once at Megève, on a slope in a meadow, by the side of the Calvaire, when it flew freely at the end of the afternoon in the sunshine, and again at Bobbie, in the Pellice valley, where it also was found in the late afternoon on a rough rock-covered slope, covered with thyme and other attractive plants, and at the foot of which was a jungle of *Eupatorium*, giant salvias, thistles, willow, etc. In both these places it was in fair abundance. In the late afternoon of August 6th, 1902, at Megève, more than a dozen specimens were seen in a short time, but, by the next afternoon, the herbage had been cut, and only single specimens were noted in the locality afterwards. The species appeared to occur sparingly far up the Pellice Valley above Bobbie, and a single example was nettsd at Au Pra, on pasturages above

6000 ft. elevation. At La Grave, in the heart of the Dauphiny Alps, it occurred on the shaly banks where flowers were fairly abundant, near the village, as well as right up to the mountain-pastures by the Meije glacier. A single example was also found on the flower-covered bankside of a field, sheltered above by a pine-wood in early August, 1906, at Beauvézer, in the Basses-Alpes. Frey observes that, in Switzerland, it flies in dry forest-meadows, and in open spaces or clearings in the forests, sometimes in company with *O. ericetorum*. Caradja also reports it as frequenting meadows in Roumania, and Wallengren observes that, in the southern and central part of Sweden, it is the most common species of the family, being found almost everywhere; *Hieracium pilosella* grows scarcer, however, in Lapland, but the moth has been found as far north as Hollola, whence Zetterstedt obtained it; it prefers dry sunny places protected from winds, and pine-forests particularly are its favourite haunts. Snellen observes that it occurs throughout the whole of the Netherlands, in sandy localities, and is often common. In Germany, it flies everywhere in the neighbourhood of Stettin, where *Hieracium pilosella* grows; Sorhagen says that, in Friedland, Stettin, and Hamburg, it flies among *Hieracium pilosella* in dry woodland-meadows, and in open spaces in woods; Stollwerck observes that, in June and July, 1855 and 1856, the species was very common along the whole eastern slope of the Kleiner Hees, near Uerdingen, whilst the dry years 1857 and 1858 only yielded the species very sparingly.

British localities.—Exceedingly local, and possibly much overlooked. [Antrim: Belfast (Birchall).] Cambridge: Cambridge (*teste* Stainton), Devil's Ditch, Newmarket (*teste* Barrett). [Dorset: Portland (Blackmore), almost certainly *Capperia heterodactyla* (Bankes).] [Gloucester: Wootton-under-Edge (Perkins), Painswick district (Farn).] Kent: Folkestone (Purdey), Dover district (Webb), [Maidstone (*teste* Barrett),] [West Wickham (Wormald).] Surrey: Mickleham, common (Stainton), Box Hill (Barrett).

Distribution.—Central and northern Europe, southeast France, northern and central Italy, Armenia, Transcaspia (Tura) (Rebel). Asia: Asia Minor—Armenia (Rebel). Austro-Hungary: Bohemia—Nirdorf, Reichstadt (*teste* F. von Röslerstamm), Moravia—near Brünn (Gartner), Lower Austria—near Hernstein (Rogenhofer), Vienna district (Mann), Tyrol—near Innsbruck, lower alpine region up to 7000 ft., Taufers Valley (Weiler), Cortina (Tutt), Salzburg (Fritsch), Croatia, Banat, Transsylvania (*teste* Rebel). Belgium: Namur, Dinant, St. Servais, Vallée de la Molignée, common (Lambillion), Brabant, Rochefort (Crombrugghe). Bosnia and Hercegovina: Sarajevo (Apfelbeck). Bulgaria: near Rilo Monastery, up to 4000 ft. (Rebel). Denmark (Bang-Haas). France: Dept. Nord—Malo-les-Bains (Paux), Seine-et-Marne—Fontainebleau (Tutt), Cher—St. Florent, Indre—Nohant (Sand), Saône-et-Loire—Couches-les-Mines (Constant), Doubs—Maison-Rouge (Bruand), Savoy alps—Chamonix, Megève, Bourg St. Maurice, Dauphiny alps—La Grave, Basses-Alpes—Beauvézer (Tutt). Finland: Helsingfors, Hollola, Walamo (Tengström). Germany: Posen—near Meseritz (Zeller), east and west Prussia, not rare—near Domnau and Sorquitten (Speiser), Pomerania—in Vorpommern, not rare (Paul and Plötz), Stettin, wherever the foodplant grows (Büttner), Mecklenburg—near Friedland, common (Stange), near Parchim (Gillmer), Neustrelitz (Messing), Hamburg—Bahrenfeld, Steinbeck, Haake (Sauber), Hanover—Hanover (Reinhold), Misburger, Kirchhof (Glitz), Göttingen (Jordan), Rhine Provinces—Uerdingen, etc. (Stollwerck), Hesse—Wiesbaden (Rössler), Frankfort-on-Main (Koch), Cassel (Knatz), Waldeck (Speyer), Thuringia, everywhere (Knapp), near Sömmerda (Jordan), Anhalt—Cöthen, not rare (Gillmer), Brandenburg—Berlin, Grunewald, etc. (Zeller), Potsdam (Hinneberg), Frankfort-on-Oder (Sorhagen), Silesia—distributed, Glogau (Zeller), the Seefeld, near Reinerz (Standfuss), Upper Lusatia (Möschler), Kingdom of Saxony—Saxon Upper Lusatia, distributed, rather common

(Schütze), Bavaria—near Regensburg, Keilstein, Winzerberge, common (Hofmann and Herrich-Schäffer), near Munich, Isar-Auen (Hartmann), Württemberg, general (Steudel and Hofmann), Baden, general—Freiburg, etc. (Reutti), Alsace (Meess and Spuler), the Palatinate (Bertram). ITALY: Piedmont—Bobbie, Au Pra, Courmayeur (Tutt), Tuscany* (Mann), Alzate, Giardini (Turati). NETHERLANDS: distributed throughout, often common (Snellen). ROUMANIA: Grumazesti (Caradja). RUSSIA: Baltic Provinces, distributed—Riga district (Berg), Stint- and Jägelsee, Magnusholm, Œsel (Nolcken), Livonia—Kokenhusen (Lienig), Grösen (Rosenberger). SCANDINAVIA: throughout Sweden, as far north as Lapland—Ostrogothland, Gottland, Œland, Scania (Zetterstedt)—Trolle-Ljungby (Wallengren). SWITZERLAND: widely distributed, near Zürich, Pfäffikon, etc. (Suter).

N.B.—The record of *Pterophorus hieracii ?*, Galway—Merlin Park, mid-June, 1880 (*Ent. Mo. Mag.*, xvii., p. 81) is certainly *pilosellae* (J. J. Walker, *in litt.*, October 10th, 1906).

Genus: CROMBRUGGHIA, Tutt.

SYNONYMY.—Genus: **Crombrugghia,** n. gen. **Alucita,** Haw., "Lep. Brit.," p. 479 (1811). **Pterophorus,** Sam., "Ent. Usef. Comp.," p. 409 (1819); Zell., "Isis," p. 902 (1847); Frey, "Die Tin. Pter. Schw.," p. 408 (1856); Knaggs, "Ent. Ann.," p. 127 (1869). **Amblyptilia,** Stphs., "Illus. Brit. Ent. Haust.," p. 377 (1834); app. p. 424 (1835). **Oxyptilus,** Zell., "Linn. Ent.," vi., p. 345 (1852); H.-Sch., "Sys. Bearb.," v., pp. 370, 372 (1855); Jord., "Ent. Mo. Mag.," vi., p. 122 (1869); Staud. and Wocke, "Cat.," 2nd ed., p. 342 (1871); Staud., "Hor. Soc. Ent. Ross.," xv., p. 424 (1880); Frey, "Lep. Schweiz," p. 429 (1880); Jord., "Ent. Mo. Mag.," xviii., p. 122 (1881); South, "Ent.," xv., p. 35 (1882); Barr., "Ent. Mo. Mag.," xviii., p. 178 (1882); Snell., "De Vlind.," ii., p. 1028 (1882); Sorhgn., "Kleinschmett. Brandbg.," p. 3 (1886); Leech, "Brit. Pyr.," p. 56 (1886); South, "Ent.," xxii., pp. 32, 103 (1889); Barr., "Ent. Mo. Mag.," xxv., p. 431 (1889); Tutt, "Young Nat.," x., p. 164 (1889); "Brit. Nat.," i., pp. 141, 181 (1891); "Pter. Brit.," pp. 60, 62 (1895); Meyr., "Trans. Ent. Soc. Lond.," p. 485 (1890); "Handbook," etc., p. 431 (1895); Hofmn., "Deutsch. Pter.," pp. 95, 105 (1895); Staud. and Reb., "Cat.," 3rd ed., p. 71 (1901); Barr., "Lep. Brit. Isles," ix., p. 365 (1904). **Oxyptilia,** Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 790 (1877).

The genus *Crombrugghia*, as already noted (*anteà*, p. 411), forms one of the constituent sections of the tribe *Oxyptilidi*. It is Zeller's sect. *a* of *Oxyptilus* (*Linn. Ent.*, vi., p. 342), Herrich-Schäffer's sect. 4 of the genus *Oxyptilus* (see *antea*, p. 405), and Hofmann's group 1, sect. A (see *anteà*, p. 412 where his diagnosis of the imagines is given). The three most striking points of the imaginal structure are: (1) The depth of the cleft of the forewing. (2) The tendency to linear form of the lower lobe of the forewing. (3) The length of the 3rd plumule of the hindwing and the position of the scale-tuft thereon. So far as our British Oxyptilid species are concerned, there can be no difficulty in at once recognising *distans* by the scale-tuft being towards the centre rather than towards the apex of the 3rd plumule of the hindwing. The Crombrugghias, as exemplified by the larva and pupa, however, present marked characters separating them from *Oxyptilus*, as here restricted. The larval structure of *Crombrugghia* (as exemplified by *distans*) is particularly noticeable for the stellate-haired tubercles that replace the simple setæ in *Oxyptilus* (that of *laetus* is much modified). It is unfortunate that the larva of this our only British *Crombrugghia* (*distans*), has never been found in this country. Comparing, however, the pupal structure of *Crombrugghia* (*distans*) with *Oxyptilus* (*parvidactyla*), Chapman gives the following details:—

CROMBRUGGHIA (*distans*): Shows the normal structure for an ordinary plume pupa, *i.e.*, it is fixed in the usual way by a ventral and terminal cremaster, and has no arrangement for movement, nor any other for fixation. It has what (following

* Zeller observes that Mann's *pilosellae*, from Tuscany, appears to present no difference from *hieracii*.

Amblyptilia) we may consider the normal arrangement of dorsal spines, *viz.*, a double spine (one being the base of tubercle i, the other of tubercle ii). It has a small mediodorsal spine on the 4th or 5th abdominal segment. It has no extra hairs on appendages or elsewhere.

Oxyptilus (*parvidactyla*): Specially modified for existence in a cocoon, and with means for travelling to and fro therein. It has no mediodorsal spines, and the dorsal spines exist only on the 4th to 8th abdominal segments, are single, and modified into a hook suitable for assisting retrograde, and preventing forward, movement. The genital bosses on the 9th abdominal segment are developed into great hooks, arranged with concavity forwards. There is no forward cremaster, and, though there are many long hairs of the posterior cremaster, their ends are insufficiently hooked to be functional. They would form an excellent buffer on rapid retrograde movement. The other hairs are fairly developed, but there are no extra ones on appendages or elsewhere.

The two species, *distans* and *laetus*, are possibly the most difficult in the European "plume" fauna to separate in the imaginal stage by means of wing structure and markings, yet, in their early stages, they are most widely divergent, and this divergence is supported by an exceedingly well marked structural difference in the ♂ genitalia of the two insects. Before entering into a detailed account of the differences existing between the genitalia of these two species, so similar in appearance, we may quote Chapman's general remarks on the genitalia of the group. He writes (*in litt.*): "The ♂ appendages in the Oxyptilids bear some resemblance to those of the Agdistids, but differ very much from those of all other plumes. In the Platyptiliids we have, roughly speaking, a form of appendages not widely different from those of, say, the Noctuids or butterflies, *i.e.*, a chitinous ring with a dorsal process more or less produced in the median line, and one pair of hinged processes, 'the clasps,' with other smaller interior processes, and, centrally, the oedeagus. In the Oxyptilids, however, no chitinous ring is very obvious, nor is there a marked central dorsal process (it is small, pale, and hidden between the other parts, and is difficult to see), but besides the oedeagus, there seem to be not one, but three pairs of lateral-hinged appendages, and which of these is the homologue of the clasp in the Platyptiliids is not quite easy to pronounce. The dorsal pair presents a very clasp-like form, but the articulation is dorso-lateral, whilst that of the second pair is ventro-lateral, which suggests that these are the clasps as seen in most of the other groups of plumes; their somewhat less simple structure points in the same direction. The third pair is hardly visible in any other plumes, but is, I think, seen (along with the clasps) in some other families; they are comparatively small and quite ventral. The structure of the ♂ appendages shows that the Buckleriids (*paludum* and *siceliota*) belong to the Oxyptilid group. The different Oxyptilid species differ especially in the relative proportions, forms, and directions of these lateral apophyses To compare *distans* and *laetus* in illustration:

(1) The dorsal pair of apophyses are wider and heavier in *distans*, the dorsal margin nearly straight, but bent dorsad near the extremity, beyond the bend the texture of the appendage is a little different. There is a wide basal attachment, but the lower margin rapidly approaches the dorsal, and then, bending forwards, makes the basal half somewhat triangular, the terminal half somewhat baton-like. In *laetus* the general structure is the same, but the terminal half is much more slender, and, instead of bending dorsad and terminating in a rounded end as in *distans*, it curves ventrad, becomes rather thinner, and ends in a slight terminal enlargement with a ventral projection or point. There is little difference in length (about 0·34mm. from dorsal angle of base to end), but the more slender and curved process in *laetus* makes it look longer.

(2) The second pair of apophyses have a hard-looking basal portion, and a softer inflated-looking terminal portion which arises not from the actual extremity of the basal portion, but just below its end. In *distans* the basal and terminal portions are in a nearly straight line, and, approximately, of an uniform width (0·7mm. in overall length, and 0·09mm. wide). In *laetus* the basal portion of the process diminishes to half its previous diameter towards the end (basally it is much the same width as in *distans*), and bends ventrad, and ends in a slight enlargement much like that of the upper process. The further portion of the clasp is very much smaller (less than half the length) than in *distans*, is directed rather ventrally, and looks as if it were quite distinct from the basal portion, much more than is the case in *distans*. (The length of the basal portion is about 0·38mm., of the terminal appendages 0·09mm., in *distans* the two portions are approximately equal.)

(3) The small lower appendages are not very different in the two species, but are largest in *laetus*, they are about 0·26mm. long, and of very similar structure to the terminal portion of the middle (true clasps?) appendages. In these two species there appears to be a central dorsal triangular plate, not above the upper paired appendages, but buried between them, and only of about half their length; this is probably the dorsal plate; it has no terminal process, and is so buried between the lateral processes, and so pale and lightly chitinised, that it is far from conspicuous, and is, therefore, probably present in those Oxyptilid species in which I do not happen to have observed it."

It is, perhaps, not really so very surprising that two insects, so much alike in their general facies, yet with absolutely distinct larvæ and pupæ, should have so markedly different ♂ genital organs. The differences are so great that there can be no possible doubt about their absolute distinctness.

Crombrugghia distans, Zeller.

Synonymy.—Species: **Distans,** Zell., "Isis," p. 902 (1847); "Linn. Ent.," vi., p. 345 (1852); H.-Sch., "Sys. Bearb.," v., p. 372 (1855); Frey, "Die Tin. Pter. Schw.," p. 408 (1856); Staud. and Wocke, "Cat.," 2nd ed., p. 342 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 790 (1877); Staud., "Hor. Soc. Ent. Ross.," xv., p. 424 (1880); Frey, "Lep. Schweiz," p. 429 (1880); Jord., "Ent. Mo. Mag.," xviii., p. 122 (1881); Barr., "Ent. Mo. Mag.," xviii., p. 178 (1882); Snell., "De Vlind.," ii., pt. 2, p. 1028 (1882); Sorhgn., "Kleinschm. Brandbg.," p. 3 (1886); Leech, "Brit. Pyr.," p. 56, pl. xvi., fig. 11 (1886); South, "Ent.," xxii., pp. 32, 103 (1889); Barr., "Ent. Mo. Mag.," xxv., p. 431 (1889); Tutt, "Young Nat.," x., p. 164 (1889); "Ent. Rec.," i., p. 94 (1890); Meyr., "Trans. Ent. Soc. Lond.," 1890, p. 485 (1890); Tutt, "Brit. Nat.," i., p. 141 (1891); "Brit. Pter.," p. 62 (1895); Meyr., "Handbook," etc., p. 431 (1895); Hofmn., "Deutsch. Pteroph.," p. 105 (1895); Bankes, "Ent. Rec.," xii., p. 165 (1900); Tutt, "Ent. Rec.," xii., p. 217 (1900); Staud. and Reb., "Cat.," 3rd ed., p. 71 (1901); Barr., "Lep. Brit. Isles," ix., p. 365, pl. 414, figs. 7-7*a* (1904). **Didactyla,** Haw., "Lep. Brit.," p. 479 (1811). **Didactylus,** Sam., "Ent. Usef. Comp.," p. 409 (1819); Stphs., "Illus. Haust.," p. 377, in part (1834). **Trichodactyla,** Stphs., "Illus. Haust.," app. p. 424, in part (1835). **Tristis** var. *b*, Zell., "Isis," p. 38 (1847). **Laetus,** Jord., "Ent. Mo. Mag.," vi., p. 122 (1869); Knaggs, "Ent. Ann.," p. 127 (1869); South, "Ent.," xv., p. 35 (1882); Barr., "Ent. Mo. Mag.," xviii.," p. 178 (1882); South, "Ent.," xxii., pp. 32, 103 (1889). [**Laetidactylus,** Brd., "Ann. Soc. Ent. Fr.," p. 34, pl. ii., fig. 7 (1861).]

Original description.—Alis anterioribus luteo-fuscescentibus, laciniis obsolete albido-bistrigatis; digiti tertii dorso pone medium atro-squamato (♂ ♀).* After a long and very careful examination, I consider it preferable to declare the examples taken in Asia Minor and Italy a separate species, as I did *P. tristis*, in the list of the moths from Asia Minor (*Isis*, 1847, p. 38). They belong to two sections of *Pterophorus* in

* This was extended, in 1852 (*Linn. Ent.*, vi., p. 345), to: "Major, alis anterioribus luteo-fuscescentibus, laciniis obsolete albido-bistrigatis, arcu laciniæ posterioris marginali albido; digiti tertii dorso longe ante apicem atro-squamato (♂ ♀)."

which it is very difficult to discover reliable characters, when one cannot compare the larvæ and pupæ, in which it is to be expected that, for these southern Pterophorids, considered on the first impression to be different species, a confirmation will be found in the future. It may, of course, prove later that *P. distans* and *P. laetus* are only the different generations of the southern *P. tristis*, to which species I was very much inclined to refer these examples after a somewhat careful examination. What gives this supposition a greater degree of probability is the circumstance that a female taken by Löw, near Macri, at the end of May, agrees in all characters most exactly with my Silesian *P. tristis*, and, as such, not to be disputed, and that, of a pair taken near Kellemisch in the middle of May (the male, however, in the plain, and the female on the mountains), the male must be placed with *P. laetus*, the female with *P. distans*. *P. distans* is considerably larger than *P. tristis*. The coloration has a somewhat more yellow admixture, from which it appears to be of a more pleasant yellowish-grey brown. The markings are exactly the same. The white border of the costal fringes on the upper lobe of the forewings is not so broad as in *P. tristis;* on the underside the space from the apex to the hindmost transverse line, into which the white costal line runs, is notably paler and narrower. The chief difference, however, is presented by the black scale-tuft on the 3rd plumule of the hindwing; it is smaller, more diffusely formed, and decidedly somewhat nearer the base, and, as it is narrower, it is notably more distant from the apex than in *P. tristis*. At the apex of this plumule the female only has a black scale on the right wing; in the male it is entirely wanting. The male I took near Syracuse, on May 7th, in a grassy dell on the slope of the former Neapolis. The female came, as already mentioned, from the coast of Asia Minor (Zeller, *Isis*, 1847, pp. 902-3).

Imago.—14·7mm.-20·3mm. Anterior wings rusty-brown or pale ochreous in colour, the costa rather darker, except towards apex, which is nearly white; the lower lobe very linear on the outer margin, and scarcely excised; three more or less abbreviated fasciæ cross the wings transversely, *viz.*, a small whitish blotch extended into a crescentic shade at the end of the cleft; two transverse whitish lobal lines, the inner wider and somewhat lunular (the points turned outwards); the outer narrow, more parallel with hindmargin, and inconspicuous on lower lobe; the wing-apex sometimes edged with whitish cilia beyond the outer lobal line; a few scattered white scales on costa towards base; a faint white scaling forming an inconspicuous longitudinal discal streak; the fringes in the cleft very dark grey, paler where the lobal lines cross, cilia with white bases towards outer edge on upperside of cleft, a few scattered black scales throughout, but especially on upper edge; fringes of outer and inner margins of wings dark grey, rather paler where the lobal lines end, and somewhat darker between these. Posterior wings bright, shiny, coppery-brown, fringes dark grey (glossy like the plumules in some lights); the scale-tuft on 3rd plumule ill-developed, formed of a few short parallel black scales set close together, rather beyond the middle of the plumule; a few scattered black scales between the patch and base, also one or two isolated ones towards apex.

Sexual dimorphism.—There is none of the marked sexual difference in size or wing-markings seen in *Oxyptilus pilosellae*, both sexes being almost identical in these respects. The different form of the abdomina, however, distinguishes the sexes at a glance.

VARIATION.—The British specimens in our possession vary considerably in size, colour, and extent and intensity of markings. In size the limits of variation fall between 14·7mm. and 20·3mm. In colour there are two very distinct forms readily noticeable, one a bright rusty-brown (almost of the tint of the brightest ♂ *Marasmarcha lunaedactyla*), the other of a much greyer tint (inclining to a greyish-fawn, with a tinge of fuscous in it). These represent the two forms known in this country, respectively, as *distans* and *laetus* (though not apparently so described by Zeller), and are generally supposed to represent seasonal dimorphism, the early brood being composed of the brighter, and the later brood the greyer, specimens. In our experience this appears to be only partly true, but it has proved impossible to get specimens with full data of the two broods from the same locality in the same year, and, at Deal, where we know the species best, the greyer form has appeared on the wing, in different seasons, from the end of June to mid-August, all possibly belonging to the second brood of different years. Our brightest examples come from the Dover district, but the month of capture is not given. Whether the variation is not more largely a matter of habitat than season (first or second brood) must still be considered, therefore, an open question, but we suspect that it is. Besides these, however, there is a very pale ochreous form, a modification of the brightest brown forms. The markings vary from clear white to a dingy ochreous, and sometimes approach almost complete obsolescence. This tendency to failure is particularly noticeable in the markings connected with the apex of the wing, and in the outer lobal line, these markings being very conspicuous in some examples, whilst, in other specimens, at the other extreme, they are practically obsolete, and, to a less extent, the failure also frequently shows in the lower half of the inner lobal line. There is, too, considerable difference in the number of white points on the costa, and on the disc of the forewing, whilst the colour of the hindwings, usually bright coppery-brown, is, in the greyest examples, often of a black-grey tint, tending to darken the general appearance. In the fringes, the scaling of the cleft of the forewings is worthy of examination, the number of short black scales, and the amount of development of the pale sections, where the lobal lines cross, varying considerably; there are also some little differences exhibited in the fringes of the inner margin. The scale-tuft is entirely different in position from that of the other British Oxyptilids, is very small and inconspicuous, and the scales forming it are rather readily lost; the number of black scales on either side of the scale-tuft, along the margin of the plumule, varies considerably. Zeller's colour description of *distans* is "luteo-fuscescentes," and the dark dirty-brown tint usually connected in our entomological literature with the term "fuscous," precludes the usual assumption that our brightest brown form of this species is really *distans*. Accepting this as a basis of grouping, our own inclination is to group the specimens we get in Britain as follows:

1. Bright rusty-brown with white markings = ab. *brunnescens*, n. ab.

1*a*. Bright rusty-brown with ochreous markings = ab. *ochrea-brunnescens*, n. ab.

1*b*. Bright rusty-brown with obsolete markings = ab. *obsoleta-brunnescens*, n. ab.

2*a*. Pale ochreous, or greyish-ochreous, with white markings = ab. *intermedia*, n. ab.

2*b*. Pale ochreous, or greyish-ochreous, with ochreous markings = ab. *ochrea-intermedia*, n. ab.

2*c*. Pale ochreous, or greyish-ochreous, with obsolete markings = ab. *obsoleta-intermedia*, n. ab.

3*a*. Yellowish-fuscous, or dirty greyish-brown, with white markings = *distans*, Zell.

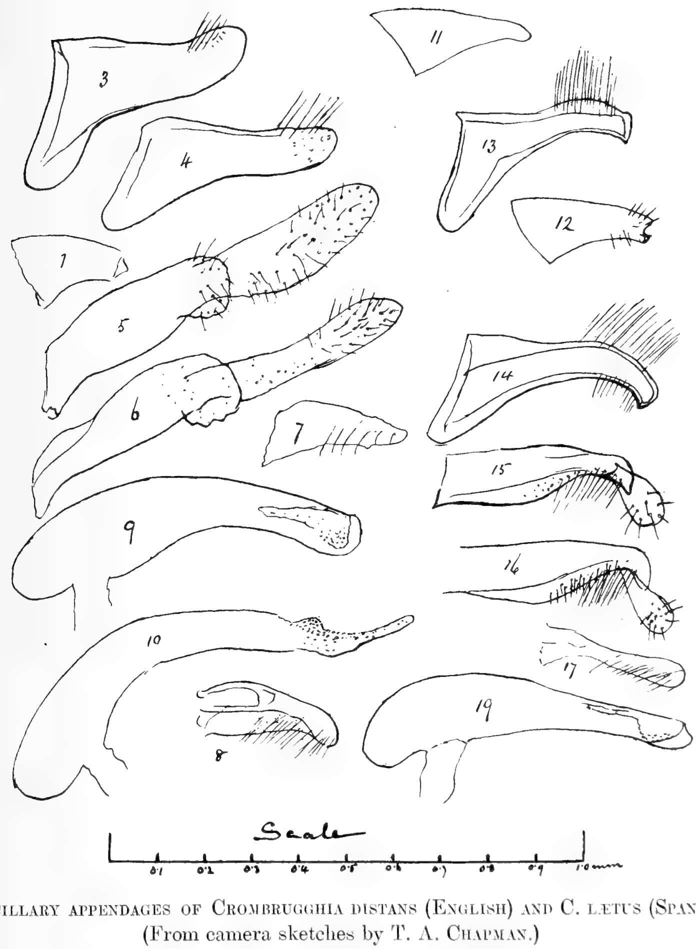
3*b*. Yellowish-fuscous, or dirty greyish-brown, with ochreous markings = ab. *ochrea-distans*, n. ab.

3*c*. Yellowish-fuscous, or dirty greyish-brown, with obsolete markings = ab. *obsoleta-distans*, n. ab.

So much for the variation as exhibited in our own series of comparatively recently caught British examples. For further comparison we have in our possession some 30 other specimens from various British and continental sources, *viz.*, (1) Two British examples, bred by Norgate, in July, 1892, from pupæ obtained in Suffolk, particularly strongly marked with fuscous, and these tally almost exactly with (2) four specimens sent by Zeller to Barrett as *distans*, and labelled "Rhætia," so that one may safely assume that they are from Bergün, where the examples, although "generally larger than those from North Germany" (see *Stett. Ent. Ztg.*, 1878, p. 163), yet one supposes to be not very dissimilar to those from Glogau, where Zeller found the species not at all common, and of a form which he says (*Linn. Ent.*, vi., p. 346) is like the Syracuse (Neapolis) (♂) and Macri (♀) specimens [described (*Isis*, 1847, p. 902) as the typical examples of *distans*], and a single specimen from Dalmatia. These are the darkest, largest, and coarsest-scaled examples of *distans* known to us. The nearest approach to these are (3) seven examples from St. Michel-de-Maurienne, taken August 1st-5th, 1897; they are less fuscous, but still belong rather to the *distans* form noted above than to any other dealt with. [It is to be noticed that, of these, the Suffolk examples were bred at the end of July, the St. Michel specimens were taken in early August, the Glogau examples also in July, the Syracuse example in May, and the Macri specimen in September, so that Barrett's idea that *distans* consisted of specimens of the first brood is hardly supported by the facts.] Allied to this form, but not quite so closely, since they are not quite shaded to the same extent with fuscous, are (4) two examples taken—one at Hyères, April 28th, 1905, and the other at Draguignan, May 4th, 1905, of a pale greyish-yellow, very slightly shaded with fuscous, and with faint markings, except the second inner line which is very well developed; these are particularly characterised by their pallid appearance. We have also under observation (5) a large specimen taken by Chapman in Macugnaga, of the colour of Norgate's bred, and Zeller's Rhætian, examples. (6) A long series of British-caught specimens, without data, from the "Mason collection," mostly of a pale ochreous tint, and with scarcely any fuscous in any of the examples (? faded), the range of tint extending from pale ochreous to a distinct reddish or rusty-brown. Besides these we have for comparison (1) a single specimen sent by Zeller to Barrett as *laetus*, and labelled "Messina," which is probably one of the three original examples noted by Zeller in his original description of *laetus* (*Isis*, 1847, p. 903), and taken in July (see *posteà*). [Superficially this bears considerable resemblance to our two Riviera specimens, noted above, the latter being, however, slightly more tinged with fuscous.] (2) Agreeing almost exactly with Zeller's "Messina" specimen is a long series of specimens taken by Chapman in June and July, 1903 and 1904, in central Spain, at Bejar, La Granja, Soria, Moncayo, etc. These are of a bright ochreous tint, but there can be no hesitation in referring these to Zeller's *laetus*, whilst the most extreme of these Spanish forms are so warmly tinged with reddish, that the deepest coloured examples are rather bright rusty-brown than ochreous, and these are, one suspects, Zeller's *laetus* var. β, which he noted as "brunnescens." (3) A specimen bred (?with others) by Walsingham, from a larva found on *Andryala*, at Granada, and which is evidently identical with Zeller's "Messina" *laetus* and Chapman's Spanish *laetus*. The closest comparison of these *laetus*, or more ochreous specimens, with the more fuscous *distans*, by Chapman and ourselves, failed entirely to discover any structural difference in the wing-structure or markings, and, presumably, we had to accept *distans*, Zell., and *laetus*, Zell., as one species, for Durrant had written (*in litt.*, December 3rd, 1904) that Lord Walsingham and himself had carefully studied all the original material in the "Zeller" collection, with the result that they were unable to separate *distans*, Zell., from *laetus*, Zell., "in fact," he added, "we agreed with your conclusion, written (*Pter. Brit.*, pp. 62-64) some years ago." But this was not altogether satisfactory, we had the pupal skins of Norgate's two *distans*, we had, also, Hofmann's description of the larva and pupa of the German *distans*, which evidently belonged to the same insect. We had, also, the larva and pupa of Walsingham's Granada *laetus* from *Andryala*, and Milliére's description and figures of the same *Andryala* insect, and these larvæ and pupæ of *laetus* were as different, structurally, from those of *distans* as could well be imagined, the former inclining to the *Buckleria* structure, the latter to the *Capperia* form. Separating, therefore, the specimens on their superficial appearance into the two groups noted above, Chapman kindly undertook the detailed examination of the genital organs, with the result that they were found to be entirely different, and proved absolutely the difference of the species, and supported the wide differences existing between the larvæ and pupæ of the two insects. That some of our British specimens of *distans* are indistinguishable from *laetus*, on wing structure and appearance, appears to be true, but *laetus*, so far as we know, is a purely southern species, confined to southern France (Lyons appears to be its most northerly point), Spain, Italy, etc., and overlapping, in south France (Riviera), Italy (Zeller), etc., *distans*, which has a much wider distribution. Snellen observes that "the 3rd plumule of the hindwing of *distans* is longer than that of the other Dutch Oxyptilid species, being above two-thirds and almost three-fourths the length of the 2nd plumule, its inner marginal fringe at the base white; the black scale-tuft is placed at two-thirds; three or four black scales are visible nearer the base, and one or two on the lower side of the apex." Hofmann observes (*Deutsch. Pteroph.*, p. 105): "The examples from the Alps are distinguished by their great size, 11·5mm., and darker brown coloration, from those of the north German plains which only measure 9mm. The black scale-tuft of the 3rd plumule of the hindwing is, in these alpine examples, very variable." Probably, this accounts for Zeller's statement (*Linn. Ent.*, vi., p. 345) that *distans* is the largest species in the section, for it is certain that the average size of British examples is a shade below that of British *pilosellae*, etc., yet the types of *distans* from Zeller, in the Barrett collection, are of about the same expanse as our larger British examples (see *infrà*), but one caught by Chapman at Macugnaga is much larger. (Our smallest and largest British *distans* and *pilosellae* are 14·7mm. and 20·3mm., and 15·6mm. and 19mm. respectively.) Rössler notes, of the Hesse specimens, that they are "rather large in size, nearly that of *Marasmarcha lunaedactyla*, of a pale yellowish-red colour, mixed with more or less grey." Of our continental examples of *distans* we have the following measurements: from Draguignan 19·0mm., St. Michel-de-Maurienne 19·0mm., Rhaetia (from Zeller) 19·4mm., Macugnaga 22·0mm., whilst Norgate's bred Suffolk examples are 19·5mm., so that whilst these are above the size, 9mm. × 2 = 18mm., given by Hofmann for examples from the north German plains, Chapman's large example from Macugnaga is 1mm. less than Hofmann notes the Alpine specimens, *viz.*, 11·5mm × 2 = 23mm. Speaking of the British specimens, Barrett notes (*Lep. Brit. Isles*, ix., p. 366) the species as "a little variable in tone of colour and the degree of darker dusting on the forewings. Specimens of the second generation, taken in August, are commonly paler and more smoothly light fawn-colour; those of the June emergence darker and dusted; these last seem to agree accurately with Zeller's *distans*, the paler forms with his *laetus*. Those found on the south coast of Kent are especially soft in colour," etc. In his earlier differentiation, he notes (*Ent. Mo. Mag.*, xviii., p. 178) that "*distans* is larger, darker in colour, and coarser-looking than *laetus*, but without any reliable difference in markings between typical *distans* and *laetus* received from Zeller. Those British examples to which the name of *laetus* was applied, were second-brood examples, lighter and brighter-coloured than those of the first brood, the majority of which were larger, decidedly darker in colour, and agreed accurately with specimens of *distans* received from Zeller; others, however, of these early examples, incline towards the brighter-coloured forms, of which the second brood is mostly composed; specimens taken at Folkestone by Purdey (which agree absolutely with continental *laetus* from Zeller), are rather paler than any Brandon specimens I have seen." In Barrett's collection are four specimens of *distans*, labelled "Rhaetia," and one of *laetus*, labelled "Messina," all received from Zeller; these are now in Chapman's possession, and have already been referred to (*anteà* p. 454) at length. South considers that the Devon examples belong to the *laetus* form. Of course, all our British examples, so far as is known, belong to one species only, *viz.*, *distans*.

Historical notes on Crombrugghia distans and C. lætus.—In Staudinger and Rebel's *Catalog*, 3rd ed., p. 71, *laetus* is sunk as the summer brood of *distans*. We have here a curious instance of continental authorities following our British lead when we are wrong, notwithstanding an often-observed constitutional objection to doing so when we are right. In the previous edition (1871) they were kept distinct. In Great Britain *laetus* does not occur, only *distans*, yet for many years pale forms of the species (*distans*), pale either geographically, seasonally, or from fading, were recorded and accepted as *laetus*, although there was a good deal of controversy as to whether they were really distinct. Barrett possessed a type specimen of *laetus* given him by Zeller (now in my possession), and, since we now know that it is difficult, if not impossible, to say positively about any specimen (or, at least, about a good many specimens), with no other guidance than its colour and wing-markings, to which species it belongs, it was very natural

PLATE IV.



ANCILLARY APPENDAGES OF CROMBRUGGHIA DISTANS (ENGLISH) AND C. LÆTUS (SPANISH).
(From camera sketches by T. A. CHAPMAN.)

Natural History of the British Lepidoptera, 1906.

[For explanation see back.]

PLATE IV.

[To be bound facing p. 457.]

DIAGRAMMATIC REPRESENTATION OF ANCILLARY APPENDAGES OF CROMBRUGGHIA DISTANS (BRITISH) AND C. LÆTUS (SPANISH).

Fig. 1. —Dorsal piece, *C. distans.*	Figs. 11-12.—Dorsal piece, *C. laetus.*
Figs. 3-4.—Upper appendages ,,	Figs. 13-14.—Upper appendages ,,
Figs. 5-6.—Intermediate appendages ,,	Figs. 15-16.—Intermediate appendages ,,
Figs. 7-8.—Lower appendages ,,	Fig. 17.—Lower appendages ,,
Fig. 9. —Ædœagus ,,	Fig. 19.—Ædœagus ,,

Fig. 10.—Ædœagus of *C. distans*, eversible membrane exserted.

N.B.—*C. distans* is our only British form. *C. laetus* is clearly a distinct species as given by Zeller. *C. lantoscanus* is a distinct species, not a form of either of these. In the latter the intermediate appendages are straight, as in *C. distans*, the end piece short, as in *C. laetus*, with other differences.—T. A. CHAPMAN.

on the part of Barrett to identify some British specimens of *distans* as *laetus*, and in this he followed, and was followed by, a good many of our leading lepidopterists. Facts, however, though difficult to seize and define, were too strong to admit of this conclusion standing, and, by 1882, we find Barrett concluding that *distans* and *laetus* were one species, a spring and a summer form. In this conclusion, South, Tutt, and others finally acquiesced. In his *Lepidoptera of the British Islands* (*circa* 1903), Barrett says, as a final conclusion, "these last seem to agree accurately with Professor Zeller's *O. distans*, the paler form with his *O. laetus*. Those found on the south coast of Kent are especially soft in colour. I think that Professor Zeller ultimately felt doubtful of the distinction of his *O. distans* and *O. laetus*. They seem to be no more than faint variations of this one species." This probably sums up the view of the two species that had obtained for about twenty years. There is no fault to find with the position, as regards British examples, since, so far as we yet know, no true *laetus* has been found in these islands, nor is likely to be (though the sporadic occurrence of an imported specimen, as of so many quite southern species, is just possible). The error is in applying this true, but insular, conclusion to the whole continental area, as evidenced by Staudinger and Rebel's *Catalog*, published in 1901; for how long before this date *laetus* was understood to be sunk we do not know. Barrett's belief as to Zeller's change of opinion may be quite correct. When Zeller dealt with these two species (1847), he possessed an acumen that is rarely reached and never exceeded. He saw distinctly that there were two species, though, how he did it on the obvious imaginal characters, it is hard for us to understand; he was, however, one of the giants, and we are but pigmies. When asked for his opinion many years later, he probably was ready to acquiesce in what he took to be the modern conclusion on a subject he had not looked at for so long, but such acquiescence goes for little. When I looked over specimens from the Walsingham collection, I found a moth (from Granada) that I could not separate from *distans*, yet it had a larva and pupa quite different from the described larva and pupa of *distans*, with which a *distans* pupa (from Mr. Norgate) quite agreed. I found also that a number of Spanish specimens before me, had genitalia (♂) quite different from any other European *Oxyptilus* I had examined. These specimens I found to be indistinguishable from Lord Walsingham's specimen, and, individually, indistinguishable from *O. distans*, yet the facies of the whole series was very clearly different from that of a series of *distans*. They were smaller, slighter, and paler. When Mr. Tutt came to the consideration of *O. distans* for his "British Lepidoptera," he found himself prejudiced in favour of the British view, and, as luck would have it, I forgot for the moment the result of my examination of the genitalia made some twelve months before. In discussing the matter, therefore, he thought there might be some error about the Walsingham specimen. Millière's account of *laetus* would be very valuable corroborative evidence, but was not clear enough to form a sound foundation. I then remembered what had made me so positive that the Spanish were quite distinct from the British examples, and, on repeating the examination on further specimens of both species, there was no escape from the conclusion that they were absolutely distinct. Lord Walsingham's larvæ and pupæ beca thoroughly trustworthy, and even Millière's plate and descrip were found to contain very strong confirmatory evidence (Chapman). Zeller observes (*Linn. Ent.*, vi., p. 345) that "*distans* is the largest species in this section, approaching in colour *P. pilosellae*, but, as a rule, with a greater admixture of grey. This is particularly the case with the few examples caught near Glogau, and solitary specimens from Dalmatia and Syracuse. In the Asiatic examples the quantity of grey is very insignificant, except in a ♀ from Macri, and consequently the colouring is a trifle lighter and less vivid than in *P. pilosellae*. The white bent line in the fringe of the hindmargin at the anal angle is very distinct, and presents a good mark of distinction from *P. tristis*. The intensity of the black scale-tuft, on the hind edge of the 3rd plumule of the hindwing, varies, and hence also does its distance from the apex of the plumule." Staudinger writes (*Hor. Soc. Ent. Ross.*, xv., pp. 425-7) that he refers "a ♂ caught May 14th in the Kerasdere, and a ♀ captured May 19th in the Tschirtschur Valley, to *distans*, although Wocke looked on the latter as *laetus*, which may be right, as *laetus* is a smaller, paler (more yellow, lighter), southern form of *distans*.* Mann, too, notes that *distans* is to be found in June, near Amasia, and in May, near Brussa. It appears to me that *laetus* is, in the south, the later brood of *distans**, as examples caught by myself near Granada,† in April and May, can hardly be separated from the German *distans*, whilst, in August and September, I caught, at the same place, typical small *laetus*, which possibly was even a third brood, as I found, in the second half of June, typical *laetus*, also near Granada. Zeller, too, caught his examples from the middle of June right into August, in Italy, and Loew, in Asia Minor, captured some in September and November (*Isis*, 1847, p. 903), near Attalia, Addionas, and Kellemisch. These *laetus*, Zeller mentions, in his note on Loew's captures (*Isis*, 1847, p. 38), as *tristis* var., but, in his list of Sicilian insects (*op. cit.*, p. 903), he refers them to *laetus*, whilst as he does not notice in his monograph (*Linn. Ent.*, vi., p. 345) that *tristis* occurs in Asia Minor, but does observe that *distans* was caught by Loew near Macri and Kellemisch, it is only logical to suppose that he finally concluded that the specimens from Asia Minor, at first supposed to be *tristis*, were *distans* and *laetus*. Johann sent me later several very typical *laetus*, from Amasia, unfortunately without dates, but I suspect they were autumnal captures. Mann, of course, mentions that *laetus* and *distans* were caught together in May, near Brussa. I also received, from Krüper, nearly typical *laetus*, captured as early as April 24th, near Smyrna, and that is why I mention here that *laetus* may be specifically distinct from *distans*, although I possess all intermediates imaginable between the two forms‡. Lederer notes *laetus* caught on the mountain slopes near Kis Aolé, but without dates." Herrich-Schäffer observes that "*distans* is somewhat larger than *tristis*, and has the colour of *obscurus*, differing, however, from the latter in the scale-tuft, which is placed further back from the apex on the 3rd plumule. The fringes of the cleft of the forewings are, at the apical half, sharply white basally, with the black longitudinal streaks as in

* This we have now shown to be entirely incorrect, the species being absolutely distinct in every stage.

† It is quite clear from the specimens in the Walsingham collection that *laetus* occurs at Granada, on *Andryala* ; one is inclined, therefore, to suspect that Staudinger's *distans* taken here are to be referred to *laetus*.

‡ This sentence shows that Staudinger's instinct was right in spite of the apparent opposition presented by the facts.

trichodactyla, those of the lower lobe likewise broadly white at the base, with a black tuft at the apex, and at the anal angle, and therefore very different from *obscurus*." One is quite at a loss to understand how Herrich-Schäffer can assert that the ground colour of *distans* is like that of *obscurus* (*parvidactyla*); they are, of course, so far as we know them, utterly dissimilar. The synonymy of *laetus*, and Zeller's original description read as follows:

Laetus, Zell., "Isis," xii., p. 903 (1847); "Linn. Ent.," vi. p. 346 (1852); H.-Sch., "Sys. Bearb.," v., p. 373 (1853); Mill., "Icon.," i., p. 333, pl. xxxix., figs. 7-11 (1864); Staud., "Cat.," 2nd ed., p. 342 (1871); "Sta., "Ent. Mo. Mag.," vi., p. 36 (1879); Jord., "Ent. Mo. Mag.," vi., p. 122 (1879); Staud., "Hor. Soc. Ent. Ross.," xv., pp. 425-7 (1880); Barr., "Ent. Mo. Mag.," xviii., p. 178 (1881); South, "Ent.," xv., p. 35 (1882); xxii., p. 33 (1889); Tutt, "Brit. Pter.," p. 65 (1895); Staud. and Reb., "Cat.," 3rd ed., p. 71 (1901). [*Laetidactylus*, Brd., "Ann. Soc. Ent. Fr.," p. 34, pl. ii., fig. 7 (1861).]—*P. laetus*.—Corpore alisque anterioribus ochraceis, his postice grisescentibus; laciniis obsolete albo-bistrigatis; digiti tertii dorso longe ante apicem squamis paucis atris instructo. Var. *β*. Alis anterioribus, brunnescentibus, basi dilutiore (As. Min., Rom.).—Size, like that of *P. tristis*, variable (expanse of forewings $3'''$-$4\frac{1}{2}'''$). Ground colour of body and forewings light ochre-yellow. The upper lobe, before the first and up to the second white transverse line, somewhat brownish; on the costa itself brown; the fringes beyond the second transverse line narrowly white, as in *P. tristis*, and, on the underside, less pure white, and, therefore, contrasting but little with the light ground colour. At the hind angle of the lower lobe, the white in the fringe usually more restricted than in *P. tristis*. The plumules of the hindwing more yellowish-brown and lighter, the scale-tuft on the 3rd plumule is always smaller, and consequently at a greater distance from the apex; at the apex are from 3 to 0 small black scales. The entire underside is much yellower than in *P. tristis*, and the abdomen particularly light without any brown. The other details agree with the latter species. The Asiatic example (from Kellemisch) is the largest, and is particularly dark (deep) in colour; the first white transverse line and the spot at the cleft are slightly shiny. A ♂ from the Campagna, near Rome, is exactly like it, but is smaller. I caught specimens on June 26th, near Catania, in company with *P. acanthodactylus*; and, on July 10th-11th, three examples in dry spots on the mountains near Messina; in the Campagna, south of Rome, specimens were flying, not rarely, on dry grass patches on August 24th and 28th, in exactly the same manner as our *P. pilosellae*. The species is probably on the wing for a long period. Dr. Loew caught it in Asia Minor as late as September-November (Zeller). DISTRIBUTION: Europe (south and central), Asia Minor, Armenia, Tura, Mauretania, Canaries (Staudinger and Rebel). [One supposes that "Central" Europe will now have to be deleted.]

Some five years after Zeller had written the original description of *laetus*, he monographed the "plumes," and gave the following diagnoses of the two forms he recognised (*Linn. Ent.*, vi., p. 346):

α. Alis anterioribus pallide ochraceis, laciniis obsolete albido-bistrigatis; digiti tertii dorso longe ante apicem squamis paucis atris instructo (♂ ♀).

β. Alis anterioribus brunnescentibus, basi dilutiore.

He then notes: "The very light ochreous colour, and the smaller scale-tuft on the 3rd plumule, readily separate this species from *P. tristis*, whilst the smaller size of its body distinguishes it from *P. distans*; var. *β*, although darker than the type, is still considerably lighter than *distans*." He adds "Castle Abbadessa in Dalmatia, in June, singly on pasture-land (Mann)," to his previous localities. Staudinger and Rebel give *laetus* under *distans* as "gen. aest." (*Cat.*, 3rd ed., p. 71) and simply diagnose it as "minor, pallidior," which is not illuminating. Chapman's recent work has shown conclusively that Millière's *laetus* (*Iconographie*, i., pp. 331 *et seq.*) belongs here; and, for reference, we here give Millière's account of the insect, which reads as follows:

Oxyptilus laetus.—Cet insecte a de grands rapports avec le *laetus* de Zeller. Il possède des caractères constants qui, à la rigueur pourraient en faire une espèce distincte ; mais je l'avoue, ces caractères ne sont point assez importants pour créer une espèce nouvelle. L' *Oxy. laetus* n'était pas connu dans ses premiers états ; je remplis une lacune dans son histoire en racontant ce qui restait à en dire. CHENILLE : Fusiforme, faiblement convexe, très-atténuée aux extrémités. D'un jaune de Naples clair, lavé de carné inférieurement et sur le dos. On ne distingue pas les lignes ordinaires, et la villosité abondante propre au plus grand nombre des chenilles de Ptérophorites, est ici rare et courte. Les anneaux sont bien distincts, et il règne un sillon assez profond sur la région dorsale. Le ventre est concolore et sans lignes. La tête, petite, globuleuse, testacée, est noirâtre sur les côtés. Les pattes sont concolores, sauf le dernier article des écailleuses qui est rougeâtre. Les trapézoïdaux qu'on ne voit qu'à l'aide d'une très-forte loupe, sont indiqués en rougeâtre. Le premier segment est surmonté de deux traits noirs parallèles, accompagnés de chaque côté d'un gros point noir. FOODPLANT : Cette chenille vit aux dépens des fleurs de l'*Andryala sinuata*, L., plante assez rare dans nos environs, ou plutôt cantonnée dans certaines localités chaudes et pierreuses. L'insecte sort de l'œuf lorsque les fleurs de l'Andryale sont épanouies, c'est-à-dire en juillet; sa croissance est rapide. Bien que fort petite, cette chenille cause un grand dommage aux fleurs dont elle fait sa nourriture, car elle en lie le sommet alors qu'elles ne sont point entièrement développées, ronge la base des étamines, les atrophie et en empêche le développement. PUPATION : Vingt jours suffisent à l'insecte pour atteindre sa grosseur ; il se place alors au centre d'un groupe de fleurs pour opérer sa métamorphose. PUPA : La nymphe est bientôt formée ; celle-ci, allongée, grèle, brune, non villeuse, passe au noir deux ou trois jours avant l'éclosion du petit Lépidoptère, La chrysalidation dure quinze jours au plus. INSECTE PARFAIT : Envergure 0·016 à 0·017 mill. Les ailes supérieures, profondément échancrées, d'un brun clair, présentent deux taches blanchâtres, vagues, oblongues, placées sur la branche supérieure des ailes qui sont elles-mêmes largement teintées de brun foncé à la côte. Les inférieures ont les deux premiers rameaux bruns ; le troisième également brun porte trois ou quatre écailles noires au bord inférieur de la côte. Tête et thorax roux ; abdomen brun avec deux traits jaune paille au sommet de chaque segment. Ces traits sont séparés par une tache cunéiforme noire. Les franges sont longues et concolores. Les pattes, blanches, sont maculées de brun aux articulations. Les tarses sont blancs. PARASITES : Cette espèce est attaquée dans de grandes proportions par un parasite de la nombreuse famille des Ichneumons. J'ai vu éclore plus de la moitié de ces parasites à la place des insectes que j'attendais. Cet Hyménoptère a été figuré (pl 39, no. 9). LOCALITIES : *Oxyptilus laetus* vient augmenter la liste de notre faune lépidoptérique lyonnaise. J'ai recueilli la chenille et l'insecte parfait de ce Microlépidoptère au pied de la montagne d'Yseron, dans la propriété même de notre collègue M. Maurice Ferrouillat. Ce Ptérophore appartient encore aux environs de Perpignan (Pyrén.-Orientales), de Thiers (Puy-de-Dômc), et de la Voulte (Ardèche). Je l'ai pris moi-même dans chacune de ces localités. OBSERVATION : Le nom de *laetus* me semble mal appliqué à cet insecte, et peut induire en erreur. Si l'antériorité n'était respectée, ce nom pourrait être plus judicieusement remplacé par celui de *Andryaladactilus* ou mieux *Andryalae* qui rappellerait la plante dont la chenille se nourrit (Millière).

COMPARISON OF CROMBRUGGHIA DISTANS WITH ITS ALLIES.—The close relationship of *C. distans* and *laetus* in the imaginal stage has already been fully dealt with. Concerning its other allies Hofmann observes that *distans* is "very near to *O. tristis*, but to be separated from that by the red-brownish or yellow-brownish coloration, which approaches that of *O. pilosellae*. At the anal angle of the lower lobe there is usually a narrow white dash in the fringes, to the upper part of which is adjoined a narrow, white, basal line of the outer marginal fringes, which mostly reaches to the apex of the lower lobe, though it sometimes vanishes even before the apex; about the middle of the outer margin ; such examples are only to be separated by their coloration from *O. tristis*, in which also a short commencement to a basal line in the fringes above the white dash at the anal angle sometimes occurs. The white transverse lines of the lobes are sometimes more, sometimes less, pronounced. The black scale-tuft on the 3rd plumule is variable in respect to size, as a comparison of 28 examples has taught me, sometimes smaller than in *O. tristis*, but also sometimes larger, that is more streak-like, stretched lengthwise. Beyond the scale-tuft the fringes have a fine, white, basal line up to the apex, at which a few isolated black scales often lie."

Ovum.—Undescribed.

Habits of larva.—Hering (*Stett. Ent. Zeitg.*, 1891, p. 224) first noted that Herms had found the dusty grey-green larvæ of the second brood at the end of June and beginning of July, in the park of Hohenkrug, feeding on the flowers of *Crepis tectorum*, in the same way as the larvæ of *Geina didactyla* do on those of *Geum rivale*. Hofmann repeats this, but adds *Crepis virens* as a foodplant, and notes that the larvæ of the first brood, occurring in early spring, must have, in any case, a different habit; he opines that they possibly live spun-up within the central shoot of the young plant. Durrant swept two larvæ in early August, *circ.* 1898, from, it is believed, *Picris hieracoides*, but one small larva was injured, and, although the other pupated, the pupa produced an ichneumon.

Larva.—12mm. long, green, with large, dark brown, stellate-haired tubercles in the usual positions. The red-brown markings consist of a broad, dorsal stripe, an indistinct, washed-out, narrow subdorsal, and similar supraspiracular, a rather broad spiracular, and a basal consisting of separated spots. Spiracles margined with dark brown. Head shining black. Prothorax green, the centre with a large black-brown spot, divided by a fine central line. Anal flap brownish-yellow, beset with bristles. Thoracic legs with 1st and 2nd joints black, the third whitish. Anal claspers with a brown chitinous plate on the exterior (Hofmann). Described from preserved larva received from Dr. Hinneberg, of Potsdam). [Head dark brown, almost black. Thorax with pronotum dull grey-green, with slight, dark brownish, longitudinal streaks at the sides and on the middle. A broad dorsal streak, much mottled with dull reddish, commences behind the pronotum, and extends to the anal segment; the sides of all the segments dull olivaceous-green, becoming somewhat paler beneath; covered with tufts of long and short whitish hairs, some short ones scattered between the tufts. True legs greyish, with their basal two-thirds brownish externally; anal claspers and abdominal prolegs concolorous with the venter (Durrant. Described from two larvæ, swept near Merton, in August, from *Picris hieracoides*, one small one was bruised and died, the other pupated but produced an ichneumon).]

Foodplants.—Flowers of *Crepis tectorum* (Herms *teste* Hering), *Crepis virens* (Schütze, confirmed by Norgate), [*Hieracium* (Sorhagen),] *Picris hieracoides* (Durrant).

Pupation.—For pupation, the dusky grey-green larva of the summer brood simply fastens itself to a leaf, flower, or stalk of the foodplant, like that of *Geina didactyla*, the pupal stage lasting at most ten days (Hering); pupæ found attached to the flower-heads of *Crepis virens* (Norgate).

Pupa.—Variable in colour, light brown to nearly black, with white bristles on the small tubercles of the abdominal segments. The dorsal keels are moderately developed, but furnished with strong thorn-like processes terminating in two points directed upwards; at the bases of these stand two white bristles, one directed forwards, the other backwards. The thorn-like process of the 4th abdominal segment has the longest points, and also a third small point directed backwards; the abdominal segments 5-9 bear similar thorn-like processes, which, however, gradually become smaller towards the anal end. The thorn-like process of the 5th abdominal segment sometimes also exhibits a third very small point directed backwards. The nervures of the wing-cases do not carry bristles (Hofmann. Described from pupa received from Hinneberg, of Potsdam). Length 9mm. Abdomen cylindrical; thorax somewhat compressed dorsally. Pupa looks very hairy, the result of the length of the hairs, for it possesses only the primary tubercular hairs (and apparently *all* of these), but no secondaries, either on the tubercles or skin-surface. The colour is pale, so that, in life, it had no markings, and was pale green (appendages darker) or ochreous. The dorsal flanges (head to 3rd abdominal segment) are well developed, and, on the abdominal segments (1-8), are tall processes, carrying i and ii. They are tallest on 1-3, where they arise from the flange. They are compressed laterally, rise with a simple pedestal, and then divide into two sharp spines, one curved forwards, the other backwards. On the 1st and 2nd abdominal segments the hairs arise from the base of the pedestal, behind this i arises from the base of the front spine, and ii from a little lower—i directly in front, ii a little on the outside of the column. The columns on the 3rd, 4th, and 5th abdominal segments have a subsidiary small spine on the back of the posterior one, the 8th has only one (the anterior) spine. The lengths of these spines, the thickness of the pupa at the 4th abdominal segment being about 1·4mm., are, on the 1st abdominal, 0·42mm.; on 2nd, 0·48mm.; on 3rd, 0·70mm.; on 4th, 0·57mm.; on 5th, 0·54mm.; on 6th, 0·51mm.; on 7th, 0·54mm.; on 8th, 0·42mm. The hairs are longest in front (i) on the forward spines, behind (ii) on the posterior, the longest are all but a millimetre in length, the shortest (in front of the 7th and 8th abdominals) 0·26mm., and 0·30mm. The termination of the dorsal flange on the 3rd abdominal is well illustrated by the spine on that segment being undercut behind, all the others spreading in both directions, but this one cannot do so, its large size being assisted in front by the flange, but not behind. On the thorax the ridge carries a hair (1·15mm.) at the anterior margin of the metathorax; on top of the mesothorax are two spines, 0·15mm. high and 0·14mm. apart, one in front of the other; in front of these a hair (curved forward) about 1mm. long, and a little further forward another. There are sundry other lateral hairs on the front of the pupa. Tubercle iii carries a long hair (about 1·0mm.), flowing outwards and backwards on all the abdominal segments (1-8). Those on tubercles iv and v are remarkable; they are on a slightly raised base, that on iv is directed backwards, and that on v forwards, with a curve that makes the ends point about exactly backwards and forwards, and the ends, unlike those of the other hairs, which are sharp, are thick and rounded, the two together looking just like the double belaying-pin for fastening ropes and cords; they are short, about 0·3mm. Tubercle vi has again a long hair, flowing backwards, and vii three rather shorter hairs; viii is not detected, nor are any very definite scar of prolegs seen. The face carries two nose-spines, one on either side. These are lower down (more ventral) than the nose-spine of *Platyptilia*, and are, no doubt, different structures, being close down to the labrum, but with room between for one hair (about 0·3mm.); each spine carries, at its extremity, a hair (0·5mm. long). The spine itself is short (0·1mm.), apparently white, and the hair points backward nearly parallel to the ventral surface. Above it, at the base of the antennæ, are two hairs on either side (the antenna-basal hairs). The prothoracic piece, beautifully sculptured in wrinkles and pits, bears three hairs, and (in dehiscence) carries at the end a comparatively large sheet of membrane and the eyepiece, the membrane having more than twice the area of prothorax and eyepiece together; an evanescent line, 0·07mm. long, on the dorsal margin of this, is probably the dorsal headpiece. The base of the antenna has high, branched, transverse ribs (white?), dwindling lower down. The wing-base is marked by a raised longitudinal ridge with a series of nodules, and a second less-marked, similarly nodulated, ridge, is just ventral to the first. The hindwing ends just below the spiracle of the 2nd abdominal segment. All the segments are transversely ridged, with 12-20 ribs; these are smooth and wave-like, with no side valleys. The fine sculpture consists of closely-set minute round pits, and, on the intersegmental membrane, the appearance is of pits rather than of tessellated pavement. There is not detected any variation from this pitting (into spicules, smoothness, etc.). The mandibles meet in the middle line, with the triangular labrum above, and a minute diamond of labium below. The maxillæ disappear below the legs (as usual), at about 2·5mm. from the base, but show again between the 2nd legs in the free spine. This includes the wing-tips and the 3rd tarsi (behind), the wings being a fraction short of the other (6) items that are all but level. The free spine is about 1·5mm. beyond the attachment to the 3rd abdominal segment. Beyond the nodules on the wing-spine, there is no trace of hair-process or spine on any of the appendages. The cremastral spine is flat vertically, with angular edges, narrowing thence dorsally to two dorsal ridges, which are high and narrow. Its form is, therefore, in section, quadrangular, with the ventral side as long as any two others. The cremastral hooks, both of forward and terminal set, are slender, long, and abundant. There are still to be noted the mediodorsal spines. Some spines, dorsal to tubercle i, seem characteristic of most Oxyptilid pupæ. (I have one of *didactylus* (?) without them.) In this respect, *Marasmarcha lunaedactyla* is Oxyptilid. These are absolutely median, and in a direct line between the middle of the dorsal spines carrying i and ii. On the 2nd abdominal the mediodorsal is just indicated; on the 3rd, 4th, 5th, 6th, and 7th abdominal segments it is well developed—a finger-like process, not quite erect, but a little sloped or curved forwards, tapering, about four times as long as it is wide at its base, with a rough surface, and with no colour but its contents. Its length is about 0·2mm. (Chapman. Described from pupa skins, obtained by Norgate, spun up on *Crepis virens*, near Brandon, from which the imagines were bred.) [In the Walsingham collection are a larva, pupa, and imago, apparently of the same species, all dated July, Granada, and labelled *distans*, with a "?." The moth is certainly very close to *distans*, I find it difficult to say precisely wherein they differ. The pupa, however, is free from all processes and horns, and has well-developed hairs. It is, therefore, exactly of the type of *Buckleria paludum*. Another very similar moth from Tangier has a nearly identical pupa, which is, however, deep black, and very solid-looking. This does not prevent them being the same species. The Granada insect is certainly *laetus* (Chapman).]

Time of appearance.—The species appears to be double-brooded throughout most of its range, although, probably, in the higher mountains it is only single-brooded. In England, it is generally said to occur in late May and early June, and again in July and August, but we have taken it, in different years, apparently continuously from June to August, at Deal, and Warren says that, at Tuddenham, it is on the wing in June and August, but whether as a succession of emergences, or two distinct broods, he would not like to say. The fact that it is double-brooded, however, appears certain, for Hering says that it appears in the beginning of June, that the larvæ of the next generation are to be taken at the end of June and beginning of July in the Park of Hohenkrug, that these pupate in due course, and the imagines of the second brood emerge in about ten days. In Switzerland, Zeller found the insect at Bergün, from June 28th throughout July 1871, 1873, 1875. In Pomerania it occurs in May-June, and again in August (Paul and Plötz); end of May to mid-June, and again in early August, in the Salzthal district (Rössler); the same periods, May-June and then August, are given for Brandenburg (Pfützner), for Saxon Upper Lusatia (Schütze), etc.; whilst June is given for the lowlands of Silesia (but a single specimen in early July, at Oswitz) (Wocke), and June alone is noted for Baden (Meess and Spuler). Mann took it in June on the pastures near Spalato, in Dalmatia. Rebel records it from Radobolje, in Bosnia, on July 19th, 1898, from Lastva, on August 20th, 1903; he also captured an example on the Calvarienberge near Bozen, on July 28th, 1892, and Frey notes it in early August on the Alp Murailg, near Samaden, at a height of 6772ft. The earliest dates we have are April 28th, 1905, at Hyères, May 4th, 1905, at Draguignan (Tutt) (the former the same date, April 28th, but in 1870, that Blackmore records *laetus* as having occurred in northwest Morocco), and May 29th, 1869, at Meseritz (Zeller). In the Baltic Provinces it has been taken in July, at Dubbeln (Teich). In Roumania it occurs in June (Caradja). In France, in May, and again in August in dept. Saône-et-Loire (Constant); whilst we found it flying fairly freely on the morning of August 1st, 1897, near St. Michel-de-Maurienne, in the Dauphiny Alps, and saw other specimens daily between then and the 5th (Tutt); Sand notes it as occurring in July on Mont Dore. In Belgium, the early brood does not appear to have been noted, but the second brood occurred on July 24th, 1901, and was very abundant at the end of July, 1902, at Coq-sur-Mer (Crombrugghe). On the other hand, only the spring brood has been noted around Brussa, specimens having been taken in May (Mann).

British records.—*First brood:* June 4th, 1870, June 13th-30th, 1871, at Brandon (Barrett); June 13th, 1885, at Brandon, abundant June 19th-22nd, 1885, and in profusion June, 1886, at Tuddenham (Warren); June 8th, 1889, between Dover and St. Margaret's Bay (Purdey); June 16th, 1898, near Tuddenham (N. C. Rothschild); June 2nd, 1897, at Tuddenham (Burrows). *Doubtful first or second brood:* Eight examples on July 4th, 1885; July 9th, 1887; June 29th, 1888; July 6th, 1889; July 7th, 1891, on the Deal sandhills (Tutt). *Second brood:* Late July, 1868, near Thetford (Walsingham); early August, 1871, at Brandon (Barrett); July 26th, 1878, near Brandon (Bower);

last week in July, 1881, in north Devon (South); very abundant and in fine condition in early August, 1884, at Tuddenham (Meek); in profusion in August, 1886, at Tuddenham (Warren); July 13th, 1889, at the Sandwich end of the Deal sandhills (Purdey); rather abundant from mid-July onwards, 1889, at Dover (Webb); July 18th, 1891, a single specimen at Tuddenham (Tutt); August 13th, 1891, at Tuddenham (Porritt); July (end) to mid-August, at Thetford (Hare).

HABITS.—Walking over the short-herbaged waste lands at Tuddenham, one may, in the daytime, occasionally put up a specimen of this species on a fine still afternoon, but we have never noticed having done so on the sandhills of Deal and Sandwich, although just at dusk it flies naturally, with a gentle movement, at some little height above the herbage, often for some distance before taking rest again, the flight continuing, apparently, until it is quite dark. Barrett says that, at sunset, it flies very quietly in its favoured haunts, but is quite easily disturbed, and induced to flit a short distance, in the afternoon especially in hot weather; he observed it once flying in the late afternoon at Brandon. Meek notes it as flying just before dusk at Tuddenham, so abundantly on one evening in early August, 1884, that he captured some 40 specimens; whilst Bower observed it flying in the afternoon near Brandon. At Stanford, near Merton, the imagines frequent *Picris hieracioides* (Durrant). At Tuddenham, Warren observed that it seemed to affect bushes of broom, which, however, it possibly only haunted for shelter. Abroad, however, the little experience we have had with the insect makes us look on it as one rather easily disturbed by day. At Hyères, whilst collecting small things, we disturbed a specimen on April 28th, 1905, from among the long herbage on the slopes at the back of the castle, in the early morning sunshine, between 8 a.m. and 9 a.m.; it flew a short distance and settled on a grass-culm, flying again a little farther, on two or three occasions, as we approached it, until, at last, we netted it; a few days afterwards a specimen was observed at Draguignan, under almost exactly the same conditions. A long search in both places failed to disclose more. At St. Michel-de-Maurienne, the species was found under almost identical conditions, during the first few days of August, 1897; the imagines were disturbed in the full sunshine, in the morning, soon after 9 a.m., and were captured as they flitted from stem to stem of the short herbage on a rather sparsely grass-covered piece of waste ground by the roadside; some seven or eight examples were thus captured in about a quarter-of-an-hour. In Brandenburg, Hesse, and Baden, near Ueberlingen, it is reported as occurring among *Ononis spinosa*, possibly, however, only seeking this plant for shelter.

HABITAT.—A series of slight hollows, sheltered by a range of low sandhills, about 100 yards from the sea, roughly overgrown with marram grass, but thickly carpeted beneath with *Ononis*, *Thymus*, *Hieracium*, *Crepis*, and other plants, formed the favoured haunt of this species on the sandhills lying between Sandwich and the sea. It was also the home of *Acidalia ochrata*, and many other local lepidoptera, which, abundant in this restricted area, were to be found more sparingly over a considerable area around. Sorhagen also notes that, in Brandenburg, it occurs in sandy spots, among *Ononis spinosa*, and Rössler in a deserted sandpit near Biebrich, about *O. spinosa*, so that it would appear to love an arenaceous soil, and to thrive thereon. Crombrugghe writes that, on the Belgian coast, opposite our own famous "Breck" district, at

Coq-sur-Mer, the insect formerly abounded on the sand-dunes by the sea, but its abundance has been much decreased by "improvements" during the last few years. Of its occurrence in East Anglia, Barrett says: "It has been found all over the sandy 'Breck' region from Thetford to Brandon, and extends from it to some of the more chalky portions of Norfolk and Suffolk. . . . The insect frequents open places among low herbage and abundant wild-flowers, on the lower slopes of chalk and limestone hills, but is more abundant on the 'Breck' sands, where it hides in the daytime among lucerne, yarrow, *Hypochaeris maculata*, and all manner of low-growing plants." Webb says that, at Dover, in 1889, it was particularly attached to one hill-slope, where *Hieracium pilosella* grows; and South observes that, in North Devonshire, it was found in a lane, leading down to the shores of Woody Bay, near Lynmouth, whilst Warren records that, at Tuddenham, its chief haunt was on rough ground sheltered by broom bushes, among which the imagines were more common than elsewhere, mainly, one supposes, because they obtained from them better shelter when on the wing; at Brandon, he notes that he has seen the insect on the allotment grounds, and Rothschild found it on rough ground by the roadside at Tuddenham. But it is not confined to the sea-coast on the continent, and Zeller observes that he obtained it freely in a "fallow" field near a spot carpeted with *Hieracium pilosella* in the neighbourhood of Meseritz, and Hering says that it also occurs in the park of Hohenkrug, the larvæ on flowers of *Crepis tectorum*. In Brandenburg, as already noted, the species flies on the sandhills among *Ononis spinosa*, *Hieracium*, etc. (Sorhagen). Zeller says (*Stett. Ent. Ztg.*, 1878, p. 163) that the species occurs from June 28th, throughout July, at Rugnux, and is not rare amongst small fir-plantations, the specimens generally larger than in north Germany. Our knowledge of the localities of this species outside Britain is limited. We met with a single example on the steep flowery slopes behind the castle at Hyères, in late April, 1905, where one suspects it would be much commoner a little later, and a second example on May 4th at Draguignan, in a little butterfly-corner on the Grasse Road, on a little patch of grass and wild flowers, just inside a garden that swarmed with butterflies—*Leptidia duponcheli*, *L. sinapis*, *Melitaea aurinia*, *M. cinxia*, *M. phoebe*, and some 20 to 30 other species. At St. Michel-de-Maurienne, directly behind the village, on the road to Valloire, on a dry sandy bank, sparsely covered with grass and wild flowers, chiefly *Compositae*, the species was not at all uncommon in August, 1897. It seems to be from the records, although our experience does not run in this direction, distinctly a mountain species in central Europe, having been taken at high elevations on the Stelvio (Eppelsheim), the Albula (Zeller), and up to nearly 7000ft. on the Alp Muraigl, near Samaden (Frey), as well as at Macugnaga (Chapman). [Rebel says that, in Bosnia and Hercegovina, it is only recorded in the second, smaller, paler generation, *laetus*, near Radobolje, July 19th, 1898 (Rebel), and Lastva, August 20th, 1903) (Paganetti-Hummler). One wonders whether this is the true *laetus*, or only a form of *distans*.] Mann notes it as occurring on the mountain-slopes near Brussa, and the pastures near Spalato, in Dalmatia; whilst Caradja records it as being found, in June, on hillsides and in young copses near Tultscha, in Roumania.

British localities.—Exceedingly local. Devon: north Devon—Lynmouth district (South). Dorset*: Isle of Purbeck—Studland, one specimen (Digby). Kent: Sandwich and Deal sandhills (Tutt), Dover (Webb), Dover to St. Margaret's Bay (Purdey), Folkestone (Adkin). Norfolk: Thetford, Stanford, near Merton (Walsingham), near King's Lynn (Atmore). Suffolk: Brandon (Bower), Tuddenham (Warren), Barnham (Norgate), Elveden (Williams).

Distribution.—Europe, central and south, Asia Minor, Canaries (Staudinger and Rebel). Asia: Asia Minor—Macri, Kellemisch, (Loew *teste* Zeller), Kerasdere, Tschirtschirthal (Staudinger), Amasia, Brussa (Mann). Austro-Hungary: Bohemia (Nickerl), Tyrol—in the subalpine region to 7500ft.—Stanser-Joch, Franzenshöhe (Heller), Taufer alps (Weiler), Calvarienberg, near Bozen (Rebel), Stelvio (Wocke), Carniola—Nanos, Dalmatia—near Spalato, Fiume (Mann), Carinthia (Zeller), Slavonia (Rebel). Belgium: coast dunes—Coq-sur-Mer (Crombrugghe). Bosnia and Hercegovina: Radobolje (Rebel), Lastva (Paganetti-Hummler). Bulgaria: Varna (Haberhauer). Corsica (Marshall). France: Aube (Jourdheuille), Saone-et-Loire (Constant), Dauphiny Alps—St. Michel-de-Maurienne, Var—Hyères, Draguignan (Tutt), Auvergne—Mont Dore (Sand). Germany: fairly distributed in north Germany, in southern Germany rarely noticed (Hofmann), Pomerania, not rare—near Voigtsdorf (Paul and Plötz), Hohenkrug (Hering), Eckerberg, Stettin-Schrey (Büttner), Garz (Hofmann), Hesse—near Biebrich, Hessler, at the end of the Salzthal, Nassau—Wiesbaden (Rössler), Brandenburg—near Spandau, Potsdam (Hinneberg), Saatwinkel, near Spandau (Stange), Posen—near Meseritz (Zeller), Silesia, rare—near Schwoitsch, Glogau (Zeller), Breslau, Oswitz (Wocke), Kingdom of Saxony—Saxon Upper Lusatia (Schütze), Baden—near Ueberlingen, Alsace (Meess and Spuler). Greece (*teste* Rebel). Italy: Piedmont—Macugnaga (Chapman), Sicily—Vallecorta, Syracuse (Zeller), the Madonie mountains (Minà-Palumbo), Lombardy—Alzate (Turati). Netherlands: coast dunes (Crombrugghe), Zeeland—Domburg (Lycklama *teste* Snellen), south Holland, north Holland, Gelderland—Arnhem (Snellen). Roumania: Dobrudscha, near Tultscha (Caradja). Russia: Baltic Provinces—Dubbeln (Teich). Switzerland: local—Upper Engadine—Alp Muraigl, 6772ft., near Samaden (Frey), the Albula, Bergün (Zeller), on the Maienwand (Kolb).

Tribe: Capperiidi.

The imaginal characters of this tribe have already been worked out by Hofmann, and the larval and pupal characters by Chapman. Besides the characteristic difference in the genital organs, as pointed out by Hofmann (*Die Deutsch. Pteroph.*, p. 99), he gives the following grouping of the three species at present referred hereto (*op. cit.*, p. 102):

Palpi slender, second joint ascending, third rather drooping (therefore, as a whole, waved); second joint with appressed scales, at the apex with few, or usually no, projecting scales; third joint very slender, shorter than the second.

A. The fringes of the outer margins of the lower lobe with a white basal line .. .. *didactylus*, L.

B. The fringes of the outer margin of the lower lobe with a white dash at the anal angle.

1. The black scaling of the third feather extended, interrupted just before the apex, on both sides, by white scales.

* "In the 'Lepidoptera of the Isle of Purbeck' (*Proc. Dors. N. H. and A. F. Club*, vi., 176) the Rev. C. R. Digby, who assisted me with it, entered the following record: '*Pterophorus laetus*, Z., Studland; one specimen taken in a wet meadow was pronounced by Mr. H. T. Stainton to be a pale individual of this species. The specimen is now in the cabinet of Mr. J. B. Hodgkinson, of Preston.' The individual in question was taken, about 1882, by the Rev. C. R. Digby, who shortly afterwards gave it to Mr. J. B. Hodgkinson. At the time of the sale of the 'Hodgkinson collection,' I failed to find, either in the cabinet or among the duplicates, any specimen that seemed likely to be the Purbeck one, nor was any labelled as such (labels were conspicuous by their absence!). Mr. Digby failed to find it among the series of duplicate *laetus* that I secured and submitted to him. No other example of *distans*, or var. *laetus*, has been taken in Dorset, but in view of the improbability of Stainton mistaking any other species for var. *laetus*, and of the fact that *distans* has been recorded (Meyrick's *Handbook*, etc.) as occurring from 'Kent to Devon . . . . ,' there seems no reason to question Stainton's identification. The 'wet meadow' is but a short distance from a stretch of coast sandhills such as *distans* might inhabit, though hitherto it has been sought there in vain" (Bankes).

a. With a broad white dash at the anal angle of the lower lobe .. .. *teucrii*, Greening.
b. With a very narrow white dash at the anal angle of the lower lobe .. .. var. *celeusi*, Frey.
2. The black scaling of the third feather compressed, without any white interruption before the apex .. *leonuri*, Stange.

The main differences, however, are exhibited in the larval and pupal stages. In the larva there are more or less well-developed tubercular warts of almost Arctiid type, whilst the pupa also is exceedingly well supplied with hairs. The general characters of the Capperiids has already been dealt with at length (*anteà*, pp. 409-411). The following details, however, may here be noted. Comparing the larvæ of the Oxyptilids (as exemplified by *parvidactyla*) with those of the Capperiids (as represented by *heterodactyla*), Chapman notes as follows:

1. Oxyptilus (*parvidactyla*): Quite internal feeder, living in heart of food-plant, eating central bud, and boring down to root. Larva looks bare and fleshy; has no secondary hairs*; the prothoracic plate has only the normal six primary hairs; posterior thoracic dorsal tubercles absent on mesothorax; each tubercle carries a single seta; i and ii are near, but quite separate; skin-points sharply pointed; hooks of prolegs small, two or three present (rarely one or four); pale spot (and others) on prothoracic plate.

2. Capperia (*heterodactyla*): External feeder. Larva hairy; abundant secondary hairs, broad at tips; prothoracic plate with abundant secondary hairs obscuring the six usual primaries, which are, however, present; posterior thoracic dorsal tubercles present on mesothorax; each tubercle a many-haired wart; i and ii fused into one large wart; skin-points blunt; hooks of prolegs well-developed, four or five hooks; no spot on prothoracic plate.

He also notes (*in litt.*) the connection of the pupa of *didactylus*, one of the species referred to this group, with those of various allied groups. He observes that most of the few Oxyptilid pupæ he has examined agree with those of the Marasmarchids and Amblyptiliids in possessing the spinous development of the more or less conjoined tubercles i and ii. A pupa of *didactylus* presents nothing very decided to mark it off strongly from *Amblyptilia*. The most definite point, that distinguishes an Oxyptilid pupa from Amblyptiliid and Marasmarchid pupæ, is that the halbert-shaped spine of the 3rd abdominal segment, has, in the two last-named, its front spine developed, wrinkled, twisted, and curved, so as to have well-deserved the description of halbert-shaped, whilst, in those of the Oxyptilines, this front spine, though usually larger than any of the others, is fairly simple, smooth, and straight. In the Marasmarchid pupa, and in those of some Oxyptilids, are other processes that occur in no other "plume" pupæ in which we have looked for them (although certain secondary hairs occupy a similar situation in *Alucita pentadactyla*, etc.). These are spines, or prominences, on a transverse ridge connecting the dorsal spines, and are, therefore, internal (or dorsad) to these spines; of these there is a dorsal or central one, and an outer or paired one, *i.e.*, one, on each side, halfway between the dorsal line and the i+ii spines. The Amblyptiliid pupa shows no traces of these spines, but, in the Marasmarchid pupa, both the median and outer set are developed. There is another difference between the Oxyptilid pupæ and those of the other two groups, *viz.*, that, in them, the hair, marking tubercle i, arises well up on the spine, leaving one in no doubt that the spine is a development of the base of the tubercle, but, in the Oxyptilid pupæ, the hair arises from the base of the spines, so that one might assert that

* British larvæ show no secondary hairs; a larva from south France (Ste. Maxime), that produced an imago quite inseparable from *O. parvidactyla*, had a good many secondary skin-hairs, but none on the tubercles (Chapman).

Distans.	Lætus.	Parvidactyla.	Didactyla.	Heterodactyla.	Siceliota.	Paludum.
Dorsal spines double, 3rd abdominal the longest	No dorsal spines	Spines single, and only from 4th-8th abdominals, developed as a hook with the point forwards	Dorsal spines double; traces of a third spine on 3rd and 4th abdominals	Dorsal spines multiple	Dorsal spines are really, or resemble, warts	No dorsal spines
Hairs long, no hairs on appendages	Hairs moderate	Hairs moderate	Hairs long	Hairs, or rather spines, on appendages	Hairs long, spines on appendages	Simple long hairs
Short mediodorsal process on 3rd-7th abdominals	No mediodorsal process	No mediodorsal process	Trace of transverse ridge, but mediodorsal spine absent	Submedian spine, on each side a bifid process, each branch long and slender, one forwards and one backwards	Submedian double on some segments, median present, iii has extra spine	No mediodorsal spines
Normal cremaster, ventral and terminal portions	No ventral portion to cremaster; terminal portion strong	Two remarkable hooks formed by sexual bosses of 9th abdominal segment;* hairs of terminal cremaster hardly hooked	Normal cremaster	Normal cremaster	Normal cremaster	Normal cremaster

* These are developed to make hooks for witl drawing pupa into cocoon after partial emergence.

the spines are extra growths interpolated between tubercles i and ii. It must, however, be noted that, in some Oxyptilid pupæ, of which that of *Oxyptilus parvidactyla* is a good example, the pupa has the spines obsolescent; in *O. parvidactyla* they exist on some posterior segments; in *O. laetus*, however, they are quite wanting. On the preceding page we add a table showing the more marked Oxyptilid pupal characters in those species whose pupæ are available.

Genus: Capperia, Tutt.

Synonymy.—Genus: **Capperia,** Tutt, "Ent. Rec.," xvii., p. 37 (1905). **Alucita,** Müll., "Faun. Ins. Frid.," p. 59 (1764); De Vill., "Linn. Ent. Faun. Suec.," ii., p. 535 (1789); Haw., "Lep. Brit.," p. 479 (1811). **Pterophorus,** Sam., "Ent. Usef. Comp.," p. 409 (1819); Curt., "Brit. Ent.," fo. 161 (1827); Wood, "Ind. Ent.," 1st ed., p. 238, pl. li., fig. 1651 (worn) (1839); [Dup., "Cat. Méth.," p. 382 (1844);] Sta., "Sys. Cat.," p. 13 (1849); "Man.," ii., p. 441 (1859); Dbldy., "Zool. Syn. List," 2nd ed., p. 36 (1859); Greeng., "Ent. Mo. Mag.," iv., pp. 16, 39-40 (1867); Gregs., "Ent.," iii.," p. 298 (1867); Jord., "Ent. Mo. Mag.," vi., p. 14 (1869); Gregs., "Ent. Mo. Mag.," vi., p. 115 (1869); Mason, "Ent. Mo. Mag.," xxv., p. 162 (1888); Porrt., "Buckler's Larvæ," ix., p. 354, pl. 163, fig. 7 (1901). **Amblyptilia,** Stphs., "Ill. Brit. Ent. Haust.," iv., p. 377 (1834). **Oxyptilus,** Jord., "Ent. Mo. Mag.," vi., p. 122 (1869); Gregs., "Ent.," iv., p. 305 (1869); Jord., "Ent. Ann.," p. 143 (1870); Barr., "Ent. Mo. Mag.," viii., p. 155 (1871); South, "Ent.," xvi., p. 73, pl. ii., figs. 1-1*d* (1883); Leech, "Brit. Pyr.," p. 57, pl. xvii., fig. 2 (1886); South, "Ent.," xxii., pp. 34, 102 (1889); Briggs, "Ent.," xxii., pp. 75, 139 (1889); Tutt, "Young Nat.," x., p. 164 (1889); Barrt., "Ent. Mo. Mag.," xxv., p. 431 (1889); Tutt, "Brit. Nat.," i., p. 205 (1891); "Pter. Brit.," p. 71 (1895); Meyr., "Handbook," etc., p. 432 (1895); Hofm., "Deutsch. Pteroph.," p. 116 (1895); Crombr., "Rév. Soc. Ent. Nam.," iv., p. 447 (1900); Staud. and Reb., "Cat.," 3rd ed., p. 71 (1901); Barr., "Lep. Brit. Isles," ix., p. 370, pl. 415, figs. 3-3*b* (1904).

The genus *Capperia* was first named in the *Ent. Rec.*, xvii., p. 37, when *heterodactyla* was cited as the type. It is one of the most highly specialised of the genera in the Oxyptilid group, if not in the whole of the "plume" fauna. The chief characters have been already noted, and are to be summarised as—

Imago: Palpi slender, second joint ascending with appressed scales, the third joint very slender and shorter than the second, the fringes of the outer margin of the second lobe with a white dash at the anal angle. The genitalia have the 9th and 10th dorsal plates slender, the latter being small, pointed, and hidden on the 9th dorsal plate; the 9th ventral plate very strongly developed, as long as the prensors, convex below, concave above, split terminally in two tips or points; the prensors very long, narrow, hollow inside, very strongly furnished with bristles without appendages; the penis is strongly bent downwards before and behind, terminating in two strong points, a shorter and longer.

Larva: Prothoracic plate with many secondary hairs, but there is no difficulty in distinguishing the usual six setæ on each side. Body deeply segmented; tubercles, many-haired warts with primary and secondary hairs; abdomen, i+ii forming a large round wart, with two primary hairs; iii also a large wart with one primary hair; iv+v also one wart, with two primaries, that representing v higher than the other; vi has one primary hair; vii three primary hairs; behind the spiracle, towards back of segment, two accessory warts; skin thickly shagreened with blunt skin-points; many minute scattered secondary hairs, broad at tips; hooks of prolegs well developed,

Pupa: Hairy pupa—dorsal spines multiple; hairs on appendages; submedian spines on each side, each forming a bifid process of which each branch is long and slender, one directed forwards, the other backwards; good cremaster.

Of the two species placed by Hofmann (*Deutsch. Pteroph.*, p. 116) in this group, he notes that "*heterodactyla* is to be distinguished from *leonuri* by the darker coloration of the latter, and by the scale-tuft of the third plumule, in which the isolated group of scales at the apex of this plumule is absent, but more certainly by the genital appendages, *i.e.*, the differently-shaped penis. From all the remaining Oxyptiline species it is to be separated easily by the formation of the palpi." The species in this genus are particularly characterised by the remarkably hairy larvæ and pupæ; in the abundant larval armature, the hairy warts remind one almost of the specialisation to be seen in Arctiids, and other highly-developed larval wart-structures. Chapman observes that preserved larvæ and pupæ of *Capperia leonuri* received from Staudinger cannot be distinguished from those of *C. heterodactyla*.

Capperia heterodactyla, Müller.

Synonymy.—Species: **Heterodactyla,** Müll., "Faun. Ins. Frid.," p. 59 (1764); de Vill., "Linn. Ent. Faun. Suec.," ii., p. 535 (1789); Haw., "Lep, Brit.," p. 479 (1811); Tutt, "Ent. Rec.," i., p. 94 (1890); "Brit. Nat.," i., p. 205 (1891); "Pter. Brit.," p. 71 (1895). **Heterodactylus,** Sam., "Ent. Usef. Comp.," p. 409 (1819); Stphs., "Sys. Cat. Brit. Ins.," 2nd ed., p. 231 (1856); "Illus. Brit. Ent. Haust.," iv., p. 377 (1834); Wood, "Ind. Ent.," 1st ed., p. ~~283~~ pl. li., fig. 1651 (worn) (1839); Mason, "Ent. Mo. Mag.," xxv., p. 162 (1888); South, "Entom.," xxii., p. 102 (1889); Barrt., "Ent Mo. Mag.," xxv., p. 431 (1889); Crombr., "Rev. Soc. Ent. Nam.," iv., p. 47 (1900); "Ann. Ent. Soc. Belg.," xlv., p. 103 (1901). [**Didactylus,** Curt., "Brit. Ent.," fo. 161 (1827); Stphs., "Illus. Haust.," iv., p. 377, *in part* (1834).] **Hieracii,** Dup., "Cat. Méth.," p. 382 (1845); Sta., "Sys. Cat.," p. 13 (1849); "Man.," ii., p. 441 (1859); Dbldy., "Zool. Syn. List," 2nd ed., p. 36 (1859); Gregs., "Ent.," iii., pp. 298-9 (1867); Greening, "Ent. Mo. Mag.," iv., pp. 16, 39-40 (1867); Tutt, "Pter. Brit.," p. 69, *in part* (1895); Porr., "Buckl. Larv.," ix., p. 354, pl. 163, fig. 7 (1901); Barr., "Lep. Brit. Isles," p. 365, *in part* (1904). **Teucrii,** Jord., "Ent. Mo. Mag.," vi., pp. 14, 122 (1869); "Ent. Ann.," p. 143 (1870); Buckl. and Barrt., "Ent. Mo. Mag.," viii., p. 155 (1871); Röss., "Schppfl.," p. 222 (1881); South, "Ent.," xvi., p. 73, pl. ii., figs. 1-1*c* (1883); Leech, "Brit. Pyr.," p. 57, pl. xvii., fig. 2 (1886); South, "Ent.," xxii., p. 34 (1889); Briggs, "Ent.," xxii., p. 139 (1889); Tutt, "Young Nat.," x., p. 164 (1889); Hofm., "Die Deutsch. Pteroph.," p. 116, pl. i. (1895); Meyr., "Handbook," etc., p. 432 (1895); Staud. and Reb., "Cat.," 3rd ed., p. 71 (1901); Barr., "Lep. Brit. Isles," ix., p. 370, pl. 415, figs. 3-3*b* (1904). **Britanniodactyla,** Gregs., "Ent. Mo. Mag.," vi., p, 115 (1869); "Ent.," iv., p. 305 (1869). **Hetrodactylus,** South, "Ent.," xxii., p. 34 (1889). [Bankes writes that the two examples of "*britanniodactylus*, bred, Gregson," in the Mason coll., were *heterodactyla*, Müll., and that the specimen of "*heterodactyla*," Haw., bearing Haworth's MS. label, was correctly identified by Mason and Barrett with *teucrii*, Greening (*Ent. Mo. Mag.*, xxv., p. 162 (1888).]

Original description.—*Phalaena Alucita heterodactyla*, alis patentibus fissis, nigris, maculis albis, anticis bifidis; posticis tripartitis. In horto (Müller, *Fauna Insectorum Friedrichsdalina*, p. 59).

Imago.—Forewings of a deep chocolate-brown, a white longitudinal discal streak, a white blotch at end of cleft surrounding discal lunule; two white transverse lobal lines, the inner wide on upper, but more or less obsolete on lower, lobe; the outer finer, apparently angulated on upper lobe, where it extends into fringe, and usually distinct on lower lobe; the costa, from outer lobal line to apex, narrowly white; fringes of the ground colour, with two white dashes on outer margin towards apex, and two more white dashes in cleft, representing extensions of transverse lines in upper lobes, a small white dash at apex of lower lobe, and a larger white patch in enclosed portion; the fringes of inner margin of wing pale grey, with two black dashes, one just before, and one beyond, the middle. Hindwings almost of ground colour of forewings, but rather greyer; fringes slightly paler, a shiny apical patch in those of 1st and 2nd plumules; the 3rd plumule with black scale-patch towards apex, well-developed on both sides of shaft; lower margin and apex of plumule distinctly snowy-white; two or three black scales at apex, and a few tiny isolated ones between patch and base.

Sexual dimorphism.—The few ♀s we have in our collection appear to be slightly smaller than the ♂s, and Bankes notices the same slight difference in average size among the many bred specimens of both sexes in his lengthy series.

Variation.—Barrett, like Haworth, notes the particularly dark coloration of this species. The former calls it black-brown, abundantly dusted with golden-brown. To the naked eye it certainly looks the darkest of our British Oxyptilids, but, under a lens, the normal coloration in Britain is almost identical with that of *O. parvidactyla*, a deep rich brown, to which the term "chocolate-brown" is better applied than to any other British species; nor does the similarity of the imagines of these two species end here, for the markings are almost identical; the slight curvature of the upper lobal lines, seen in *parvidactyla*, however, is apparently absent, and the outer lobal line is much more distinctly marked on the lower lobe in *heterodactyla*, whilst, in the latter, also, the scale-tuft of the 3rd plumule of the hindwing is more marked on the upperside of the shaft than in *parvidactyla*; yet the remarkable fact remains that the two British Oxyptilids that are most unlike in their larval and pupal stages, are most like superficially in the imaginal, except, of course, in size, and here again they are at the two extremes, as the largest and smallest of the *Oxyptili*, excluding the Buckleriids. There is no doubt that the two "Coverdale" *hieracii* (see *Brit. Pter.*, p. 69) belong here. They are somewhat narrower in the forewings than usual, due probably to lessened fringe-scaling, and, perhaps, a trifle worn, and the ground colour is a trifle paler. In a series of some 26 examples, from Clevedon, King's Lynn, Canterbury, and Purbeck, little variation is exhibited. There is a slight difference in the intensity and brightness of the ground colour (some are particularly shiny in appearance), and the Canterbury, and some of the Purbeck, examples are, perhaps, a shade paler (? greyer) than the others; a few examples (two from Clevedon, two from Purbeck, one from Canterbury) without white scaling in the discal area (the pale space, however, is marked), the tendency to obsolescence of the inner lobal line in the Clevedon and King's Lynn examples (one of the Clevedon, and three of the Purbeck examples have this specially strongly marked), and the occasional obsolescence of the lower lobal half of the outer line (very noticeable in one Clevedon and one Purbeck example), about cover the range of variation. The most variegated specimen, with all the white markings specially strongly developed, comes from Clevedon. The most obsoletely-marked and uniformly-tinted specimens, with only the upper halves of the lobal lines, of all the white markings, at all distinctly outlined, is from Purbeck. Two forms have been described as distinct species from German examples, but Hofmann says that their genitalia are identical with those of *heterodactyla*. These are:—

a. var. *loranus*, Fuchs, "Stett. Ent. Zeitg.," p. 48 (1895); Hofm., "Pter. Deutsch.," p. 117 (1895); Fuchs, "Stett. Ent. Zeitg.," p. 338 (1897); Staud. and Reb., "Cat.," 3rd ed., p. 71 (1901). *Obscurus*, Rössl., "Cat.," p. 163, no. 867 *in part* (1881). *Parvidactylus*, Rössl., "Cat.," p. 222, no. 1123 *in part* (1881).—Under *obscurus*, Zell., Rössler writes (*Cat.*, p. 163): "The specimens from Lorch and the Dennelbach Valley, near Wiesbaden, belong possibly to a distinct species.

In size they sometimes approach *hieracii*, but are usually smaller, and of the grey hue of *tristis*, although, in other respects, they agree with *obscurus*, yet are distinguished therefrom by the black edging of all the white markings towards the body. The scale-tuft of the 3rd plumule is larger than that of *obscurus*, and extends on either side." Under the head of *parvidactylus*, Haw. (*obscurus*, Zell.), Rössler also writes (*op. cit.*, p. 222): "Two of my specimens are larger, have longer 3rd plumules, and have the apex of the 3rd plumule of the hindwings isolated from the large scale-tuft by white; the white transverse lines, also, of these specimens, on the inner side are edged with black, as in Herrich-Schäffer's figure of *marginellus*; as they were caught not far from *Teucrium scorodonia*, they may probably belong to a new species not yet described, the larva of which was found by Schmid near Regensburg, on *Teucrium*, or to the English species *teucrii*, which is unknown to me in the imago state, etc." Hence it is seen that a species of the *parvidactylus* group has been known to Rössler and myself for a considerable period of time. The best distinction from *parvidactylus*, to which this species is nearest related, is given in Rössler's *Catalogue*, *viz.*, its grey colour, in which it agrees with *O. tristis*. Unfortunately, this fact has been ignored, and the species has been referred to *teucrii*, a species that not only occurs in England, but has been found by Reutti, and other collectors of micro-lepidoptera, in Carlsruhe and other parts of the duchy of Baden. Comparing our insect with two Baden specimens of *teucrii* sent by Hering, it is clear that they are not the same, as *teucrii* is not only darker than *loranus*, as Bang-Haas pointed out when I sent him two for expert opinion, but shows decidedly the red-brown tint of *parvidactyla*, which *loranus* does not show; besides, *teucrii* is larger. Therefore, the characters quoted as most important in Rössler's *Catalogue*, must be insisted on, *viz.*, that *loranus*, with all its undeniable relationship to *parvidactylus*, has always the normal grey colouring of *tristis* without the admixture of red-brown. The transverse lobal lines are never pure white, but yellowish, so that they do not contrast with the light ground colour of the wing, as in *parvidactylus*. The black edging towards the base, of which Rössler speaks, I do not see in my specimens, so that this point is not decisive. The size, too, does not suffice for distinction, as it varies. On the other hand, there seems to be a biological distinction of which Rössler was not aware, *viz.*, that in 1893* *loranus* was double-brooded, occurring first in the middle of May, and again abundantly in the middle of August, whereas, of *O. parvidactylus*, I only found on August 18th, 1893, one ♀, which had developed rapidly owing to the summer heat; the irregularity of its development giving it a marked appearance of being dwarfed; the August specimens of *loranus*, on the other hand, are in no wise inferior in size to those caught in May. Of the range of *loranus*, even in the Wiesbaden district, nothing definite can be stated, as Rössler, in his statements already quoted, speaks only of two examples in his collection. That Rössler caught this species near Lorch-on-the-Rhine, which is not far from me, I learned from him personally; later he must have had his doubts about their belonging to the same species as the specimens he took in the Dennelbach Valley. At present it can only be said that *O. loranus* is found in the Rhone Valley from Lorch downwards (Fuchs).

Hofmann (*Deutsch. Pter.*, p. 117) says that he cannot separate *loranus* from *heterodactyla*; the slender palpi without rough scaling at the apex of the 2nd joint, the broad white dash in the outer marginal fringes of the lower lobe, and the black scale-tufts on the third plumule, of which the dark apices are cut off like a little "knob from the larger dark parts by white," as mentioned by Roessler (*Schuppenfl.*, p. 222), and the quite similar formation of the male genitalia, decidedly point to its place here; the darker, more grey coloration, and the smaller size, cannot be made the foundation of a specific distinction. *O. parvidactylus*, with which Fuchs compares it, belongs, on account of the formation of the palpi and male genitalia, to quite another group. Fuchs took objection (*Stett. Ent. Ztg.*, 1897, p. 338) to this, and complained that Hofmann was wrong in uniting *loranus*

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* In the marvellous summer of 1893, both in Britain and Central Europe, very many usually single-brooded species were double-brooded.

with *teucrii*. He says that, in the Roeslingberg, *loranus* only occurs without any transitional forms to *teucrii;* at the beginning of June, 1897, the insect was already on the wing, whilst many fresh specimens were observed between the beginning of July and the 20th of the month, amongst them a couple paired, both sexes true *loranus* form, in 1895." He adds: "I found at the same place a fresh ♀ as late as August 19th. In the Lenning, there flies, without definite transitional forms to *loranus*, round *Teucrium scorodonia*, the species named after this foodplant, *teucrii;* it occurs in the second week of June, and, compared with *loranus*, is abundant, and continues till the beginning of July, never later. In the Heimbach Valley, where I discovered *loranus*, and where I have since repeatedly met it, although never so abundantly as on the Roesling mountain, I only once, on May 31st, 1897, captured *O. teucrii*, a fine ♂, flying round *Teucrium scorodonia*. The two insects with us have different habitats, which can only be attributed to different foodplants, but, although I have not yet found the larva of *loranus*, I am satisfied that it does not live on *Teucrium*. On the Roesling mountain the moths are always found flying about a pretty but tiny plant, blooming in July, that I have been unable to determine, but which certainly is not *Teucrium*." It must be confessed that Fuchs' argument is here particularly weak, so much so that Staudinger and Rebel have no hesitation in referring *loranus* to *teucrii* (*Cat.*, 3rd ed., p. 71) with the diagnosis "var. minor, obscurior, magis grisea. South-west Germany."

β. var. *celeusi*, Frey, "Stett. Ent. Ztg.," p. 18* (1886); Schmid, "Corr. Regensb.," xl., p. 200 (1887); Hofm., "Deutsch. Pter.," p. 116, pl. i., fig. 2 (1895); Meess and Spul., "Lep. Baden," p. 152 (1898); Staud. and Reb., "Cat.," 3rd ed., p. 71 (1901).—This stands, according to Hoffmann, next to *obscurus*, Z., on account of the white longitudinal dash in the outer marginal fringes of the lower lobe, and of the nearly equal length of the black scaling on each side of the apex of the third plumule of the hindwing; it is, however, usually larger, and of a darker, more coffee- or yellow-brown, ground colour, while *obscurus*, Z., has a red-brown coloration, which, in viewing a number of specimens, very easily catches the eye. The white markings on both lobes of the forewings are broader and more shining than in *obscurus*, Z., also the disc of the wing carries several white dots, which are wanting in the latter, so that var. *celeusi* appears much more variegated. The palpi in var. *celeusi* are, in 18 specimens bred here and quite perfect, more slender and rounder, mostly somewhat curved upwards with slightly drooping terminal joints; the 2nd joint is outwardly brown with two, more or less large, white spots, and has no porrected tuft of hairs at the extremity; the 3rd joint is white, with a pair of fine brown spots, or brown with white spots; in several specimens the palpi, outwardly, are almost entirely white. On the inner side the palpi are marked just as on the

* The *pilosellae-hieracii* group is one of the most difficult amongst the plumes, and one suspects that too many species have been described therein. This doubt was impressed on me when I read, in Stainton's *Ent. Annual* for 1870, the description of a new species, *teucrii* (Greening), Jordan. This doubt was increased when I received from Zeller two specimens of this new English species (probably from Jordan). The larvæ of this, I learned from Regensburg, had been reared on *Teucrium scorodonia*. A few years ago, Schmid found a larva on *Teucrium chamaedrys*, near Kelheim, that produced an *Oxyptilus*, which the discoverer, thinking he had a new species, called *O. celeusi*. As a result of many years' collecting I possess a very large number of specimens belonging to the *pilosellae-hieracii* group from different countries, and I have become very doubtful as at the specific difference of *hieracii* and *pilosellae*. *O. teucrii*, Jord., and *O. celeusi*, I unhesitatingly conclude to be dark forms of *hieracii*; two specimens, received years ago from Glitz, of Hanover, completely agree with the specimens from England and Kelheim, etc. (Frey).

outside. *Obscurus*, Z., has, on the other hand, broader, laterally compressed, palpi, usually directed forwards; the 2nd joint terminates in a pointed tuft of hairs, which only appears absent when the 3rd joint is somewhat drooping, and is thereby pressed up against the tuft of hair. The palpi are white at the base, the 2nd joint outwardly brown with a white border above and below, the 3rd joint, which is very short, is quite brown; on the inner side, the palpi are marked as on the outer side, only some examples have the 2nd joint inwardly white with brown borders. *Hieracii*, Z., to which species Frey (*Stett. Ent. Zeitg.*, 1886, p. 18) seems inclined to refer var. *celeusi* as a dark form, may be very easily distinguished from var. *celeusi* by the want of the white longitudinal dash in the outer marginal fringes of the lower lobe, and by the short black scales on the costa of the third plumule of the hindwing. This plume, ill-recognised in former years [in the *Lepidopteren-Fauna der Regensburger Umgegend*, by O. Hofmann and Dr. Herrich-Schäffer, Fortsetzung, 1855, p. 148, *marginellus*, Z., is brought forward and described as hardly specifically different from *obscurus*, Z.], flies everywhere, in June, in our Donaubergen, also in Kelheim, where I first found the larva on the Brannt, in May, 1879, of various sizes, on *Teucrium chamaedrys*; it lives exposed on the leaves of this plant, which usually serve as its food, though it also gnaws the tender stalks of the young shoots, which thereby acquire a withered appearance. When in want of food they do not spare each other. The fullgrown larva, according to Hofmann's drawings, reaches 8mm.-9mm. in length, and is dusky pale green; the head looks black, when viewed casually, but, more closely observed, one notices that it is of the same colour as the body, but bears broad, shining, black spots on its borders. The prothoracic shield and anal shield are not especially marked, but concolorous with the body, as well as all the legs and anal claspers. The whole body (in the young larva transparently reddish) is beset with rows of blackish-brown, narrowly white-ringed, warts, which bear stellately-arranged white hairs. The slender elongate pupa, fixed to the leaves or to the stalks of the plant, is bright green in colour, with a double row of small humps on the dorsum, each of which bears a number of strong bristles, directed forwards. The name of this species is derived from Celeusum of the Romans (Kelheim) (A. Schmid).

Although we have given Schmid's excellent note above as the original description of this insect, it is to be observed that Frey first published the name, which had hitherto been merely a MS. name, originating with Schmid. Frey's notice we have added as a footnote (p. 474). One point Frey makes clear, *viz.*, that, at the time he wrote the note, he was certain that the examples of *teucrii* from England, *celeusi* from Kelheim, and *hieracii* from Hanover, were all one species —a conclusion since confirmed by other lepidopterists. Hofmann says (*Deutsch. Pteroph.*, p. 117) "*celeusi* is like *loranus*, Fuchs, somewhat smaller, and, as a rule, darker brown without reddish admixture, although distinctly red-brown examples occur; the white dash in the outer marginal fringes of the lower lobe is mostly much narrower than in the typical *O. teucrii*, and the inner marginal fringes of the upper lobe are, beyond the outer transverse line, only seldom so distinctly twice cut through with white as is the case with the typical form; but, nevertheless, both these distinctive characters are inconstant, and, therefore, I do not venture to found a separate species upon them." Staudinger and Rebel accept this as a form of *teucrii* (*Cat.*, 3rd ed., p. 71), and diagnose it as "minor, obscurior, minus rufescens. Bavaria." *Celeusi* is recorded by Meess and Spuler as occurring in the Geisinger Bergen, singly, in June, the larva, according to Hofmann, feeding on *Teucrium chamaedrys*.

Comparison of Capperia heterodactyla with its allies.—Although this species, for a long time overlooked, and referred to the names rightly belonging to other species, was clearly separated from *hieracii*, in 1869, by Jordan, yet the German lepidopterists continued to send it out as that species (see *Ent. Rec.*, iii., p. 58) until the publication of Hofmann's *Deutsch. Pterophorinen*, in 1895. Even now it is little known abroad, and is repeatedly mixed with other allies, although it is probably one of the best characterised of all the Oxyptilid species. So far as our British species are concerned, it is absolutely different from all the others, on the most superficial glance. The ground colour is entirely different from that of *pilosellae* and *distans*, and, in this respect, it most closely resembles *parvidactyla*, from which, however, its size at once distinguishes it, apart from any details of structure. It is, therefore, somewhat remarkable to find Hofmann still comparing *heterodactyla* with *hieracii* rather than with *parvidactyla* in colour (*op. cit.*, p. 116), although his slender material was evidently the cause, for the one marked character of our finest British specimens is certainly the chocolate-brown tint which it shares with *parvidactyla*, and not the mahogany-brown, or red-brown, tint of *hieracii*. He writes: "Of the size and coloration of *O. hieracii*, forewings (9mm.-10mm.) dark red-brown, marked with pure white; the fringes of the lower lobe, from the anal angle to halfway up the margin, or even beyond, are white for their whole length, purest at the base, towards the apex somewhat running into yellowish or greyish; above this white portion the fringes are brownish, and, at the apex of the lower lobe, furnished, at the base, with a black spot, bordered on both sides with white. On the inner margin of the upper lobe, beyond the outer lobal line, the fringes are, at the base, twice cut by fine white lines, between which lie deep black scales. The black scale-tuft of the 3rd plumule is much extended, mostly somewhat further along the costa than on the inner margin, the scales themselves, on both sides, are of equal length; they extend on the costa not quite up to the apex, which exhibits a few white scales at the base of the fringe; on the inner margin, the black scaling is interrupted by white scales shortly before the apex, so that, at the apex of the plumule, just on the inner margin, there is a small isolated black scale-tuft, surrounded by a ring of little white scales; only in an English example do the black scales on the inner margin of the 3rd plumule run, without interruption, up to the apex. The palpi are very slender, the second joint brown, bordered with white, or spotted with brown and white, the third joint brown with a white apex. This description, drawn up from numerous examples from the Reutti collection, exactly suits also the four original English examples, which, through the kindness of Messrs. Oberamtsrichter Eppelsheim and Oberlehrer Stange, I received for inspection. *O. teucrii* is easily to be separated from *O. didactylus* by the outer marginal fringes of the lower lobe being furnished with a broad, white, dash [or wash]."*

Egglaying.—The eggs are yellowish in colour, laid on the underside of the leaves of *Teucrium scorodonia*, and are exceptionally conspicuous, in some lights, although agreeing well with the tint of the underside of the *Teucrium* leaves. Most of the eggs are laid flat, and near a midrib, although others are placed in the large depressions of the underside of the leaf; one is laid on end, with the rather wider micropylar end forming the apex, but this appears to be a chance position, due to its being lodged against the large midrib. Bacot observes that, in captivity, eggs were laid either singly, or in pairs, in

* Hofmann describes this portion of the fringe in *didactylus* as having a sharp, white, basal line (p. 114).

the hollows between the veins on the undersides of the leaves. On another occasion, eggs were laid on both the upper- and undersides of the leaves, but, as the plant was a weakly one, and the leaves were on a somewhat curved stem, this may not be the normal habit.

Ovum.—Length 0·4mm.; width nearly 0·3mm.; oval in outline, plump, yellow in colour; the micropylar end rather wider and flatter, the nadir much more rounded; the surface shiny, covered with a delicate, but large-celled, polygonal reticulation (Tutt, July 6th, 1899). Of the cylindrical type; size about ·4mm. long, and 2·5mm. wide and thick; rather a broad oval, not flattened on sides, and would give an almost (or quite) circular cross-section; of a pale, but bright, green colour, with varnished-looking surface, showing faint traces of surface facets of the type exhibited by the egg of *M. lunaedactyla** (Bacot, July 2nd, 1899). Yellowish; oval in all aspects, except that one end is very decidedly flattened; length 0·40mm., width 0·28mm., height 0·21mm. The sculpture is bold, in a network of strong, flat, broad ribs, fairly high, and forming irregular polygons, each of about 0·027mm. in diameter (Chapman, July 2nd, 1904).

Habits of larva.—The young larvæ attack the youngest leaves, springing from the axillary buds, or from the growing shoot, but few of the unopened buds are in a condition for the larvæ to enter; those, that are so, are attacked much in the same way as the loose terminal buds of the speedwell are by the larvæ of *Stenoptilia pterodactyla* after hybernation; on the expanded leaves the larvæ remain upon the underside, and eat small irregular holes, apparently leaving the nervures untouched. When several larvæ attack one small leaf, it is nearly skeletonised. The young larvæ grow with such rapidity that, by July 20th, 1904, when about three weeks old, some were 3·5mm. in length, and, judging from memory, already of the adult form, the segments distinct, and the body tapering at both head and anus (Bacot). Gregson also notes (*Ent.*, iv., p. 306) that "the young larvæ leave the eggs in autumn, and the tiny larvæ eat little round holes in the upper leaves of *Teucrium scorodonia* growing in sheltered places; they appear in winter as small oval tufts of whitish hair, attached to the underside of the leaves; early in spring they move, and eat into the young shoots of the foodplant, and, in a few days, if the season be fine, they may be seen on the upperside of the young leaves, casting their skins, and then they appear like little oblong pinkish bundles of hair. They now begin to eat freely, previous to the next change, and may be easily found, often two or three, sometimes more, upon each spike of their foodplant, always on the upperside of the terminal leaves. In a few days they move down the stem, and eat a small round hole in it, about two joints down, which soon causes the tips of the plant to droop, and, near this cover, they remain for some weeks, eating the young growing leaves around them, until they appear as whitish-green hairy larvæ, with a retractile head, attenuate to the anus, four to five lines long, and change in May and June to a pinkish and green, and eventually brown, pupa." The larvæ seem to grow very little

* A later description reads: "In shape, a long regular oval of a pale and transparent yellowish-green colour, with the usual highly-varnished surface. Some faint surface-markings are present, but they are not definite enough to describe as sculpturing. Length about ·450mm.; width about ·2mm. to ·225mm.; these eggs also appear to be more or less circular in cross-section, at any rate. I can only manage to get them into positions that give me the one measurement" (Bacot).

until after hybernation, which seems to end towards the end of March or the commencement of April, the larvæ usually moulting soon afterwards. The first larvæ discovered in this country were in this stage, the young larvæ being found at Delamere Forest, on May 1st-2nd, 1867, sitting on the tops of the leaves, having just (it was assumed) concluded their first moult. A week later they were more difficult to find, having gone down the stem to within about 1½ inches from the bottom, where they had eaten the stem just halfway through, causing the parts of the plant above the bitten place to bear down, and soon to become half dead and very soft. On this part the larva now feeds, and, as it ceases to grow, the neighbouring plants soon overtop it, and cover it up, so that one cannot see it until one looks well for it under the other plants; this dying part appears to afford sufficient food for a single larva, and to accommodate it till it is fullfed. The larva, when feeding, still attaches itself to the upperside of the leaf, but, since the upper part of the plant is inverted (owing to the stem having been bitten through), it is effectually protected from wet (Greening). In the spring, the larva feeds on *Teucrium scorodonia*, gnawing nearly through the stem, and eating portions of the withering leaves near the tip of the shoot, and often the actual heart of the shoot. It moves from shoot to shoot, treating each in the same manner (Bankes). Barrett says (*Ent. Mo. Mag.*, viii., p. 155) that "the mode of life of this larva is curious; it gnaws a deep round hole in the side of the stem of a young shoot of *Teucrium scorodonia*, stopping the flow of sap, and, causing it to droop, then crawls slowly to the heart, and eats portions of the younger leaves, biting them clean through like ordinary larvæ, and never, apparently, gnawing the surface of the leaf like some of its congeners, nor entering the shoot like others; it does not confine itself to one shoot, but, after eating bits of several leaves, goes to another, which it causes to droop in the same way; in wet weather the shoots will recover and raise themselves, but, if the sun is hot, and the weather dry, they wither, and serve as signal flags to show where a larva is to be found. In confinement, the larva makes no attempt to wither the shoot, but eats the young and fullgrown leaves indifferently. Its principal object is, evidently, shelter from the sun, and it is so sluggish that it can hardly ever be seen to move when light is upon it. It is liable to a disease which causes it to become distended, and to die, when it looks like a little hairy bladder." On April 25th, 1904, Bankes found the larvæ scarce in the Isle of Purbeck, but those he found were, on April 26th, 1904, sent to us, feeding on *T. scorodonia*. Each of the shoots of *Teucrium* attacked had the central bud cleared completely out, and the remaining outer leaves bent in towards each other, making a sort of tent, in some of which the larvæ still remained. Scattered through this chamber was a considerable amount of loose frass. The larvæ hang readily by a thread if disturbed, or wriggle actively to the ground, where they remain for a time comparatively still. We have elsewhere mentioned that the larva stretches its anal legs out behind posteriorly, and uses them as pincers to take hold of, and throw to some distance, the pellets of frass (April 27th, 1904). In confinement, however, the larvæ eat out pieces of leaf somewhat irregularly, and apparently from any part of the leaf. The resemblance of the smaller larvæ to bent pieces of the leaf-stalk is sometimes very striking (Tutt). By the end of May and early June the larvæ are fullfed, although, in some years, they go on feeding longer, *e.g.*, Adkin records (*Proc. Sth. Lond. Ent. Soc.*, 1891, p. 123) the larvæ common at Eynesford on June 20th, 1891 (see also *infrà*). Usually, however, they are much earlier—young larvæ found at the end of April, in north Wales, were nearly fullfed by May 19th, 1867; whilst on March 25th, 1867, and following days, in the Llanferras district, young hybernating larvæ were just beginning to feed (Gregson); larvæ were searched for on June 5th, 1904, but were then nearly over, and only three obtained, although many stems showed where they had been attacked; the larvæ had mostly fed up and apparently left the plant (Atmore). Bankes gives the following dates for the taking of larvæ—June 6th, 1887, and June 19th, 1888, in the Isle of Portland; imagines from the last lot bred July 17th-20th, 1888; larvæ in the Isle of Purbeck from May 27th-June 11th, 1885, produced imagines June 21st-July 7th; also from the Isle of Purbeck—larvæ June 7th, 1886 (imagines June 28th-July 10th), larvæ June 8th, 1887 (imagines June 19th-July 3rd), larvæ May 31st, 1888 (imagines June 25th-July 6th), larvæ April 25th, 1904. He also has notes of the larvæ being found in the Isle of Purbeck, by Digby, on May 5th, and May 16th-31st, *circa* 1883. Bower notes larvæ common on Box Hill, June 24th, 1887, young larvæ May 26th, 1902, at Shoreham, Kent, the larvæ biting partly through the stems of their foodplant, causing the tops to wither and fall over. Buckler figures (*Larvae*, etc., pl. clxiii., fig. 7) a larva of this species after its final moult, feeding openly and exposed on *Teucrium scorodonia*, on May 16th, 1867. On June 24th, 1887, also, Richardson reported taking larvæ in the Isle of Portland, whilst in the following year they were obtained in the same locality from May 26th-June 11th.

Larva.—*First instar* (about to moult): Pale reddish-brown in colour, with a double series of white dorsal patches; the skin much wrinkled, lateral flange already present. Head polished black; thoracic segments large; true legs strong, prolegs weak, but tall, as in adult larva; prothoracic plate of a medium brown tint. On the meso- and metathorax, as well as abdominal segments, i+ii are on the same plate. On the meso- and metathorax, iii is large and iv small (the former well in front of the latter); v, placed below them, carries a strong hair. On the abdominal segments, tubercle iii is situated in its usual position, iv and v, each carrying a hair, forming a twin pair directly below the spiracle, v the smaller. The skin appears quite smooth and shiny under a $\frac{1}{4}$-inch objective, showing no trace of spicules. The hairs are comparatively short, smooth, and tapering, with slightly knobbed ends, but not thorned (Bacot, July 10th, 1904). *Second instar*: 3·5mm. The segments very distinct; the body tapering both at head and anus. Head black. The body with a coat of coarse spicules; secondary hairs restricted to the tubercular areas, with two exceptions, and these are where secondary hairs occupy the positions later taken possession of by the accessory warts. Secondary hairs are, however, numerous on the prothoracic shield, and show their knobbed character very plainly. All the primary hairs appear to be slightly knobbed, but not thorned, and they show some amount of tapering; the tubercles, from which they rise, are wart-like in character. Spiracles raised. Colour of larva dull red, with whitish areas surrounding the bases of warts, and a dark mediodorsal line. *Third instar* (hybernating skin) (April 27th, 1904): The larva is the smallest of several sent by

Mr. Bankes from the Isle of Purbeck, rather differently tinted from the others, being much redder; it is rather under 4mm. in length. The head is black, the ocelli still blacker, the mouth-parts brown, the chin white; studded with comparatively long white hairs. The prothorax is remarkably long (front to back), gradually increasing in width to the mesothorax, projecting somewhat in a point medially over the head, divided distinctly into two halves, the front half not haired, glossy white in tint, retractile with the head into the hinder half, on which the dorsal warts form a broad, transverse, bristly, prothoracic hood, the hairs of which, when the larva is in repose, form a protecting cover to the head. The body segments—mesothorax to anus—are of a delicate reddish tint, with deeply-cut, bright, orange-yellow, intersegmental incisions; on each segment the tubercles are arranged in a transverse ring of warts—on the thoracic segments as i+ii, iii+iv, v, vii, and on the abdominals as i+ii, iii, iv+v, vi, vii—of which i+ii, iii, iv+v are large and raised on an elevated base, vi of moderate size (low, with one long, black-based, central hair), and vii of small size (low, with two long, black-based, central hairs); the bases of the raised warts are silvery-white, inclining to be transparent and glassy, the flat apex dark grey, from which a number of long, serrate, blunt-ended hairs spring from black, shining, chitinous bases, rising in two alternate rows, one below the other, with one large central hair; the long hairs appear to be rather darker, but, in general appearance, they are almost like spun glass; vi appears to be lost on the prothoracic segments, and, as already noted, i+ii make, on the prothorax, a long transverse wart. The posterior edges of the segments are also white. There appear to be two subsegments to each segment, the hinder exceedingly narrow. The reddish body-colour breaks up, under a lens, into somewhat moderately-developed mediodorsal, subdorsal, and supraspiracular longitudinal rows. The anal segment is covered with black chitin, from which arise numerous white hairs, similar to those on the warts, but shorter. The shagreening of the skin on the dorsal surface is very striking, the raised points looking (under certain lights) like drops of shiny liquid. The projecting black spiracles form also a very striking feature. The dorsal surface carries a number of irregular, scattered, secondary hairs, similar to, but smaller than, those on the tubercular areas; one surmises that those on the posterior portion of the mesothorax and metathorax have a definite morphological value. (They appear to suggest a duplication of the dorsal warts). The venter is whitish in tint, with very clear yellow-orange intersegmental incisions, and few scattered hairs. The prolegs are long, slender, glassy-looking, almost transparent, although tinged with black; the proleg hooks are also black; the anal legs are also very long, and well developed, glassy in appearance, and tinged with black. The true legs are glassy, almost transparent, grey-black, each with a single, sharply back-curved, hook (Tutt. Larvæ, April 27th, from the Isle of Purbeck, sent by Mr. Bankes). Plump, slug-shaped, grey in colour; tapering to either end; 4th and 5th abdominal segments are the largest, as regards girth, while the 8th is probably slightly the longest; the segmentation very marked in the Arctiid or Anthrocerid fashion, the incisions being very deeply cleft. The larva rests with its body curved. Head glassy in appearance, very dark brown, almost black on crown. *Body:* The skin is pale flesh-coloured, whiter on dorsal area, and, where it immediately surrounds the tubercles, nearly pure white. Both the true legs and prolegs are pale, the latter being very tall and slender. Skin covered with numerous raised chitinous buttons, evidently a development of the spicular coat, and, although they are actually minute, they are, relatively to the size of the larva, large and coarse. The spiracles are dark brown or black, and are raised into short tubes that taper upwards from the base like a lighthouse, they are about one and a half times as high as the diameter of the longer transverse axis. The skin bears a small number of hairs (secondary skin-hairs) in addition to those arising from the tubercular area, and these, together with the smaller tubercular hairs, appear to be enlarged at the tips, when seen under a 1-inch objective; with a $\frac{1}{4}$-inch objective, they are found to be merely blunt-ended, but, as they are very nearly transparent for the greater part of their length and filled with an opaque white substance at the tip, the apparent enlargement, when viewed under a lower power, is most probably optical. The longest (probably the primary) tubercular hairs arise from dark brown or black bases; they are tapering, and of pale colour, with one or more dark bands round them at about half their height, and then pale to their tips. *Tubercles:* The dorsal tubercles have converged and developed into large raised warts. There is no secondary wart behind spiracles, only a group of three or four small hairs. Tubercles i+ii are combined into a single wart on all segments from the mesothorax to the 8th abdominal; iii is a large wart in about normal position above spiracle; iv and v conjoined form another below it; there is also a marginal series. There is a tolerably conspicuous reddish patch just above base of true legs (Bacot, May 1st, 1904). *? Fourth instar* (after moulting hybernating skin): Between 6mm. and 7mm. long when crawling, almost 6mm. at rest. The body pale greenish, with broken, reddish, mediodorsal line; subdorsal and supraspiracular lines still sufficiently well-developed to give a marked red tinge to the ground colour (but much less so than in preceding instar), in spite of the magnificent assemblage of white silvery hairs arising from the tubercles. The body also is a little stouter, but still quite cylindrical, and with no perceptible inclination to flattening ventrally, thinning off, also, both anteriorly and posteriorly. The head is now of a semitransparent greenish-yellow, with two dark brown patches on the upper part of the clypeus. The tubercles appear to be arranged as in the preceding instar. The prothorax is covered dorsally with a panoply of hairs, arising from a large combined wart, i+ii, which projects over, and protects, the somewhat retractile head; on the other segments the tubercular warts are —i+ii united, iii rather smaller than these, iv+v about the size of iii, vi somewhat smaller, vii very ventral, rather larger than vi, also a small accessory postspiracular; i+ii, iii, and iv+v are raised, and each produces a magnificent series of divergent white hairs, with blunt-ended tips of a silvery-white colour, of three sizes, shining, under a good light, like filigree-work; the longest of these appears to be readily recognised as the primary setæ, the smallest are very similar to the secondary, scattered, blunt-ended hairs that arise irregularly from the body surface; vi and vii are almost flat. The spiracles are very striking, dark, almost black in colour, with a median metallic-looking spot. *Same instar preparing for another moult:* 6mm.-7mm.

long, in position for moulting. Head drawn in ventrally, invisible from upperside; prothorax and metathorax also drawn down ventrally. Skin of a dull greyish-yellow; segments distended, intersegmental incisions stretched, but very clearly marked. Tubercles as before, the hairs, however, much broken, the longer black and white setæ less disturbed. The spiracles drawn in, and appearing as small, black, shiny plates. The 9th and 10th abdominal segments much contracted, their whole area being, as it were, covered with complex, tubercular, warts, similar to those on the preceding segments. *Final instar:* A larva that has just completed a moult is of a peculiar dove-grey, owing to the pale hairs and pinkish skin, but it is much too hairy to allow of any description in detail before it has filled out somewhat. A large larva in same skin, at rest, is 8mm. to 9mm. in length. It rests with its head turned downwards and its thorax compressed, so that its greatest girth appears to be towards the anterior end, and it appears to have a longer and more gradual taper posteriorly than anteriorly. Otherwise than this, it is of the same shape as the smaller larvæ, except, perhaps, that the segmentation in the smaller larvæ was rather accentuated, owing to the approach of a moult. In colour there is a complete change, the skin being now of a bright yellow, with some red mottling on the lateral area of the thoracic segments. The spiracles are not so tall as previously, and are of a paler hue, which renders them less conspicuous. The tubercles are pale brown, and the head is also paler, the dark brown or black markings of the previous skin being replaced by pale brown. To the naked eye the spicules appear to be smaller in comparison, and more closely set, and much less conspicuous in consequence. The hairs are similar to those of the earlier stage, but are more conspicuous, partly, I think, owing to their greater length, and partly to a considerable increase in their numbers. The postspiracular group of (secondary or body) hairs forms a much more conspicuous feature, but there is no raised skin-area, nor any sign of a wart. No clear subdivision of the segments can be made out. Long hairs are minutely thorned (Bacot, May 1st, 1904). *Final instar* (well-grown): Much stouter, and plumper in build, than in the preceding stadium, less attenuated at the ends, and altogether more stumpy, but still not flattened ventrally; 8mm. at rest, 9mm.-10mm. when crawling. The larva examined has lost the whole of its red coloration, and is now of a delicate yellowish-green, much whiter towards the anterior edge of each segment and at the bases of the tubercles, much yellower at the hinder parts of the segments, and there is certainly no clear trace of a second subsegment when the larva is at rest. A somewhat darker greenish line is traceable, as a mediodorsal, from the prothorax to the anal flap. The tubercles are splendidly developed, the bases pale, the hairs very numerous and variable in length, but the body-surface covered to nothing like the extent it is in the preceding instar, owing to the great growth of the larva in width as well as length, *i.e.*, the tubercles occupy much less space in proportion to the size of the larva. The skin is still heavily shagreened. There is no trace of a subspiracular flange, but, below the spiracular area, the body is more distinctly yellow-green. The head is of a semi-transparent, pale, greenish-grey, the mouth-parts almost colourless; a brown patch above them; the summit of the clypeus is also tinged with brown;

the ocelli brownish-black. The true legs are of the same semi-transparent greenish-grey tint as the head, the terminal hooks being black, but, laterally to the legs on either side, and below the marginal tubercle, is a red-brown patch (? slightly chitinous) on each of the thoracic segments, a somewhat similar, but smaller, patch being placed higher up, directly above the marginal tubercles. With the exception of a trace of the lower one on either side of the venter of the 1st abdominal segment, these brown patches are confined to the latero-ventral area of the thoracic segments. The remainder of the venter is more or less of the greenish ground colour, but, under a good lens, the ventral area of the thoracic segments, the bases of the true legs, the fronts of the abdominal segments, the bases of the prolegs, as well as the venter of the 9th and 10th abdominal segments, are semi-transparent, and very glassy-looking. The prolegs are long and slender (and there is some sign of a slight "loop" when the larva is walking hurriedly). The hooks on the prolegs are few in number, and exceedingly small; the anal prolegs are of the same pale, semi-transparent, greenish colour as the others, the hooks are also very minute. I was interested to see a larva use the anal prolegs as pincers, by means of which it was seen to throw a frass pellet to a considerable distance from the body. On those segments, which do not carry prolegs, a tiny tubercular point carries one or two hairs in the proleg position. All the short, irregularly-scattered, secondary hairs appear to be bluntly bifid, and like the short hairs on the tubercular warts; the 1st and 2nd abdominal segments have a very large number of secondary hairs on the venter (Tutt. April, 29th, 1904). *Final instar* (fullgrown): Yellowish-green in colour, looking glaucous or hoary, from the abundant hairs, and paler, round, large warts, from which they arise; short and thick, 8mm. long, 1·8mm. wide; small ochreous head with brown markings, overhung by a thick curtain of hairs from margin of prothorax; it tapers in either direction from the 1st abdominal segment, but the change is slight in the first six abdominal segments; there is a green dorsal line (dorsal vessel?), but otherwise the colouring is very uniform, and there are no markings except on thoracic segments, where there are small brown patches below tubercles v+vi, and, on mesothorax, in front of i+ii also. The hairs are white; the tubercles pale, except a darker shade at base of principal hairs; the tubercles carry numerous secondary hairs, but these are much longer than the secondary hairs scattered over the skin-surface. The tubercles i and ii, on the abdomen, form one large round wart, with two primary hairs, distinguishable from the others by being tinted with sepia basally, and with a dark ring of origin; they are smooth and pointed, that representing i being in front of, and inside, that representing ii, about 1·0mm. long, ii being about 2·0mm. long; these, and other primary hairs, are marked with rings like those of a porcupine, there being only one, two, or three, to a hair; several secondary hairs are long, smooth, and pointed, and even ringed like the primary, but, basally, they are abundantly distinct; then there are very definite secondary hairs, to the number of twelve to fifteen, of various lengths down to 0·1mm.; the smaller they are, the more they are thickened at the end; this thickening is gradual, and generally ends in two or three divisions or points; tubercle iii may be described in similar terms to i+ii, except that it has only one primary hair; iv+v, again, carries two primaries, the upper one (that representing v) in front; it is otherwise like i+ii. Behind the spiracle, near the posterior border, is a very definite little tubercle, with eight or ten hairs, none of which have the characters belonging to the primaries on the other tubercles; another very similar tubercle lies immediately below this, and as far below iv +v as this one is above it; vi has a primary hair about 1·0mm. long; the tubercle itself is much flatter than those above, and has seven or eight typical secondary hairs, but none of the pseudo-primary as in i+ii. The general surface is closely set with skin-points; these are almost colourless, so that, in some lights, it is difficult to believe they are not little pits; there are, also, very numerous minute, white, secondary hairs, finely swollen, and bifid at tips; their length is about 0·1mm., but some are nearly 0·17mm.; they are disposed at a considerable distance from the tubercle, leaving a free surface round each, so that they may be said to lie along the borders of the segments, and, from these, form transverse rows between the tubercles. The prothoracic plate is crowded with secondary hairs of all lengths, but the usual six long hairs on each side can be distinguished; one specimen has a well-developed tubercle, almost a wart, with long hair, behind the 1st tubercle on mesothorax, whilst another is without it; this is wanting on the metathorax. On the mesothorax, i has two primary hairs; on the metathorax it has apparently only one, ii and iii each have two. The head ochreous, with darker markings. The legs pale. The prolegs on long props, ending in a bulbous extremity with five hooks, omitting outer quadrant (Chapman. June 8th, 1904). *Quiescent stage preceding pupation:* The segments very deeply cut at incisions, no subsegments apparent; larva has an Arctiid appearance, owing to tall many-haired warts. Spiracles tall, rims raised into tubes, as usual, pale brown. In addition to the hairs on raised warts, many secondary hairs are present on general skin-area (Note. This is a feature not developed at all in *Porrittia galactodactyla*, *Alucita pentadactyla*, *Ovendenia septodactyla* (*lienigianus*), and *Oidaematophorus lithodactyla*), and also a coat of spicules, of the same colour as the general skin-surface; the warts on the abdominal segments, are placed as a single transverse row, or ring, round each segment; i and ii carry dark-based hairs placed with other hairs on a single wart; iii, a single dark-based hair on a wart with other hairs; iv+v, with two dark hairs, in a large many-haired wart, and vi and vii as in *Marasmarcha lunaedactyla*. The posterior lateral warts (secondary) are well-developed on meso- and metathoracic segments; the dark-based hairs (? i and ii) combined within the limits of a single large wart; the primary hairs are long and thorny, secondaries and smaller wart-hairs are shorter and glandular, enlarging at tip, as in *M. lunaedactyla*, all hairs white. Prolegs of the usual long and slender description. (Bacot. June 18th, 1899).

Pupation.—The larva, when fullfed, descends to just below where it has bitten the stem halfway through, and, attaching itself by the anal segment, changes to a pupa with the head downwards; the stem to which it is attached is very short and stiff, and the pupa is usually well protected by the taller plants that have covered it (Greening). The larvæ of *Capperia heterodactyla* occasionally pupate on the plant on which they have fed up, outside the feeding area, but not generally, I think, although the habit seems a common one in confinement (Atmore). The pupal state seems to be assumed, under any convenient object, close to the ground, as the hairy pupa is not often to be found on the plants on which the larvæ have matured (Buckler). The larva pupates on the underside of a withered leaf, clod, or stone, attached by the anal segment (South).

FOODPLANTS.—*Teucrium scorodonia* (Greening), *T. chamaedrys* (O. Hofmann) [*Marrubium vulgare* (E. Hofmann).]

PARASITES.—*Limneria barrettii*, Bridg. (Barrett), *L. teucrii*, Bridg. (W. H. B. Fletcher), *Angilia virginalis*, Grav., *Mesochorus vitticollis*, Holm. The species is very subject to the attacks of ichneumons. I bred more parasites than moths from the larvæ reared in 1900 (Crombrugghe de Picquendaele).

PUPA.—Length 8mm., greenish, more olive-reddish towards the anal end, greyer in front, with practically no markings. Very similar in build to the pupa of *Porrittia galactodactyla*, *Wheeleria migadactyla*, and especially *Ovendenia septodactyla* (*lienigianus*). It differs from the latter in the remarkable arrangement of the hairs on tubercles i and ii, which suggests in *O. septodactyla* the design carried out in *C. heterodactyla* (*teucrii*), *viz.*, the hairs of the series are all arranged in the same antero-posterior flanges, forming, on each segment, a pair, and the whole are extensions of the dorsal flanges. It differs especially in having, internally conjoined, i+ii, on either side in the middle of the dorsum, a pair of secondary hairs, one pointing forward and one backward, certainly small, but still such that, without the homology with *Ovendenia septodactyla*, etc., it would be impossible to say that it might not be the real i and ii. The fan-like tubercle iii (containing the wing-line of hairs) is less developed, each tubercle possessing two hairs only; tubercles i and ii, combined, possess five hairs, fan-wise, not quite antero-posteriorly arranged, but with the front slightly twisted outwards, but so little that the effect is to present the series as all lying in one plane; iii has a true hair pointing forwards, smooth and pointed, and a very similar secondary hair curved backwards; the secondary hair has, however, no well-marked ring-base, is thick, blunt, glassy-looking, and coarsely spiculated. This difference between primary and secondary hairs shows the mediodorsal double pairs to be secondary, that i and ii lie nearly flat, forwards and backwards (like *Stenoptilia pterodactyla*, etc.), and that the upstanding hairs are secondary. Equally, iv+v are a triplet, the upstanding central hair being secondary; vi carries a long hair sloping backwards, with a short projecting secondary. The head is well armed with hairs which form a border, chiefly those of the front of the antennæ. The mesothorax has a pair of long hairs (i ?) within the dorsal flanges, which are ringed with black, fading out to their tips. The dorsal flanges (as in *Platyptilia*) are not very strong, but are accentuated by a continuous row of hairs, most of which are secondary; on the metathorax the largest hair of the flange is primary, and there are a couple of primaries at its outer front angle. In front, the band projects a little ventrally, the 1st leg has a strong keel, like the pupa of *Eucnemidophorus rhododactyla*, but much more marked, and there is no femur visible. The antennæ have a fine hair to each joint, but legs, maxillæ, etc., are without them. There are two hairs (primaries) at the eye-centre, one on the clypeus (each side), and on the labrum. The antennæ end 2mm. short of the end of the appendages, and the 1st legs go only about 0·3mm. further; the 3rd legs are barely visible, the 2nd being but slightly separated at the tip. The beads are various minute nodules and ridges, the most marked of which, perhaps, follows closely the line of the glazed eye inside it; seen laterally, the two clypeal hairs have a very walrus-tusk aspect, in spite of their relative delicacy, and the antennæ form fine nodulated ridges. The wings begin basally with three rows of hairs; the middle one is very short. The second dorsal one ends at the posterior margin of the 2nd abdominal segment, but here are, again, a few hairs of a middle row, and, in front of these, the beginning of a fourth row of hairs (or 5th, if the few hairs just mentioned are not part of the first middle set). An outer row again appears, and these rows proceed till stopped by hind margin. The very finely pointed wing-tip is about 0·3mm. short of the end of the 2nd legs. The above description was made from a living pupa, and under the impression that the apparent hairiness of the pupa allied it with the hairy Alucitids, and before a fuller study of the Oxyptilid pupæ showed the necessity of distinguishing between: (1) true hairs, (2) secondary hairs, (3) skin processes (spines or horns), and (4) enlarged skin-points. [The following note, made more recently from mounted pupa-shells, will afford to correct the preceding description which is in error in calling skin-processes hairs: The pupa of *C. heterodactyla* is Oxyptilid, in having essentially the same development of the bases of the dorsal tubercles into spines and processes that is characteristic of *C. distans*, and that is carried to such high development in the Amblyptiliid and Marasmarchid pupæ. In *Capperia heterodactyla*, the spines are much more slender than in *Crombrugghia distans*, are, in fact, so thin, that one describes them as hairs, until a closer examination of them is made. In this way, one confuses the structure with the very different one of, say, *Wheeleria migadactyla* (*spilodactyla*), where tubercle i (with ii just behind it) carries a number of true hairs. In *Capperia heterodactyla* there is a single, definite hair to represent i, and another for ii; the other hair-like structures are pupal-processes, like the halbert spines of the pupa of *Amblyptilia cosmodactgla* (*acanthodactyla*), *i.e.*, extension of the pupal integument into this form. In *Crombrugghia distans*, these horns or processes have a rough surface due to their having the same structure on the general pupal surface, *viz.*, a minute, closely-set, pitting. In *Capperia heterodactyla*, these horns, having become slender and hair-like, retain a similar roughness, and have all the appearance of spiculated hairs. One is so used to spiculated hairs, especially on larvæ of "plumes," that a first impression is that these must be similar spiculated hairs; this, however, is at once corrected by noticing that their surface is continuous with that of the body of the pupa, without any separation by line or suture, whilst the two hairs proper of i and ii are very obvious, with their elaborate basal articulation. They are perfectly plain and smooth, without any trace of spiculation, and so contrast with the horns. The pupa is not, therefore, really a hairy pupa as it appears to be, except, of course, in the very natural sense that any filamentous cutaneous structure may be called a hair. We need not here burden ourselves with other questions that may arise in regard to other pupæ, but, having referred to that of *Wheeleria migadactyla* (*spilodactyla*), we may note that the long hairs on that pupa are true hairs arising from "warts," *i.e.*, many-haired tubercles, whilst the short ones are neither true hairs, nor pupal processes, as in *Capperia heterodactyla*, but, apparently, enlarged skin-points like the secondary "hairs" on the larvæ of *Platyptilia*. The wing-hairs of the pupa of

Wheeleria migadactyla (*spilodactyla*) are small and numerous, and appear to be, similarly, skin-points, whilst the pupa of *C. heterodactyla* has fewer and larger ones that are spiculated and apparently "horns" like the dorsal ones. One would expect the wing-hairs to be the same structure in both cases, until one reflects that this is no more necessarily the case than for the dorsal "hairs" of i and ii.] (Chapman). *Pupa-case:* The extremely sharp angle, at which the upper portion of the pupa-case is bent backwards after emergence, is only paralleled in *Adactylus bennetii*, among the species that I have examined, and it renders accurate measurement very difficult. The length appears to be from 8·5mm. to 10mm., the diameter just under 2mm. at the end of the wing-cases. The colour of the empty pupa-skin is pale yellowish-white, with a trifle darker shade on the anterior dorsal region. In shape it is nearly, or quite, cylindrical. The spiracles are low, only slightly raised, with a slit-like opening. There are structural dorsal ridges, of the nature of thin walls, on the anterior abdominal segments in the line of the dorsal tubercles, the processes, on which these latter are placed, rising directly from, or through, the flange. The antenna-cases, and chief nervures on the wing-cases, are fringed with hairs, but this is not so prominent a feature as in *Porrittia galactodactyla*, *Ovendenia septodactyla*, or *Oidaematophorus lithodactyla*. In reality, the tubercles bear single hairs, but, owing to the exceedingly hair-like development of the dorsal processes or horns, really a development of the raised skin-area which bears the dorsal tubercles, the pupa, at a casual glance, appears to bear many-haired tubercles. This arrangement suggests a fairly close relationship with *Marasmarcha lunaedactyla*. All the dorsal tubercular processes are fairly well developed from the 1st abdominal to the 8th abdominal, and, although the 3rd abdominal bears the largest processes, there is not the same marked disparity that there is in the case of *M. lunaedactyla*. Each process consists of the raised skin-area bearing i and ii; between these tubercles rise two tall, slender, tapering horns. The tubercles themselves are situated just below the juncture of these horns, rather to the outer side of the process, their hairs pointing anteriorly and posteriorly at a low angle; slightly on the inner side of the process, and lower down than the tubercles, arise two smaller horns, one anterior and the other posterior. On the 2nd and 3rd abdominal segments, the posterior horn is nearly as large as the central ones, while on the later segments, (?) 4th and 5th, but certainly on the 6th, 7th, and 8th, this hair is altogether wanting. On the 2nd to 8th abdominals there is a pair of small, forked, horn-like processes, one on either side of the dorsal line, on a low transverse ridge, which connects the large dorsal processes, one fork of each pair bending forwards, and one backwards; tubercle iii is situated posteriorly to, and above, the spiracle; it appears to bear two large hairs, but a closer examination shows that the anterior alone has a tubercular base, the posterior being a slender, horn-like, process, arising at the base of the tubercle; iv and v are in line below iii, the bases of the two hairs being separated by another tall slender horn, that could quite as easily be mistaken for a hair as that at base of iii; tubercle vi carries a single large hair, with a very small process at its base, and vii two hairs, with their bases a short distance apart. The hairs are white, and smooth; they taper very gradually and evenly; the horn-like processes, although confusing at first, are easily enough distinguished after a short examination, owing to their heavier and less even appearance, their surface being roughened and spiculate. The meso- and metathoracic segments also bear a dorsal ridge of hair-like horns, but the real tubercular-based hairs are as in *M. lunaedactyla*, four dorsal on the meso- and two on the metathorax, each segment having two lateral hairs at the base of the wings, also as in the above-named species. The abdominal segments, especially the 4th, 5th, and 6th, on their dorsal area, show the transverse wrinklings of the integument very sharply; they are fine and even, and appear as flattened folds. The intersegmental area is very finely, but sharply, pitted. It is interesting to note that this genus retains the wing, and antennal, hair-fringes that are lost in *M. lunaedactyla*. The development of hair-like processes in proximity to the tubercular hairs, in this species, suggests that perhaps the additional hairs of species like *Ovendenia septodactyla*, etc., may be of the same character, but a further examination of the last-named species shows that there is not the same clear differentiation, and, as regards the dorsal groups, the two large central structures are most certainly hairs (Bacot).

Variation of pupa.—The pupæ, like the larvæ, vary somewhat in colour, being sometimes pale pinkish, at other times pale green, and occasionally brown, with intermediate varieties, but the pale forms all become darker before emergence.

Time of appearance.—The species is on the wing, in most years, from mid-June till towards the end of July, although, in such early years as 1893, imagines were already on the wing before the end of May, and in late years specimens are to be found in August. In Baden, it occurs in the Hardtwald, near Carlsruhe, from the beginning of June on into July, sometimes very abundantly among *Teucrium scorodonia* (Hofmann), also as late as August, near the Todtmoss, Tauberbischofsheim (Meess and Spuler). In Belgium, usually abundant in late June and July, in the Forest of Soignes (Crombrugghe); abundant June 29th, 1901, in the Forest of Libin (Derenne). Chapman took a specimen at Moncayo, in Spain, between July 12th-24th, 1903, probably in the beech-wood zone, at about 3500ft.-4000ft. The earliest example, in 1867, was bred on June 14th, from larvæ received from Delamere Forest (Knaggs); July 16th-17th, 1869, flying amongst wild sage at Witherslack (Gregson); July 31st, 1869, common between Norwich and Ranworth; July 14th, 1870, near Norwich (Barrett); July 14th, 1878, near Brandon (Bower); July 19th, 1881, in the Isle of Portland (Bankes); end of July, 1882, in Tilgate Forest (South); early July, 1883, at King's Lynn (Atmore); July 19th, 1883, in the Isle of Portland; bred June 21st-July 7th, 1885; bred June 28th-July 10th, 1886; captured July 5th, 1886, in the Isle of Purbeck (Bankes); June 24th, 1887, at Box Hill (Bower); June 29th-July 1st, 1887, at Portland (Richardson); bred June 19th-July 3rd, 1887, also June 25th-July 6th, 1888, from larvæ taken in the Isle of Purbeck, and bred July 17th-20th, 1888, from larvæ found in the Isle of Portland (Bankes); July 8th, 1888, at Crohamhurst (Sheldon); bred July 21st, 1888, from larvæ taken near Weymouth; July 2nd, 1889, and August 1st, 1890, in the Isle of Portland (Richardson); July 19th, 1888, June 23rd, 1889, June 24th, 1891, at Clevedon (Mason); May 31st, June 2nd, June 10th, 1893; and June 16th-25th, 1894, in the Isle of Purbeck (Bankes); June, 1897, at Bentley (Burrows); July 15th, 1897, at Hartlebury Common (J. E. Fletcher); July 18th, 1901, in the Isle of Purbeck (Bankes);

June, 1905, in the extreme north of Sutherland (Cruttwell, *Ent. Mo. Mag.*, xli., p. 260).

Habits.—The species is rarely to be disturbed during the morning, but, as the afternoon advances, it may be readily started from its hiding-places, among the herbage, where *Teucrium scorodonia* grows. It flies more freely, however, in the late afternoon, although the early evening is undoubtedly its natural time of flight, and Barrett notes that, on one occasion, on a rough piece of ground beside the roadway, between Norwich and Ranworth, a thunderstorm impending, one afternoon, made the "plumes" so lively, that they danced over the *Teucrium* like *Tipulae;* the same observer, however, notes that, normally, the moth hides itself during the day in patches of woodsage, and can hardly be induced to fly, except in the afternoon, and then very sluggishly, but at dusk it dances about in a lively manner, sometimes in plenty, over the same patches. Bower found that it was readily disturbed in the afternoon of June 24th, 1887, at Box Hill, occasionally flying on its own account later in the afternoon, whilst on July 14th, 1878, he was able to disturb specimens by walking through their haunts, at Brandon. South, however, records that the imagines were seen darting about in the sunshine among a large patch of *Teucrium* in Tilgate Forest, in 1882, an observation doubtless that led to Leech's general statement that "the species is local but plentiful where it occurs, flying over woodsage in the sunshine in July." Bankes says that, in Dorset, the imago can be disturbed from among its foodplant in the daytime, but is then very sluggish. Its true flight-time appears to be in the evening. At Clevedon, it is generally on the wing for a fortnight or so each year; it is usually to be obtained by beating wood-sage and low-growing bramble-bushes in the daytime, flying for a yard or two, and then generally settling on the flowers of the wood-sage. It is rather a difficult insect to follow during flight, being so similar in tint to the herbage (Mason).

Habitat.—This species appears to be most particular in its choice of habitat, and we know many spots where *Teucrium scorodonia* grows abundantly, yet where we could never find the insect. Gregson says that it was first taken freely, in Britain, in Pettypool Wood, in the Delamere Forest district. Atmore notes that the species is exceedingly local on the heaths in the King's Lynn district, where the foodplant grows in patches, every one of which, however, does not produce the species; he notes that it seems to be less particular in the New Forest, where the species appears to be very abundant. Barrett says that the species prefers the patches of wood-sage that grow on open heaths, in extensive gravel-pits, or in open woods, and appears rarely to be found on a hedgebank or under bushes, although the plant may be there in abundance; it prefers sand-heaths and gravel-pits to woods. South, however, says that the insect occurs on stunted plants of *Teucrium* growing on a dry embankment, in a fir plantation in Tilgate Forest, and Cambridge notes that it occurs in woods among *Teucrium scorodonia*, at Bloxworth, and Freer that it is found sparingly on Cannock Chase. Mason observes that he could only find it in one restricted locality in Clevedon, *viz.*, in an open glade in a wood growing on a limestone hill. At Folkestone it is found freely on the undercliff in the Warren, not far from the railway-station there, whilst its first record as British was, as noted above, from Delamere Forest. In Belgium, Derenne also records it as very abundant in the Forest of

Libin, whilst Crombrugghe says that it is abundant in the Forest of Soignes, in somewhat shady places. Bankes says that it is an extremely local species in Dorset, where, although its foodplant is abundant both away from, as well as on, the coast, the insect appears to have been only found at one inland station, *viz.*, Bloxworth. He adds: "Personally I have never met with it except on the coast-line, but have there found it in, and on, various warm hollows and slopes on sheltered strips of undercliff. Some of these spots lie fully exposed to the east, but they are all protected from the prevalent west and south-west winds. *C. heterodactyla*, in my experience, is not confined to any particular kind of soil." W. H. B. Fletcher finds it on a sandy common on Hayling Island.

Localities.—The species is exceedingly local in England, has been once reported from Scotland, and only from Ireland, without details, by Gregson (*Ent.*, iv., p. 306). Berks: Reading (Bazett), Boar's Hill (Sedgwick). Cheshire: Bidston (Brockholes), Pettypool Wood (Gregson), Delamere Forest (Greening), Birkenhead (Stainton). [? Cornwall: Botus Fleming (Marshall), recorded as *hieracii.*] Denbigh: Llanferras, Pen-y-Garrowin, Pant Moen (Gregson). Devon (*teste* Barrett). Dorset: Isle of Purbeck (Bankes), Isle of Portland (Richardson), Bloxworth (Cambridge), Weymouth (Richardson). Durham: Darlington (Stainton). Gloucester: common—near Durdham Down, Almondsbury (Hudd), Bristol (Stainton). Hants: Hayling Island (W. H. B. Fletcher), New Forest (Atmore). Isle of Man (Gregson, *Ent.*, iv., p. 306). Kent: Folkestone Warren (Tutt), Shoreham (Bower), Canterbury (Parry). Lancashire: [Warrington (*teste* Leech). Possibly intended for Pettypool Wood (Tutt)], Humphrey Head (Gregson). Lincoln: Ashby, near Brigg (Cassal). Norfolk: Yarmouth, Norwich, Ranworth (Barrett), King's Lynn (Atmore). Northumberland: Newcastle (Stainton). Somerset: Leigh Woods, Brockley Coombe (Hudd), Clevedon (Mason). Stafford: Cannock Chase (Freer). Suffolk: Brandon (Bower), Bentley (Burrows). Surrey: Crohamhurst, near Croydon (Sheldon), Box Hill (Bower). Sussex: Tilgate Forest (South). Sutherland: Extreme north of the county (Cruttwell *teste* Holland). Westmorland: Witherslack (Gregson). Worcester: Witley, Hartlebury Common (Edwards).

Distribution.—The continental distribution of the species is practically unknown, and, even as late as 1892, examples were being sent out by Staudinger as *hieracii* (see *Ent. Rec.*, iii., p. 58). Rössler and others, however, had previously almost reached a solution of the difficulty, but it was not until 1895 that it really was distinctly recognised as a species apart from *hieracii* (see Hofmann, *Die Deutsch. Pteroph.*, p. 116), and, as recently as 1900, Crombrugghe de Picquendaele felt it necessary to point out the different life-histories of the two insects* [*Rev. Ent. Soc. Namur*, iv., p. 47 (1900)]. Belgium: Forest of Libin, very abundant (Derenne), Forest of Soignes, abundant (Crombrugghe). Germany: Baden—Hardtwald, near Karlsruhe (Hofmann), Heidelberg (Meess and Spuler), Schwarzwald—St. Blasien (Bischoff), Todtmoos, Geisinger Bergen (Meess and Spuler), Rhine Provinces—Lorch-on-Rhine, Dennelbach Valley (Rössler), the Senning, Roeslingberg, Bornich, near St. Goarshausen (Fuchs), Bavaria—the Donauberg, Kelheim (Schmid), Hanover (Glitz), Marktsteft, near Würzburg, Württemberg—Urach (Hofmann). Spain: Moncayo (Chapman).

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* Having reared both species, Crombrugghe de Picquendaele writes: "The larva of *O. hieracii* feeds on *Hieracia*, chiefly *H. laevigatum*, that of *C. heterodactyla* will eat only *Teucrium scorodonia*, refusing entirely *Hieracia*. Their mode of life, too, differs completely—the larva of *hieracii*, far from exposing itself, lives hidden in the heart of the stem, and folds the young leaves, and only quits this hiding-place when fullfed, wandering off then to find a suitable pupation-place. That of *heterodactyla* feeds openly on the stem, or on the leaves. The pupæ of the two species, too, differ markedly—that of *hieracii* has a row of carmine-red spines separated by black points; these are wanting in *heterodactyla*" (*Rev. Ent. Soc. Namur*, iv., pp. 47-48).

Tribe: Buckleriidi.

Genus: Buckleria, Tutt.

Synonymy.—Genus: **Buckleria,** Tutt, "Ent. Rec.," xvii., p. 37 (1905). **Aciptilus,** Zell., "Isis," p. 866 (1841); H.-Sch., "Sys. Bearb.," v., p. 382, supp. fig. 19 (1855). **Pterophorus,** Zell., "Isis," p. 866 (1841); Dup., "Cat. Méth.," p. 383 (1844); Sta., "Supp. Cat.," p. 13 (1851); Thomps., "Ent. Wk. Int.," ii., p. 106 (1857); Dblday., "Syn. List," 2nd ed., p. 37 (1859); Sta., "Man.," ii., p. 445 (1859). **Aciptilia,** Zell., "Linn. Ent.," vi., p. 400 (1852); Staud. and Wocke, "Cat.," 2nd ed., p. 345 (1871); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 810 (1877); Frey, "Lep. Schweiz," p. 432 (1880); Büttner, "Stett. Ent. Zeit.," xli., p. 473 (1880); Teich, "Stett. Ent. Ztg.," xlv., p. 214 (1884); Sorhgn., "Kleinschmett. Brandg.," p. 9 (1886); Cambr., "Ent.," xx., p. 326 (1887); Tutt, "Young Nat.," x., p. 166 (1889); South, "Ent.," xxii., p. 36 (1889). **Alucita,** Cuní y Mart., "Cat. Lep.," p. 204 (1874). **Trichoptilus,** Meyr., "Trans. Ent. Soc. Lond.," p. 484 (1890); "Handbook," etc., p. 430 (1895); Tutt, "Brit. Nat.," i., p. 253 (1891); "Pter. Brit.," p. 77 (1895); Hofmn., "Deutsch. Pter.," p. 121 (1895); Staud. and Reb., "Cat.," 3rd ed., p. 70 (1901); Barr., "Lep. Brit. Isles," ix., pl. 417, fig. 7 (1904); Chpm., "Trans. Ent. Soc. Lond.," p. 133 (1906). **Trichoptylus,** Barr., "Lep. Brit. Isles," ix., p. 396 (1904).

When Zeller first described (*Isis*, 1841, p. 866) *paludum*, he grouped it in his *Aciptilus*, placing it in a separate sect. *g*, next to sect. *f*, which contained *pentadactyla*, L. In 1852, he adopted (*Linn. Ent.*, vi., p. 400) the Hübnerian title, *Aciptilia*, and placed it with *siceliota*, Z., and *baptodactyla*, Z., in his group *d*. Herrich-Schäffer, who largely followed Zeller, in 1855 placed it in his sect. 1 of *Aciptilus*, with *siceliota*; whilst Doubleday, in 1859, placed (*Syn. Cat.*, 2nd ed., p. 37) it in his heterogeneric genus *Pterophorus*, between *microdactyla*, Hb., and *brachydactyla*, Tr. Staudinger and Wocke (*Cat.*, 2nd ed., p. 345) retained it in *Aciptilia*, placing it directly after *pentadactyla*, L. Meyrick, in 1890 (*Trans. Ent. Soc. Lond.*, 1890, p. 484), placed it in *Trichoptilus**, a genus created and described by Walsingham (*Pteroph. of California and Oregon*, pp. 62-63) for an American species, *pygmaeus*, and it is especially noted that the third lobe of the hindwings is adorned with a projecting tooth of scales, very slightly beyond the middle of its hinder margin, and that the tuft is situated nearer to the base than in any other genus known to the writer. Meyrick had already used the generic name (*Trans. Ent. Soc. Lond.*, 1885, p. 7), extending the

* Trichoptilus, gen. nov. *Aciptilo* affinis. Antennæ pubescentes, articulo basali incrassato; floccus frontalis nullus. Palpi capite longiores, tenues, articulo secondo vix fortiore quam apicalis. Pedes sat robusti. Tibiæ posticæ nodis duobus penicillo supra ornatis, calcaribus primis pæne paribus, secundis brevioribus. Alæ anticæ ultra medium fissæ, laciniæ perangustæ, diversæ, angulus analis obsoletus. Alarum posticarum digiti tres filiformes, tertio paulo post medium squamis projectis ornato. Antennæ pubescent, palpi projecting beyond the head, slender, acuminate, the second joint scarcely thicker than the apical joint, and about the same length. The legs fairly stout. The posterior tibiæ thickened at the base of the spurs, and ornamented above them with erect brush-like tufts of scales; the first pair of spurs of nearly equal length, the second pair equal and shorter. Forewings cleft to slightly beyond their middle, the lobes very slender, diverging; the anal angle not defined. Posterior wings with the upper cleft reaching to within one-fourth of their base, the lower cleft nearly reaching the base; all the lobes very slender, almost filiform, the third being adorned with a projecting tooth of scales very slightly beyond the middle of its hinder margin. The cleft of the forewings is deeper, and the tuft of scales on the third lobe of the hindwings is situated nearer to the base than in any genus with which I am acquainted. It approaches the genus *Aciptilus* in its narrow lobes and in the absence of a defined anal angle.—Type: *Trichoptilus pygmaeus* (Walsingham, *Pteroph. Cal. Oregon*, pp. 62-63).

characters for various species from localities as far distant as the Cape de Verde Islands, Queensland and New Guinea, although he rightly acknowledges that he does not know whether the generic name rightly belongs to the species he describes. One suspects not, at any rate, in the cases of *scythrodes* and *ceramodes*, and possibly of many more. In his *Handbook*, p. 431, he gives "a slight black scale-tooth in dorsal cilia of 3rd segment of hindwing" as one of the characters of the genus in which he places *paludum*, which is, however, without the scale-tooth. That *paludum* belongs to the American genus we are not inclined at all to grant, and, for our European species without the scale-tuft on the 3rd plumule of the hindwing, we created, in 1905, the genus *Buckleria*. Although we do not think Meyrick was right in the use of the name *Trichoptilus*, we are fully in agreement with him in following Hofmann in bringing it into close proximity with his genus *Oxyptilus*, for even he had, in 1886, followed (*Trans. Ent. Soc. Lond.*, p. 6) his predecessors in keeping the insect close to *Aciptilia*. That Meyrick's diagnosis of *Trichoptilus* applies to the whole of the Buckleriid group, or tribe, is clear from his description (*Trans. Ent. Soc. Lond.*, 1890, p. 484), which reads as follows :

Face without tuft, rounded; ocelli obsolete; tongue developed. Antennæ two-thirds; in ♂ ciliated (one-third to two-thirds). Labial palpi moderate, ascending, second joint with short projecting scales beneath, tending to form a short angular apical tuft, terminal joint short or long, filiform, tolerably pointed. Maxillary palpi obsolete. Tibiæ thickened with scales on origin of spurs, outer spurs nearly equal inner. Forewings bifid, cleft from before middle; vein 2 out of 4 or absent, 3 absent, 5 and 6 extremely short, 7 absent, 9 absent, 10 from near 8 or absent, 11 from near 8, long. Hindwings trifid, 3rd segment with more or less developed tooth of black scales in dorsal cilia, often slight; vein 2 from middle of cell, 3 absent, 5 and 6 very short, 7 to apex.

Meyrick then says (*loc. cit.*, p. 485) that this is "a genus of limited extent, but cosmopolitan ; more species are known from Australia than any other region." His later diagnosis (*Handbook*, etc., pp. 430-431), specially written for *paludum*, still maintains that "the 3rd segment of the hindwing has a slight black scale-tooth in the dorsal cilia." Hofmann, as usual well ahead of all his contemporaries, first brought the Oxyptilids (*Oxyptilus*) and Buckleriids (*Trichoptilus*) into close connection (see *anteà*, p. 91), and his is the latest independent work, Staudinger and Rebel's *Catalog*, 3rd ed., pp. 70 *et seq.*, being a mere copy of Meyrick's system, and including all his errors. An examination of the ♂ genital appendages indicates that Hofmann's grouping is correct, and Chapman notes thereof: "The structure of the ♂ appendages shows that the Buckleriids (*paludum* and *siceliota*) belong to the Oxyptilid group. The middle (true clasp ?) appendage consists of two portions, a basal one of tolerably solid chitin, clothed with scales and some bristles, and a terminal one, that is much more delicate (and easily deformed in preparation and mounting). It has an inflated appearance, and is covered with fine bristles, regularly disposed, at some little distance apart. In *Buckleria* (*paludum*) this curious appendix arises near the middle, not the end, of the shaft which is very long and slender. In *Stangeia* (*siceliota*) it is hardly developed, and the structure is less close to *Oxyptilus*, than is that of *Buckleria*." Some ten years after the position of the Buckleriids with the Oxyptilids had been satisfactorily worked out by Hofmann and Meyrick, Barrett wrote (*Lep. Brit. Isles*, ix., p. 397) that "*paludum* has recently been included in the genus *Leioptilus*, but has been separated by Lord Walsingham, under the present name (*Trichoptilus*), with a number of closely allied North American and other exotic species." So far as we know, the species has never been placed by any author in *Leioptilus*, whilst, further, Walsingham created *Trichoptilus* for certain American species, without, however, referring *paludum* thereto; it was Meyrick who referred our *paludum* and other exotic species, differing apparently in structure, to the American genus. Hofmann's *Trichoptilus* is largely based on *paludum*, and is, therefore, nearly synonymous with our *Buckleria*. His diagnosis (*Die Deutsch. Pteroph.*, pp. 169-170) reads as follows:

Forehead and crown smooth-scaled; antennæ loosely scaled all round, especially in the apical third, where some of the scales of the joints are erect. Palpi rather long and slender, smooth-scaled, second joint somewhat ascending, sometimes with a few slightly-projecting scales at its apex, terminal joint shorter than the second, directed downwards. Tibiæ with scale-thickenings at the origin of the spurs. Forewings fissured to the middle, both lobes narrow, and running to a point, the upper broader than the lower. Plumules of the hindwings similar to one another; in the only German species, without scale-tufts on the inner margin of the 3rd plumule; in a second south European species, with a very small and weak scale-tuft in the middle of the inner margin of the 3rd plumule. The neuration differs from that of the genus *Oxyptilus* in that II_1 (Branch 11, H.-S) is absent, and that only one stem arises from the upper angle of the central cell, namely, the common stem of II_2, II_3, and II_4. II_5 (Branch 7, H.-S.) arises at some distance from this common stem out of the very weakly indicated, vertically running, discocellular, and runs parallel with stem II along the inner margin of the upper lobe. III_1 and III_2 are scarcely to be recognised, III_3 (Branch 4, H.-S.) is adjoined to IV, and arises with the very short and weak branch IV_1 (Branch 3, H.-S.) out of the stem IV shortly before the apex of the lower lobe. IV_2 (Branch 2, H.-S.) arises, at the base of the lower lobe just at the fissure, out of stem IV, is very weak, closely adpressed to the main stem, and vanishes at about the middle of the lower lobe in the wing membrane. Stem V is, in the basal half of the forewings, very weak, afterwards stronger, and vanishes at the base of the lower lobe where IV_1 arises. Stem *a* is only weakly indicated at the base of the wing. On the hindwings, stem IV only throws off a short branch, which, running very close to the main stem, gradually loses itself in the middle plumule. The male genitalia are distinguished by the very remarkably formed genital clasps; these are extended lengthwise, narrow, hollow within, and furnished with a broad, axe-shaped (beilformig), bristly, membranous process (Taf. iii., fig. 10). The 10th dorsal plate obtusely triangled, arched, and directed downwards at the apex. The 9th dorsal and ventral plates exhibit nothing especially noticeable. The much more perfect neuration, the thickening of the tibiæ with scales, and the differing typical markings, similar to those of the genus *Oxyptilus*, completely justify the separation from *Aciptilia*. From *Oxyptilus*, the genus may equally well be differentiated by the perfectly-pointed, narrow lower lobe, without a trace of an anal angle, and by the neuration. Only one German species—*paludum*.

Buckleria paludum, Zeller.

Synonymy.—Species: **Paludum,** Zell., "Isis," p. 277 (1839); p. 866 (1841); Dup., "Cat. Méth.," p. 383 (1844); Zell., "Linn. Ent.," vi., p. 400 (1852); Sta., "Cat.," supp. p. 13 (1851); H.-Sch., "Sys. Bearb.," v., p. 382, supp. fig. 19 (1855); Thomps., "Ent. Wk. Int.," ii., p. 108 (1857); Sta., "Man.," ii., p. 445 (1859); Jord., "Ent. Mo. Mag.," vi., p. 150 (1869); Staud. and Wocke, "Cat.," 2nd ed., p. 345 (1871); Cuní y Mart., "Cat. Lep.," p. 204 (1874); Hein. and Wocke, "Schmett. Deutsch.," iii., pt. 2, p. 810 (1877); Bütt., "Stett. Ent. Ztg.," xli., p. 473 (1880); Frey, "Lep. der Schweiz," p. 432 (1880); Snell., "De Vlind.," ii., pt. 2, p. 1057 (1882); Teich, "Stett. Ent. Ztg.," xlv., p. 214 (1884); Sorhgn., "Kleinschmett. Brandbg.," p. 9 (1886); Cambr., "Ent.," xx., p. 326 (1887); Tutt, "Young Nat.," x., p. 166 (1889); South, "Ent.," xxii., p. 36 (1889); Tutt, "Brit. Nat.," i., p. 253 (1891); "Pter. Brit.," p. 78 (1895); Meyr., "Trans. Ent. Soc. London," p. 485 (1890); "Handbook," etc., p. 431 (1895); Hofmn., "Deutsch. Pter.," p. 122 (1895); Staud. and Reb., "Cat.," 3rd ed., p. 70 (1901);

Barr., "Lep. Brit. Isles," ix., p. 396, pl. 417, fig. 4 (1904); Chapmn., "Trans. Ent. Soc. London," p. 133 (1906).

Original description.—Alis anterioribus rufo-griseis, laciniis niveo-bistrigatis, digito tertio setaceo non atro-squamato. (Forewings reddish-grey, with two snow-white transverse lines across the lobes, the 3rd plumule bristle-like, without black scales) (one male and three females) *Isis*, 1839, p. 277.* The smallest plume, even less than *P. microdactylus*. In colour and markings it appears similar to the species related to *P. hieracii* (section *b* of the genus), but differs essentially in that the forewings are fissured more than to the middle, that the lower lobe, like the upper lobe, is quite bristle-like, and that the 3rd plumule is quite without the black scale-tufts in the fringes. It belongs, therefore, to the same section as *P. pentadactylus*, from which it is distinguished by its short, but very long-spurred, legs. Body brownish-grey. Upper margin of the eyes white. Antennæ brownish, with a white longitudinal line, and with short bristle-like, somewhat erect, threads on the joints in both sexes. Palpi much longer than the head, curved upwards, slender, whitish, with a brown longitudinal line on the side; the apical joint slender, rather long, projecting horizontally, brown beneath. Legs shorter than usual. Coxæ brownish dust-colour; the four hinder ones whitish. Femora on one side silvery-whitish, on the other brownish, with white lines; † tibiæ white, with a brownish longitudinal line, thickened at the ends with brownish scales; those on the hind tibiæ are conspicuous by their white terminations. Tarsal joints silvery-white, brownish at their ends. Abdomen, upper- and undersides, with interrupted, and partially extinguished, silvery lines.† The narrow forewings fissured to more than the middle, brownish-grey, on the inner margin just before, and at, the fissure, with crowded whitish scaling. The two lobes have, at the commencement of the second and third thirds, a broad, somewhat faint, silvery-white transverse line, which runs on the costa into the fringes. Fringes blackish, here and there with whitish spots, with which that before the apex of the inner margin of the 3rd plumule contrasts well. Hindwings pale brown, with rather long grey fringes; the fringes at the apex of the 3rd plumule whitish. All the plumules very narrow, the two first as long as two-thirds of the total length of the hindwings. I took eight examples of this species (and could have taken more if I had not merely considered them remarkable on account of the situation and small size) near Frankfort-on-the-Oder, at the end of July, on a peat-moor, where I also collected *Tipula fasciata*, *Chrysops sepulchralis*, and *Tabanus*

* Yet another species has a resemblance to *didactylus*, which, however, immediately falls away, when one observes the long, narrow, 3rd plumule of the hindwings entirely destitute of the black scale-tufts, wherefore, also, I did not at all take it into consideration above. It is like the very smallest *didactyli*, and has, in common with this species, and with *Pterophorus tristis*, the long hind tibial spurs, the longest in the whole genus; its palpi, however, are different from those of both species. I took eight examples, of which my collection only retains four, on a peat-moor near Frankfort, at the end of July. It is named *Pterophorus paludum*, Zell. (*amaurodactylus, in litt.*), and should, still less than *P. tristis*, be considered in connection with Degeer's or Linné's *didactylus* (Zeller, *Isis*, 1839, p. 277).

† This description is taken from Zeller's own copy (in Nat. Hist. Museum Library); both the paragraphs marked † are "?" in Zeller's handwriting, and unterbrochen (=interrupted) is deleted, verloschen (=extinguished or faint) being substituted.

plebejus. According to news from Herr Fischer v. Röslerstamm, this plume occurs also near Berlin (Zeller, *Isis*, 1841, pp. 866-867).

Imago.—12mm.-15mm. Forewings fuscous-brown, with very deep cleft, the lobes narrow and pointed; the costa narrowly blackish to the first lobal line; two bright, shiny, silvery-white, transverse lobal lines; apices of lobes also white; discal area thickly sprinkled longitudinally with white scales; a small white fissural spot at end of fissure, directly above a tiny black one; fringes fuscous, with white streaks (sometimes edged with black) terminating the transverse lines, and at the apex; several crowded short black scales towards centre of upper and lower edges of fissure. The hindwings very deeply cleft; dark fuscous; fringes not quite so dark as the plumules; there is no trace whatever of any scale-tuft, or isolated scales of a specialised character, on the 3rd plumule.*

Sexual dimorphism.—The ♂s are distinctly larger than the ♀s, averaging from 2mm. to 3mm. more, with much longer and more slender abdomina, wider wings, and generally with somewhat darker ground-colour, and more abundant silvery-white scales. The *paludum* in the Frey Coll. also show distinctly the smaller size of the ♀. Bankes writes (*in litt.*), "Although both sexes vary considerably in size, there is, on the whole, a marked difference between them in this respect, the females averaging about 2mm. smaller in wing-expanse than the males. In my lengthy series of second-brood specimens, all captured, the *alar. exp.* of the latter runs from 13mm. to 15·5mm., while that of the former is only 12mm. to 13·5mm. I have little doubt that the individuals of the first brood, of which I have not sufficient for useful comparison, would, in both sexes, average rather larger than those of the second, and my only ♀ of the earlier brood expands 14·5mm., although none of the few first-brood ♂s before me measures more than 15mm. The ♀s seem a little variable in colour, but my limited number of representatives of this sex are, on the whole, rather lighter and brighter than the ♂s, the brown ground colour showing a stronger tendency to be tinged with reddish. Owing partly to this, and partly to the white markings being more concentrated because the wing expanse is smaller, the females, in general, present a rather more variegated appearance, and remind one more of *O. parvidactylus* than do the males. The sexes can be easily separated by a glance at the abdomen, that of the ♂ being long, slender throughout, especially anteriorly, and appearing broader terminally than elsewhere, while that of the ♀ is rather shorter, markedly stouter, and of a totally different shape, being of greatest girth somewhat behind the middle, and tapering thence gradually towards the thorax, and rapidly towards the anal extremity. In addition, there arise on the abdomen of the male, shortly before the termen, which they surround, six separate tufts of hair-scales, *viz.*, two subdorsal (long), two lateral (short), two ventral (long), projecting obliquely outwards and backwards. A view from above frequently shows clearly the tips of the two subdorsal tufts on either side of the tip of the termen proper, which is seen between them at a somewhat

* This is absolutely true of every specimen we have seen in different collections, but Chapman observes that, in some bred specimens, there are sometimes three or four scattered scales of the "tuft" set. We have never seen such.

lower level. These remarkable tufts of hair-scales are absent from the abdomen of the female."

Variation.—The imagines are variable in size, the larger specimens looking also much wider-, as well as longer-winged. The ground colour varies somewhat, an occasional example being quite bright brown (tinged with reddish) rather than dull fuscous-brown ; the quantity of white scaling on the costa, and in the discal area also, varies considerably, some specimens occasionally having quite a white discal area ; in one example under observation, the white is very much more developed on the left, than on the right, forewing. The continuation of the inner lobal line over the lower lobe is also at times somewhat ill-developed, but the actual amount of variation does not appear to be very great or very marked. Bankes observes (*in litt.*) that the moths vary but moderately in colour, but the sexes show considerable difference in size, good-sized ♂ s expanding 15mm., whereas good-sized ♀ s only expand 13mm. Barrett observes that Yorkshire specimens are much larger than those taken elsewhere, but, as only two Yorkshire examples are known, the data hardly warrant such a sweeping generalisation. Hofmann writes (*Die Deutsch. Pteroph.*, p. 170) : " The distribution of the markings is quite similar to that of the species of *Oxyptilus*. The ground colour grey-brown at the base, with white scaling forming an indistinct longitudinal stripe; on the costa, likewise, a few white scales. Inner-marginal spot and discoidal spot white (sometimes indistinct). The inner-marginal spot is bordered, towards the base, by a more or less strongly expressed short black streak. Immediately before the fissure there is, in the (height)* neighbourhood of the costa of the lower lobe, a black spot, and a white spot above it (fissural spots). Across the lobes run two, often indistinct, white transverse lines, which are continued into the dark brown costal fringes. At the extreme apex these (the fringes) are white, and cut below by a narrow, deep black, longitudinal dash. On the inner margin of the upper lobe the fringes are brownish, with a strong black dash bordered on each side by white just before the apex, which cuts through the whole length of the fringes (in contrast with *Oxyptilus*, where the dash, at the situation named, cuts only through the basal line of the fringe, and is often very small or altogether absent). Under the white transverse line are a few white scales, and also on the inner margin of the upper lobe, and besides, between these situations, there are some broad black scales. The fringes of the lower lobe are brown, at the extreme apex white, with several single black scales, at the base, on the costa, as well as on the inner margin, and with a broad white dash below the outer transverse line, bordered with black towards the base, which cuts the whole length of the fringes. Below the first transverse line the fringes of the inner margin are sometimes, for their whole length, cut through with white, but more narrowly than below the outer band, and beset with single, coarse, white scales. This second white dash is bordered outwardly with black scales. Hindwings, together with the fringes, grey, only at the apex of the 3rd plumule are a few white hair-scales. Underside grey; the white dashes in the fringes of both lobes, as well as the outer transverse line on the upper

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* Hofmann has Höhe (=height), but I suspect this must be a misprint for Nähe (=neighbourhood) (Sich).

lobe, distinct; 1st plumule of the hindwings, especially towards the apex, beset with broad white scaling. Head and thorax brown-grey; palpi the same, on the lower edge of the second joint white; the third joint outwardly brown, inwardly white; antennæ brown on the edges, with fine white, somewhat erect, scaling, indistinctly white-ringed towards the apex. Thorax yellow-grey; coxæ brown, the middle ones outwardly bordered with white. Femora brown, bordered with white on both sides. Fore and middle tibiæ brown above, white below, only slightly thickened at the extremities. Hind tibiæ white, before the base of the spurs, to a greater or less extent, brown, and thickened with brown scales. Spurs very long, brown above, white below. Tarsal joints white, at the apices of the joints more or less extensively brown. Thorax, behind, yellowish-white. The 1st abdominal segment on both sides broadly whitish. Abdomen brown, with interrupted white longitudinal lines on the back and below, on the 2nd and 3rd segments very long. The long, wedge-shaped, brown, anal tuft of the ♂ is bordered above by two brown, below by two shorter white, scale-tufts." In the Frey collection the Bremgarten specimens are of a pale, grey-brown, tint, clearly marked with white, transverse, lobal lines, and white fringe-streaks towards the apex of the upper, and the inner margin of the lower, lobe of the forewings. The median part of the forewings paler, very thickly scaled with grey; one example much browner than the rest. From the Katzensee are two quite brown specimens, a ♂ and ♀, the ♀ very small. From Bunzen, three similar specimens, two ♂s and one ♀, the latter also small; the ♂s particularly well-marked with clear, white, and complete lobal lines, the apices of the lobes of the forewings, and those of the plumules of the hindwings, being exceptionally well-tipped with white.

Comparison of Buckleria paludum with its allies.—Very closely resembling *Pterophorus siceliota*, but easily recognised by the antennæ, which have no rings. It differs much from *baptodactylus* by the hind lobe of the forewing, which is not white-coloured, the white-banded front lobe, etc. (Zeller).

Egglaying.—The egg is laid (in confinement) on the petioles of the glands near the margin of the leaves of *Drosera rotundifolia;* this was sufficiently frequent to suggest it as the situation preferred. They were also laid on the undersides of the leaves, on the petioles and on the dead flower-stalks of the previous year, and even on the peat beside the plant (Chapman). A ♀ captured near Wareham, Dorset, on August 23rd, 1904, refused to oviposit on *Narthecium ossifragum*, at first supplied to her, but, when given a green seed-head of *Drosera rotundifolia*, she laid altogether fourteen eggs on its calyces, branchlets, and stem, before dying on August 30th. [Although *Drosera rotundifolia*, from its well-known peculiarities of structure, etc., and carnivorous habits, seemed so unlikely to be the foodplant of *Buckleria paludum*, I had suspected, ever since 1890, that it might be so, from having then noted it as apparently the only possible foodplant which was common to the spots known to me for the insect. A thorough search, however, on this and other plants, in 1891 and subsequent years, produced no result, doubtless owing to the great abundance of *Drosera* and the scarcity of the larva.] The details of the egglaying were as follows:—Single ovum laid August 23rd, 1904, by ♀ (no. 1) caught near Wareham, Dorset, August 20th, 1904. Single ovum laid August 23rd, 1904, by ♀ (no. 2) caught near Wareham, Dorset, August 20th, 1904. Single ovum laid August 23rd, 1904, by ♀ (no. 3) caught near Wareham, Dorset, August 20th, 1904. These three ♀ s all died after laying a single egg each, one egg being attached to the paper of the cardboard box, while the other two were dropped as the moths were expiring. Two ova laid August 26th, 1904, by ♀ caught near Wareham, Dorset, August 23rd, 1904. Fourteen ova laid August 26th-30th, 1904, by ♀ caught near Wareham, Dorset, August 23rd, 1904. All these ova were sent to Dr. Chapman (Bankes). Chapman writes: "My observations began in August, 1904, when I received several eggs from Mr. Bankes, laid by ♀ s captured near Wareham, Dorset. I find from my notes that ♀ s, taken August 20th, laid eggs from which two larvæ hatched on August 30th, and from a ♀, captured August 23rd, two larvæ hatched on September 6th. A further supply of eggs was received on August 31st. The first larvæ that hatched were placed on all sorts of bog-plants obtainable near Reigate, but without result, and when these were finally placed on the *Drosera* plants, sent by Mr. Bankes, they were already rather exhausted. It was on August 31st, 1904, that the plants of *Drosera* arrived, along with sixteen eggs on the same date. Some of these eggs were laid loosely, two were on leno, and the rest on a flower-stalk, or rather fruit-head, of *Drosera*. A curious point is that, of the August 31st eggs, those separate, and one on the muslin, hatched; the others on the muslin proved infertile and did not change colour. Those hatched September 6th; the eggs on the seed-stem are still (14th) unhatched; they changed colour a day or two later than the others, and their hatching was expected about the 8th, but they make no sign. The young larvæ inside have, since that date, been obviously mature. The eggs remain free from shrinking, mould, or other sign of death or decay, and give the impression of intending hibernation. On September 16th, 1904, the remaining eggs were still unhatched, and they ultimately proved to be dead" (Chapman). Moths that were confined over growing *Drosera* in June, 1905, with a view to eggs, never got caught by the plants except on one occasion, when a moth escaped only by losing a leg caught in the glue; another moth fell on a leaf, where it died, and, being left there, was largely enveloped by the leaf after a few days. Some moths thus confined, between June 18th-29th, 1905, laid eggs in confinement, one was detected beneath a leaf-petiole, another attached to a gland-stalk at the margin of a leaf, and so on. On June 17th, 1905, South also obtained a pairing in confinement, the ♀ remaining alive some days over the foodplant; she laid eggs on, and around, the foodplant; it was from the eggs thus obtained by South and Chapman that our knowledge of the life-history of the summer brood was obtained.

Ovum.—Bright yellow at first, becoming afterwards duller in tint. It is oval in any longitudinal section, circular in any transverse one. Its length is 0·38mm., and its diameter 0·24mm. It has very large, bold, sculpturing, consisting of a net-work of ribs enclosing irregular polygons. The ribs are broad, about one-third of the width of the enclosed hexagons (or as may be). The diameter of the cells is about 0·02mm., of a cell and one wall about 0·026mm. (Chapman).

Habits of larva.—*Autumn, winter, and spring larva:* The first larvæ that hatched (two on August 30th, 1904, from eggs laid by ♀ s taken August 20th) were placed on all sorts of bog-plants obtainable near Reigate, but without result, and when these were finally placed on *Drosera* plants sent by Bankes, they were already exhausted, and only three ultimately survived; these seemed more at home on the *Drosera* than on anything yet tried; one placed on a leaf was, however, in process of digestion next morning; the others had disappeared somewhere, apparently in the hearts of the little plants. A new set of eggs began to hatch on September 6th (from eggs laid by a ♀ captured August 23rd); much time was spent in watching the young larvæ on the plants; none were placed amongst the glands on the leaves, but the largest of the unexpanded leaves was selected. They eventually got down towards the centre of the plant, and became much more quiet and sluggish there, but still on the move. The next day none of them could be found. *September 14th:* Looked at occasionally; nothing could be made of the *Drosera* plants, but to-day a careful examination shows a small pile of frass, near the centre, in two of the plants. Another shows nothing, and in the fourth is a living larva of *paludum*, a little grown, but out, exposed, and looking sluggish. *September 16th:* On one plant a small larva, by the conspicuousness of its darkish tubercles, in its second skin, is seen down amongst the leaf-stems just outside the central heart, covered by a slight web of silk, and this a little obscured by some frass. On another plant a small larva is exposed in about the same situation; this one is well-fed up in first skin. *September 17th:* The larva under the web has thickened it, both with silk and other material (frass ?), so that he is now invisible. On another plant the exposed larva is now quite fat, in first skin, but is still exposed. *September 22nd:* The cocoon is still firm and opaque, its strong structure leads one to suppose it is for hybernation. It is placed between an outer dying leaf-stalk (of a not thriving plant) and the central bud-bulb, and the adjacent leaf, on its inner side, looks as if dying at the tip, from being eaten or excavated; this is the only point to suggest that the larva is feeding. The "exposed" larva, though looked for every day, has been invisible since the 17th, and it was feared something might have happened to it; to-day, however, it is out, crawling over the minute leaves of the leaf-bud in the centre of the plant; no trace is seen (of course, without pulling the plant to pieces) of where it spent the interval. It is now in the second instar. *September 24th:* A plant, in which a larva was placed, September 6th, and of which no trace could since be found, although the plant has been examined most carefully nearly every day, when examined to-day, was found to have on it a larva in second skin, which was constructing a silken web over itself at the side of the central bud, and close to the base of a larger leaf. No trace of any of the work of the larva in the interval can be found. The larva, found on the 17th, has thickened its web, and pellets of frass are conspicuous on its upper surface. The larva can still be faintly outlined beneath. The first larva is quite invisible. *October 22nd:* The three inhabited plants are not looking flourishing; two, which have the largest green centres, have the cocoons as last described; the third, however, has only a small central bit of green, and there is a new and larger cocoon on the other side of this from the original one, that does not look much different; the new cocoon is still imperfect, and one glimpse was got through it of the black head of the larva moving about, and apparently spinning, and again of the body of the larva, of which no details appeared, but it was decidedly larger, and of a flesh tint. It is unfortunate that the larva was not seen when on the move, and transferred to a better plant, and a description of it taken. The presumption is that it is now in its third skin. *October 24th:* This larva is found crawling about outside to-day. It may be merely in second stage, although two days since noted as being presumably in the third (see *infra*). *October 27th:* The larva was found to have made some slight spinning. Yesterday (October 26th) the spinning formed a fairly complete cocoon, with some black dots of frass, and to-day it is more dense, and the larva is completely hidden. *November 20th:* Larva (no. 2) noted 27th, remains *in statu quo*. Another (no. 1) is found to-day to have begun a new tent; it is still somewhat visible through the silk, and can be seen to be fat, and larger, if anything, than no. 2 at its spinning, but no details are discernible. No. 3 has its cocoon wet, from water soaking up the plant; on this plant the central bud is wet, as it is not in plants of 1 and 2. The cocoon does not look very satisfactory, and possibly the larva inside is not doing very well. *December 10th*, 1904: No. 2 (of November 20th) is found to-day outside its tent, on the move, and opportunity taken to describe it. It does not seem to have grown, or to be in feeding-humour—moves very sluggishly. *January 14th*, 1905: Not liking the look of my plants, I examined them; the first was dead, remains of a larval head detected; the second was alive, but no trace of larva could be found; the third contained a larva, which was preserved, lest worse befall him. He seemed much as described at the last entry. The cavity, containing his cocoon, was excavated towards the heart of the button, or bud, of the plant, several of the small undeveloped leaves (?) being well eaten into. This bud was preserved in formalin. When the cocoon was removed, the eaten portion, or rather what was not eaten, formed a small hollow, into which, or *on* to which, the cocoon would just fit. This closed the campaign with the 1904 eggs. It appeared from this that the young larva feeds somewhere in the centre of the plant as an internal feeder, and finally makes a cocoon in the heart of the plant for hybernation. The one cocoon, of which I made the most satisfactory examination, consisted of a cavity, the greater part of which was excavated out of the material of the outer leaves of the centre bud (winter bulb), and completed by a silken cover. This renders it certain that some of the central material of the plant is eaten; but for this, my experience in 1905 would have led me to suspect that the young larvæ fed on the leaves, as those of the summer brood do. The larvæ, in their first instar, on the leaves, are often very difficult to see and find, even when one is sure they are there, so that, in my ignorance, in 1904, I might easily have overlooked them. I am still inclined to suspect that it is possible that, in the first instar, they feed on the leaves, in the same way as the summer brood do, and only descend to the centre of the plant in the second instar. Against this is the fact that the young larvæ directed their wanderings to the centre of the plant, and that the centre was found to have afforded a good deal of food material. The note in describing one larva, as to the presence of secondary hairs (October 22nd), and the surmise that it was in third instar, agrees with later observations; it is probable that this larva was endeavouring to complete its cycle without hybernating, and really was in the third instar, as the second instar larvæ do not show any secondary hairs. This larva probably perished earlier than the others. So the matter remained for further investigation in 1905. The larva, like so many of the Platyptiliid division of the "plumes," clearly hybernates full-grown in its second instar, and ought to be discoverable in the spring in its further stages. I owe it to Mr. South that I was able to visit a locality for the species, and to continue the observations in 1905. Of course I did not quite know what to look for, but, as good luck would have it, the discovery of the larva in the spring proved fairly easy. *May* 31*st*, 1905 : Accompanied Mr. South to a locality in the Esher district of Surrey, where *Drosera* is found, and where *B. paludum* had been taken, and searched for larvæ of *B. paludum*, and found about a score. The first specimen was found seated on the underside of the petiole of a leaf of *Drosera*. It was nearly full-grown, and was of about the length of the petiole. This will give some idea of the size and state of the plants, which were growing on peaty ground amongst heath, and apart from *Sphagnum;* most of them were very small, with the leaves lying flat to the ground, the one above noted being a fine specimen, about twice the size of the majority. There had been a drought for a considerable period before this, and the ground was by no means boggy. The small size was more probably due to drought than to the period of the season. A fine plant would be 35mm. across only, majority 25mm.-30mm., and some only 20mm., and even less. The remaining larvæ were found in various positions, some on the petioles, some under, and some on top of, the leaves, and some sitting across the centre of the little plants. In no case, either in the field, or in various observations afterwards at home, did a larva place himself on the top of a sound, healthy, leaf. They seemed on the whole, however, to be rather reckless in the way they moved about amongst them. Their hairs probably protect them against contact with the leaf-glands, unless they actually walk over them. They would eat any part of the plant, least frequently, however, attacking the central bud. The most usual point of attack was the margin of the leaf, approached by the larva seated on the petiole or beneath the leaf, and, in several cases, the attack was continued till the whole leaf was eaten, and a portion of the petiole also. In one or two cases the larva attacked, and ate, the glandular processes, until it had cleared the middle of a leaf, which then formed its resting-place. Twice a larva, looking for a place to pupate, escaped from a flower-pot by crossing the water in the saucer, so that they are probably able to deal with the habitat, when flooded, without much injury. The larva is a brownish-red above, varying from rather dark to a bright rosy colour, and sometimes with some greenish shades; beneath, it is green. The dorsal tubercles are darker and more rosy, and retain a bright rose-colour, whilst the rest of the larva, when fixed for pupation, becomes quite green; the colour involves not only the tubercles, but a little of the base around them, especially behind. The hairs are long, and slightly clubbed, or rather flattened at the end, and so the ends reflect light so as to look larger than they actually are. The resulting appearance of the larva is that it looks very much like some aspects of the *Drosera* leaf, sometimes the hairs, sometimes the red tubercles, suggesting the glands, and their supports, on the *Drosera* leaves, and the general tone of colour is much that of the green leaf seen through the forest of rosy hairs. In looking for a larva, a slightly edgewise view of a leaf often suggests a larva, and a larva is probably easily overlooked by its close assimilation to the plant. The larva taken were, for the most part, in their last skins, and their measure was 7mm., and a large or well-stretched one 8mm. long. Several were, however, in the previous skin, and one so small that I took it to be in the antepenultimate. This was probably erroneous. The following day, June 1st, several fixed themselves for pupation, etc. *Summer larvae—June 26th-28th*, 1905: Eight larvæ hatched from eggs received from Mr. South, and were placed, each on a plant of *Drosera*, on petioles low down, in the belief that they wanted to go to the central bud. *June 29th:* Four of these larvæ are now easily seen, in the centre of a leaf, leisurely eating the very short-stemmed hairs and glands that occupy that position; one has already cleared a little circle of more than his whole length in diameter. The intestinal contents look dark. One concludes that these eggs are most naturally placed that are on the stem of the glands at the margin of a leaf. One observes also that the *Drosera* is infested by an Aphis. This is of interest, as bearing on the supposed immunity of the plant from insect attack, due to its insectivorous habit. Such immunity would appear to be a fiction. *July 2nd:* These larvæ clear the centre of the leaf of the short stems and glands that occur in that position, leaving the longer marginal ones alone; the little larva itself, even when grown a little, is very inconspicuous and difficult to find. With a lens, the cleared central portion of the leaf, with red frass scattered over it, is easily seen; but, without a lens, the red frass gives very nearly the same tone to the leaf as the glands do, so that, except by very close scrutiny, nothing unusual presents itself. This morning one larva is found to have changed its skin, and appears to be eating the cast skin. The moult occurred near the centre of the leaf, where the feeding was done; the only protection by way of web, tent, or any other shelter, being a few threads spun across the tops of the adjacent glands, making a flimsy, and almost invisible, cover. The larva has a, relatively, rather large head, and the hairs are about as long as the larva is thick, and look dense and crowded together. The larva is still pale and transparent-looking, but the eye-patch is densely black, the dorsal tubercles (not the hairs) are dark, and the dorsum has a pale ruddy tint; the longer hairs are slightly clubbed at their tips. In the first skin, the larva grows a good deal, but remains very colourless, or rather transparent, the dark intestinal contents being conspicuous, and the only coloration being a denser white round the bases of the dorsal tubercles. *July 3rd:* Two larvæ (of the eight that hatched from Mr. South's eggs), that had gone a-missing, are now seen to have hidden themselves, and still are in unopened leaves amongst the undeveloped glandular hairs, with which their interiors are full. The leaves are now slightly opened, and frass is very evident. These larvæ, therefore, went into incompletely-expanded leaves in order to eat the glands; these were not, however, probably functionally active at this stage. *July 8th:* A small larva (very young in second skin) had wandered off in the test-tube, in which I had put it for observation, and was probably hungry. I put him on the petiole near the base of a vigorous leaf, on which the red glands had each a large globule of gum. He walked very deliberately to the base of the leaf (upper side), apparently spinning a web, and also searching carefully from side to side; at length he arrived at the gland-hairs, which, next the petiole, are deflexed down it; these he carefully examined on each side of his way, even moving quite to the side of his proper track; his method looked as if he contemplated climbing up them. The largest are about three times his length (2mm.), but actually, when he reached as far as he could without removing more than one pair of prolegs from the leaf, he withdrew, and continued his march. At length he got nearer the middle of the leaf, and found that his reaching-up process brought him to the glandular top of the hair. This, the red knob and transparent gum, is thicker than, and in bulk nearly one-third that of, the larva. I watched him demolish one of these, which he did rather quickly, and make considerable inroads on another. The gum, which is thick and glairy, and draws out into threads, was eaten; he got his legs into it, and ate the stuff off his legs, and also ate up the portion drawn out between them; he did not, however, appear to completely clean his legs, yet, shortly after, they were certainly quite clean, and the gum was removed; though he worked at one side only, it disappeared also from the other. Possibly the elasticity of the gluey stuff pulled it off, but I was certainly puzzled to know how several legs got quite clean in some mysterious way. He ate up the red knob of a size about equal to his own head. He left the green gland-stem. In attacking the second gland, he appeared to get the front of his head into the gum, and drew it out, showing the front of his head, and his legs, to be involved in it. He ate away, however, quite unconcernedly, and, though again I saw no definite cleaning process, he was apparently quite clean immediately afterwards. The gum stuck to his head and legs in such a way as to make it difficult to suppose they got clean because it did *not* stick to them, nor did it appear to be wiped off against the plant. Up to full-growth in the second skin, the food of the larva seems to be entirely the red glands and their secretion. *July* 14*th:* Visited *B. paludum* in its habitat, and observed three larvæ, two laid up for second moult, and one for a third. *July* 16*th:* The larvæ fed up in confinement have been paler than the captured ones of the first brood, and also than those taken two days ago. These pale larvæ are green, with no red, except on the dorsal tubercle, as in the ordinary newly-changed pupa, and a pupa is without any trace of red whatever. These green larvæ show very well the greenish-yellow subdorsal lines (just dorsal to the tubercle i and ii), and also the slightly oblique one below them. The larvæ, when small, were given to wandering, if the plant was not strong and healthy enough to surround the red glands with plenty of fluid gum, these glands, and the gum, being their favourite (and only) food, unlike the winter brood which eats the central portion of the plant. Later, the larvæ would eat anything, being fond of the flower-buds and flower-stems, and eating nearly the whole of the leaf. When nearly fullfed, if the plant was a small one and the leaves well demolished, the larvæ would eat portions of the petioles, and finish by clearing off the young leaves and central bud of the plant. One or two young larvæ appear to jerk the frass away, but, as a rule, the frass remains where excreted. The young larvæ thus leave minute red dots, more or less in rows or groups, in some degree replacing the devoured glands in the colour-scheme of the leaf. In its later stage, a larva would sometimes eat a large quantity without moving; this especially happens when it takes to the middle of the plant, and can reach much food without moving, a pile of green-black frass, about twice as bulky as the larva, accumulating in some instances. All being well with the foodplant, the larva has no tendency to move until the time for pupation arrives. These detailed notes on the progress of individual larvæ were much broken up, and rendered of little use, by the way in which the larvæ succeeded in hiding themselves, as well as by cases of wandering away to another plant, really getting lost, etc. This occurred with single larvæ, each on a separate plant. In several cases I gave up the larva for lost, but it duly reappeared again. These facts apply mostly to the youngest larvæ, and are the ground for my suspicion that, in the autumnal larvæ, I may have been wrong in thinking they all fed only in the centre of the plant, though the extrusion of frass there, in one instance observed, could only be compatible with the larva being ensconced amongst the leaf-buds of the central rosette. These notes refer frequently to the young larvæ (first and second instars) eating especially the glands, the leaves themselves being attacked only by the older ones (in third and fourth instars). It is also noted that the larvæ eat their cast skins. As to one larva, it is described as very green and yellow, with no red except the dorsal tubercle, and that it was on a rather pale plant of *Drosera*, surrounded by plenty of *Sphagnum*. The identity of their schemes of colour with that of the plants, or leaves, they were on, is several times referred to (Chapman).

Larva.—The larva appears to have four instars. In the *first instar* it is without tubercle vi, and without skin-points. In the *second instar* it acquires these, and i and ii acquire a common chitinous base. There are no secondary hairs. At this stage it hybernates, in the autumnal brood. In the *third instar* it acquires a small number of secondary tubercular hairs, making the tubercles into warts. In the *fourth instar* it differs from the third in the secondary hairs being more numerous, but there do not appear to be any secondary hairs on the general skin-surface; vi remains a solitary hair, and there is no indication of secondary tubercles, either on the thorax, or behind the spiracles on the abdomen; i and ii form one compound wart, though the two primary hairs are quite distinct. The prolegs have six and seven crochets. *Autumnal to spring larva.—First instar* (newly-hatched, ? September 6th, 1904): The newly-hatched larva is fully 1mm. in length, when stretched out. Head, prothorax, and anal plate, dark, but not black; hairs and bases dark, the rest white or colourless. Tubercles i and ii are distinct from each other, but very close together, i very small, hair about one-sixth the length of that of ii, which is about 0·06mm. long; both incline backwards. The corresponding hairs on the 2nd and 3rd thoracic, and the 9th and 10th abdominal, segments are no less than 0·20mm., 0·23mm., 0·40mm., and 0·20mm. long, respectively, that on the 9th abdominal segment being, in fact, as long as half the length of the larva, when it is not extended; iii is about 0·17mm. long, and is directed forwards; tubercles iv and v are on distinct bases, but very close together, rather more on a level than usual [the contrary, for example, of *Amblyptilia cosmodactyla* (*acanthodactyla*)], the front hair 0·06mm., posterior 0·18mm., long. A long way below, about the middle of segment, are two hairs, one about 0·17mm. long, and the other, below and in front of it, about 0·1mm.; vi appears to be absent, and there are two of the three hairs of vii. On the prothoracic plate, one of the three usual front hairs seems to be absent,

Explanation of Plate.

(*To be bound opposite Chromo-litho. plate of Buckleria paludum.*)

Fig. 1.—Egg magnified $\times 56$.

Fig. 2.—Larva in 1st instar $\times 30$.

Fig. 3.—Larva in 2nd instar $\times 20$.

Fig. 4.—Larva in 3rd instar $\times 14$.

Fig. 5.—Larva in 4th (and last) instar, lateral view $\times 8\frac{1}{2}$.

Fig. 6.—Larva in 4th (and last) instar, semidorsal view $\times 8\frac{1}{2}$.

Fig. 7.—Pupa, lateral view $\times 8\frac{1}{2}$.

Fig. 8.—Pupa, dorsal view $\times 8\frac{1}{2}$.

Fig. 9.—Larva in 2nd instar in centre of leaf. [In the figure the conspicuousness of the larva much exaggerated; correctly represented it would hardly be visible.] $\times 4$.

Fig. 10.—Larva in last instar feeding.

Fig. 11.—Portion of leaf as eaten by larva.

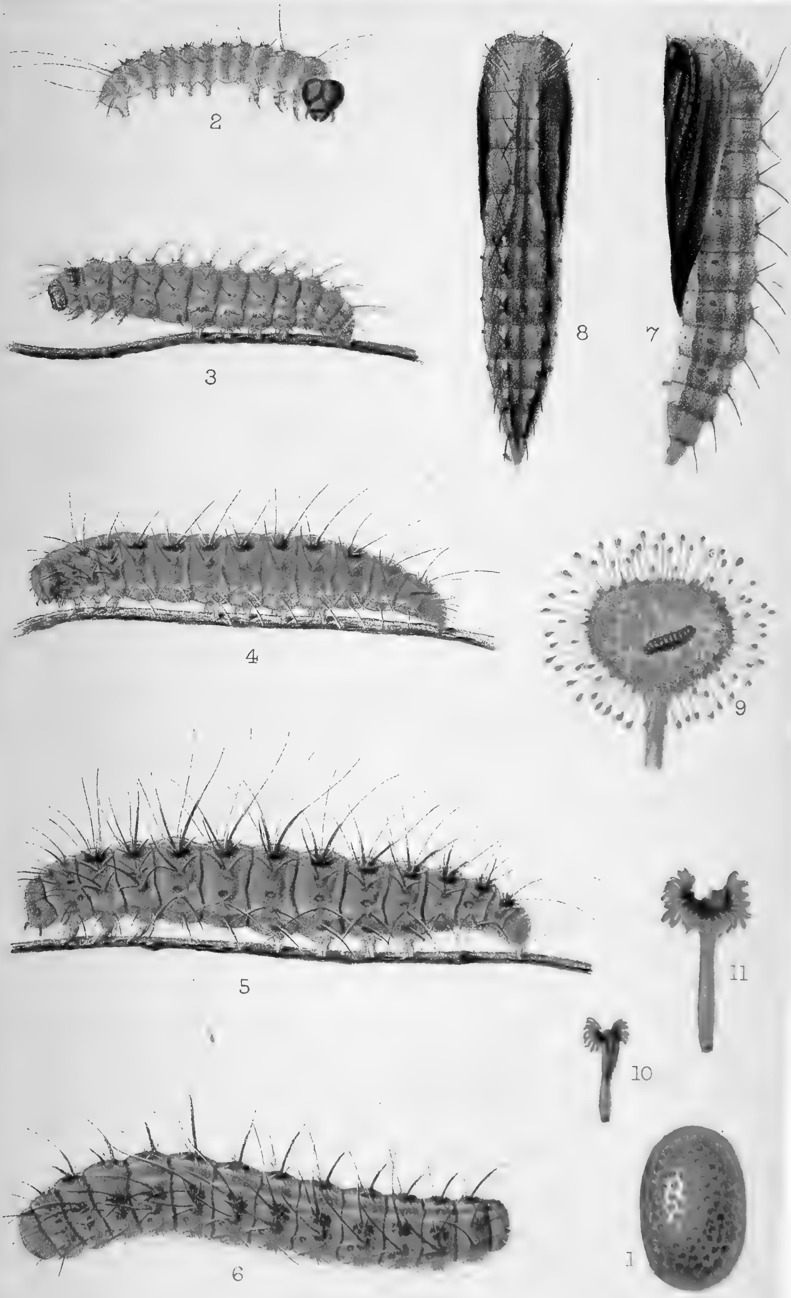
In Fig. 2, except a dorsal hair or two, the setæ shown are only those of one side—those of i and ii together, iii, (spiracle not shown,) those on iv and v together, (vi wanting,) two hairs of vii.

In Fig. 3, the tubercles i and ii of both sides are shown; vi present; vii hardly visible, being beneath; spiracles hardly indicated.

In Figs. 4 and 5, the dorsal tubercles of other side only indicated by a hair or two.

Fig. 9 almost impossible to show satisfactorily.

PLATE I.



E.C. Knight del.

BUCKLERIA PALUDUM. *Zeller.*

West, Newman chromo

The Natural History of the British Lepidoptera, 1906.

and only the long central one of the back row is clearly seen. Of the usual four pairs of hairs on the meso- and metathorax, the third appears to be represented by one hair only. The props of prolegs are about 0·04mm. long, with three crochets, four on claspers. *Second instar* (September 22nd, 1904): About 1·5mm. long; head dark, of about same width as body; tubercles i and ii are on one large chitinous base; iii, iv, and v, are smaller. These bases have a slightly dark tint; the hairs are long, ii nearly as long as width of body, i perhaps a quarter of ii, iii long, iv and v each rather shorter. The larva might be described as pale whitish-fuscous, with a reddish dorsal line, and another between ii and iii, but it seems more accurate to say the ground colour is pale reddish-brown, and that there is a narrow white line round each large tubercular plate. The larva being young, in this instance i and ii reach practically from front to back of segment, leaving only room for the narrow pale line. The hairs are very distinctly thickened at the tips. The larvæ hybernate apparently in this instar, forming little cocoons amongst the small leaves of the winter buds. One larva, however, in November, 1904, apparently went on to the *Third instar* (but may still only be in the *second*) (October 24th, 1904): It is fully 2mm. long, head black, general tint flesh-colour, made up of white and reddish markings. The tubercles i and ii are united on one base; ii carries the longest hair. Base of hairs, and spiracles, dark; 1st thoracic plate has a white central line, with black line on each side, and a black spot further out. Each tubercle is surrounded by a white area; between is dull red; the red area has fine skin-points, which are absent, or very indistinct, in the white areas. Hairs slightly clubbed, that on iii bent forwards, the front (upper) one of iv+v directed rather forwards, shorter than the posterior, which is directed outwards. The white and red are, perhaps, better described as being in longitudinal lines, a red dorsal one, then a broad white one, including i and ii, then a red one, which has various processes, so that the description of the white circles round the tubercles results from these taking circular arcs, with the tubercles, spiracles, etc., for centres. But there are other centres with white, that are not at present occupied by tubercles. On the 1st segment is a little longitudinal stripe of red, from i forwards, and, on the thorax, the dorsal and next red line are more or less conjoined. Under low magnification, the thoracic plate looks nearly black, and somewhat homogeneous in colour. Inside i and ii is a dark depressed spot. Anal plate not dark. [The larva is not tormented to get a fuller description, but is carefully placed on a better plant in hopes of rearing it.] * *Same larva* (December 10th, 1904): Short and thick; yellow, with very large porcellanous-white plates, or, perhaps, is rather porcellanous-white with certain yellow, or orange-ochreous, lines. The plates being apparently surroundings of tubercle, the tubercle and hairs are black, so that the little larva is a rather striking object when closely examined. Length, when stretched, 2·7mm. Taking the white as the ground colour, there is a narrow, dorsal, orange line, a little widened in front of each segment, and sending branches, pale and less conspicuous, along the

* The endeavour to describe this larva, without disturbing it, probably explains why it is said (*Trans. Ent. Soc. Lond.*, 1906, p. 136) to have had secondary hairs, which the further note shows to have been an error (Chapman).

front and back margins of segment, so that they are lost in the incisions, when the larva is not stretched. Tubercles i and ii are close together, and on a common eminence, and almost conjoined. These, and other tubercles, single-haired. Between i, ii, and iii, is another longitudinal, ochreous, line. Round i and ii the surface is smooth and porcellanous, but, in front of segment, on each side of dorsum, is an area with fine skin-points. Head and spiracles black. The subdorsal yellow line (between i, ii, and iii) sends down branches marking off a somewhat square white are around iii; iii is placed slightly backward. Of iv + v, the front one (v) is the higher with the shorter hair. Hairs about half the diameter of the larva in length. Props of prolegs rather short. When at rest, the incisions are deep, and the segments stand out high and cushiony, with the elevation of the tubercles—especially i and ii, and iv and v—making angular points. Below iv + v is a single hair, and, at the base of prolegs, the usual three hairs, which are, however, very conspicuous, being black on a white ground. On the 1st thoracic, the plate is rather dark, divided centrally by a pale, hardly yellow, line, with, on either half, a nearly central large hair, a small one at outer angle, and three along front edge, a three-haired tubercle in front of spiracle, and one at base of leg. The 2nd and 3rd thoracic segments have, on either side, four double tubercles along the middle of the segment, the 3rd with an extra hair above, and behind, it. The prolegs carry seven crochets in a circle, incomplete at its outer margin. The black crochets on the pale white base have a very pronounced aspect, different from the more usual pale brownish crochets on a yellowish base. *Antepenultimate instar* (May 31st, 1905—taken wild near Esher): The smallest larva found was just about to moult for the last time but one. Its length is 4·5mm., and its longest hairs about 0·5mm.; its general aspect precisely that of the larger larvæ, and the disposition of the primary hairs identical, though these are not so long; there are no secondary hairs, however, to be discovered.* *Penultimate instar* (May 31st, 1905): The next smallest larva was about to moult for the last time; its length about 6mm.; the longest hairs about 0·8mm., and there are a good many secondary hairs, two or three round i and ii, one behind iii, and one above, and behind, iv and v. These are secondary tubercular hairs, not skin-hairs, as are also those of the larva in its last skin. *Final instar* (May 31st, 1905): The fullgrown larva is 7mm.-8mm. long, of a form much like that of the larvæ of *Eucnemidophorus rhododactyla* and *Adkinia zophodactyla*, thickest about the 3rd or 4th abdominal segments, and tapering to either end, but, when at rest, or feeding, has the forward segments rather contracted, so that it looks thickest about the metathorax, and the mesothorax seems nearly as large; in colour, the dorsum is red, or reddish-brown, or pink, with an underlying green tone, the difference of tint being due rather to the attitude of the larva, and the degree to which it is mature, than to individual variation. The hairs are very long, and many of them are clubbed, being somewhat flattened, at the tips especially; some are dark with white tips, which look club-like. The hairs transmit, and reflect, the red of the larva and of the hair-glands of the plant, so that the resemblance of the larva, in some aspects, to a leaf is very close; in others, a leaf, seen

* This specimen raises a doubt as to whether the wintering larvæ do not have five moults (an extra one on leaving hybernaculum) (Chapman).

edgewise, may be easily mistaken for the larva of which one is in search. This is assisted by the lower surface of the larva being green, separated from the upper red surface by a yellow line, sometimes not very conspicuous in tint, but in some very bright; it occupies the lateral prominence (upper portion of lateral flange) which carries tubercles v and iv. Below this is a second flange-like projection carrying vi (a single hair directed forwards), which is marked off, above and below, by a rather deep sulcus, and which bends downwards in front, upwards behind. There are two paler dorsal lines just within the dorsal tubercles, rather curved outwards at the middle of each segment; the space between them is a rather greener pink than the rest of the dorsum, due to the dorsal vessel showing somewhat. There are other pale marblings, especially a tendency to a line through i and ii. This, however, is much interfered with by the large size of the combined base of these tubercles, almost entitled to be called a hump, which is of a dark dense red that extends a little beyond, especially behind, the hump. This red, which, at that stage, becomes a brighter pink, persists when the larva is laid up for pupation, when all the rest of the larva has become green. The lateral yellow line is abdominal only, the same region of the thorax is pink. There is a pale (yellow) spot in front of iii, and, below, there is a pink shade in the green (yellow ?) under-surface, above, behind, and below vi, which stands out on a yellow eminence, as does also the eminence of the three hairs at base of prolegs. The larva, at rest, is about 1·1mm. thick, whilst the dorsal hairs (ii) are about 1·6mm. long; legs nearly colourless; pale (colourless) prolegs, tall, slender, with bulbous ends; hooks, wanting on outer aspect, seven or eight in number, nine on claspers (Chapman). *Quiescent stage preceding pupation* (June 5th, 1905): The larva has the depressed dark-coloured spots on the scutellum. The spiracles are very low for a plume larva, almost flush with skin-surface; they are narrowly rimmed with black. There is a fine coat of spicules on the skin, but no trace of scattered secondary hairs, only a few small additional hairs attached to the wart-like groups into which the primaries have evolved. Tubercles i and ii form a conjoined wart on all segments from mesothoracic to 8th abdominal; there are no accessory (supernumerary) groups behind these on meso- and metathorax, as is usual in the species that develop warts, neither are there any behind the spiracular tubercles. The hairs are noticeably knobbed at tip. Judging by the silk threads spun about among the hairs, it seems questionable if this larva would not attempt some sort of silk-spinning before pupation, and form a slight, at any rate theoretical, cocoon (Bacot). *Summer larva:—First instar* (July 7th, 1905): Rather over 1mm. long, whitish-green, almost transparent. Head black, thoracic plate dark, as well as bases of tubercles and anal plate. Each tubercle has a distinct plate, larger than the mere hair-base. Tubercles i and ii are on a common base, as are also iv and v; the hairs are black. The thoracic plate has three hairs of the same length in front; central of back series very long, other two short. Single hair in front of spiracle. On the 2nd and 3rd thoracic segments are the usual four pairs of tubercles on each side, each pair on a single plate, and the third pair apparently possesses a third hair on the same plate. The head has a very long hair on the centre of each side of the front of the cranium. The long hairs on the head, and the 1st and 2nd thoracic segments, about

0·13mm.; hairs on ii, iii, and iv, on abdominal segments about 0·1mm. Points of hairs white, and apparently clubbed. Towards moult, shows some reddish tinting between the tubercles. *Second instar:* 2mm. long; hairs white, arising from black points, more clubbed and proportionally shorter than in first skin. No secondary hairs. The tubercles are on distinct largish plates of a faint cinereous tint, and round them is a whitish shade, as of a porcellanous-white thickening of the skin; the rest is a pale brownish-red, forming a dorsal band, a line along the posterior border of each segment giving a branch forward (and obliquely upwards) between ii and iii, and between iii and spiracle. There is, however, some variation in tint and extent of red marking, either in different specimens, or according to different degrees of maturity. The central hair on the head is still long. The first and third posterior hairs of thoracic plate are very short compared with the long second one, the outer one of the front row is also long. The prothoracic plate is paler, with dark marbling on each side of the central suture, and the dark spot between the second and third hairs is distinct, rather nearer the posterior margin of the plate. The prespiracular tubercle has three hairs, and there are three hairs on the third tubercle of the meso- and metathorax; i on the 9th abdominal is very small, but is quite visible. The anal plate carries six hairs on either side. The spiracles are black, but not very large or prominent. *Third instar:* 3·5mm. long, before feeding much; it has now quite the adult "plumage," though the secondary hairs are fewer and much smaller than in the final instar. The tubercles are on, or rather form, almost raised humps. The secondary hairs are, four on i+ii, two or three of them very small and inconspicuous, one on iii, none on iv+v, or on vi. These secondary hairs are white, and clubbed. The primaries arise from black points, are ochreous, with white clubbed tips. The skin-points, wanting in the first instar, transparent and sparse in the second, are now abundant. The tubercular areas are free from them, these areas, which probably correspond with the earlier tinted scuta which are not present now, have a little differentiation of colour, and texture, to mark them off from the surrounding skin. The larva is still very transparent and flimsy-looking. The white, under the tubercles, seems subcutaneous, as does also the red-brown of the dorsal stripe, and of a great part of the rest of the larva. The red is, however, in marks or marblings, and not in continuous streaks. The two hairs on the head and on the mesothorax are long, but only a little longer than the longer ones on the abdomen. The longer hairs are from 0·35mm. to 0·4mm. long, not quite three times as long as the others, as in previous instar. The prolegs are long props, slightly bulbed at the end, and with seven dark crochets round the inner margin. The six eyespots are very prominent, more than hemispheres. The head is translucent, with ochreous marblings. A large black mark under the eyespots, but three of them escape it, or seem to do so, at certain angles, and look quite white. There is a short hair, ventrally, close to the middle line on the abdominal segments without prolegs, probably present in other instars, though not noted. The last joint of the true legs is markedly long and slender (Chapman).

Foodplant.—*Drosera rotundifolia* (Bankes). The foodplant, *Drosera rotundifolia* (and probably the other forms; I found many larvæ on *D. rotundifolia*, but the Dorset plants varied somewhat towards *intermedia*), is one that was probably never before suspected to support a lepidopterous larva, and was therefore never searched, except by Bankes, for that of this species. The prevailing idea is that the plant devours insects, and though this is undoubted, it now appears that to assume that insects would not, and could not, also eat it, is to fall into a plausible, but false, method of reasoning. Nevertheless, it comes as somewhat of a surprise to find that a lepidopterous larva, without any special means of protection, but simply acting in the ordinary larval manner, attacks it with entire impunity. No doubt it avoids walking over, and especially resting upon, the gluey glands, but it does this, apparently, merely because it has no need to do so, and the glands with their secretion are certainly favourite items of its food, especially when it is small (Chapman).

Pupation.—Fullfed larvæ found in the Esher district, May 31st, 1905. The following day, June 1st, several fixed themselves for pupation, one on the underside of a *Drosera* leaf, another on a thread of heath-stem. On June 2nd, several more fixed themselves up; one pupated this afternoon. By June 3rd, 7 a.m., two are now in pupa. The rapidity with which they finish feeding is apparently great. The temperature of the last day or two has been about 70°F. On June 15th, the last larva pupated (Chapman). Of four larvæ, taken by Mr. South on May 31st, he remarks that one was suspended when he found it "head downwards from its anal attachment to a slender twig of heather. Another was on the middle of the crown of its foodplant; neither of them changed its position, but they are now pupæ in the exact places they occupied as larvæ, when I came across them. A third larva had pupated on a heather-twig, and the fourth had pupated on the flat rim of a fern-pan, in which I set the foodplants. A curious fact in connection with this last larva is that, although I had twice removed it from the rim of the pan, it succeeded in getting its own way, and became a pupa on the spot it had fixed upon, and there it now remains." The larva seeks, for pupation, a bit of slender, upright, stem, the ideal position, possibly, being the dead stem of last year's flowers; a slender bit of heath will serve; one of mine pupated on the underside of a leaf of *Drosera*, and Mr. South met with one that pupated across the centre of the foodplant. But a bit of dead grass-like stem is what the larva prefers; no fewer than three selected the only piece of this material in one of my tins, and a fourth fixed itself at its base, being crowded off by the previous tenants. Of six in this tin, the two others selected slender stems of heath. The larva will take a horizontal position, and does not much mind which side is up, but appears to prefer one with dorsum upwards. When it obtains its pupal position on a vertical stem, it always fixes itself head downwards (Chapman).

Pupa.—The change before pupation in the larval colour is very marked, the whole larva becoming green, except the hump of i and ii, which assumes a conspicuous dark rosy-pink. For some time after pupation the pupa has the same coloration, the pink eminence being very conspicuous, and ornamental, on the green pupa; gradually, however, the colours change, the pink fades, and the rest of the pupa, remaining green, acquires an overshading of faint ruddy brown, disposed, roughly speaking, in longitudinal bands; in one of these the tubercles i and ii still present a slightly darker shade, but in only one or two cases at all decidedly so. The length of the pupa is 6·7mm.; width of thorax, 1·3mm.; abdomen, 1·2mm.; 1mm. at about the 5th abdominal segment; the ♀ apparently a little shorter and thicker. The thickness is much the same to nearly the end of the 5th abdominal segment (and wing-cases), whence it (in 2mm.) tapers regularly to a rather fine point, at least it does so, seen sideways, and, seen dorsally, the thorax is wider than the following segments, and the tapering of the 6th abdominal segment onwards is by a curved outline, with sharper finish in the 9th and 10th abdominal segments. The head in front is rounded, but has two lateral eminences, and a double (or two minute) frontal one between them. Seen dorsally, when the form has been fully acquired, but the pink colour of the dorsal tubercles persists, it is a most beautiful object, from the elegance of its outline and delicate, but bright, colouring. The hairs are of some assistance to the pleasing effect. Before describing the hairs, it may be best to note that there is the usual double dorsal flange, or ridge, beginning behind the middle of the mesothorax, with a rounded eminence, succeeded by a lower one, then running across metathorax and abdominal segments in line of tubercles, and ending with the tubercles on the 3rd abdominal segment. It is not high and marked, as it is in some "plume" pupæ, but is quite definite and distinct, the tubercles on the following abdominal segments (4th, etc.) are in line with it, but represented only in the middle of each segment, there being no continuous ridge between them. The hairs on the mesothorax are, on either side, two in line of the dorsal ridge but in front of it, and about the distance apart that the last one is from the initial hump of the ridge; outside each of these is again another hair; all equally spaced, so that there are two rows of four hairs across mesothorax in front of anterior end of ridge. The prothorax has a row of six hairs across it, three on either side, and one or two of the head (antenna-basal ?) hairs come into this same dorsal view. These hairs are all colourless, and about 0·7mm. or 0·8mm. long (two-thirds thickness of pupa). On the head are, in front above, two hairs on each side, and one on each side below, above the labrum. These are 0·3mm.-0·4mm. long, colourless. On the metathorax are two hairs, one on either side, white, about 0·6mm. long, porrected and arising, at front margin of segment, from the ridge. They appear to correspond with the first of the two hairs in the following abdominal segments, which have the same appearance, nearly the same length and direction (porrected), but arise further back on the segment. The metathorax has no posterior hair, as the other segments have. The 1st, 2nd, 3rd, and 4th, abdominal segments have each two hairs on either side, apparently i and ii, not arising very close together, but still on a common eminence, which, on the 1st, 2nd, and 3rd, abdominal segments, is part of the dorsal ridge, the hairs are at an angle to each other of about 90°, the first directed forward, the latter backwards, and increasing the angle by a little curvature; the posterior one is black, quite 0·6mm. long, whilst the front one is shorter on each segment up to the 4th abdominal segment. On the 5th abdominal segment, and beyond, there is only the posterior one, on to the 9th abdominal segment, where it is at posterior margin of segment. It has about the same length (0·6mm.) on each segment. On these segments is a little eminence and scar, suggesting where the missing tubercle i would have been. On the front outer angle of metathorax are two minute black dots. On the

1st abdominal segment, at the same place, is a similar dot, with a large, spiracle-like, oval scar behind it, and of a dark colour. Otherwise, there are no hairs, or other structures, except the small ochreous spiracles down to the subspiracular flange; on this, are two minute black dots (iv+v) on the 3rd to 7th abdominal segments; on the 8th abdominal segment there are, at the same places, two short (0·3mm.) hairs. These are repeated on the 9th, except that the 1st has another just below it. On the 10th abdominal segment, one similar hair seems distinct from the cremastral hairs in which it is very close, and equally short, but straight. The double dots, that occur on the 3rd abdominal segment to the 7th abdominal segment, are forwards, rather close together, and behind the spiracle. More ventral on the 5th, 6th, and 7th, abdominal segments, in fact ventral, are, on either side, two short deflexed hairs, vii, about 0·1mm. and 0·2mm., long; on a pale line, between these and the subspiracular flange, is a small black dot, hardly a hair, vi; a similar trace of iii is also to be detected. On the several lines of these, *viz.*, iii, iv+v, vi, and vii, there are longitudinal pale lines that look sometimes like ridges, largely owing, however, to coloration, but this is just so much raised on the subspiracular, iv+v, line, that I have ventured to call it a subspiracular flange. The appendages reach to the middle, and even to the posterior margin (in ♂s ?), of the 5th abdominal segment, and look attached to it, but are free beyond the 3rd abdominal segment. The cremaster consists of two portions, a small one in the centre of the 9th abdominal segment, and a larger one on the 10th abdominal segment. The hairs, together with the dorsum of the last two segments, are pinkish, about 0·1mm. long, straight, or nearly so, with a small knob at one side of the end, as though a hook had soldered itself to the shaft, to which it had turned round. The appendages are transparent green, with rather darker olive shading, beside the wing-veins, on the antennæ and first legs (Chapman).

Variation in pupa.—The variation in the colour of the pupa is, first, in the amount of pink. This tends to fade as the pupa matures, and some pupæ lose it altogether, becoming entirely green. One pupa, on the other hand, has a dorsal, a broad subdorsal (through hump and hair-bases), and a lower (along iii ?), rose-pink line, nearly continuous from end to end of the pupa, and is consequently a handsome, brilliant, pupa. The depth of green also varies a little, especially on the wings and appendages, which may be pale and transparent, or a deep solid-looking green. A certain olive-brown tint appears, as the pupa matures for emergence, the eyes, wings, &c., becoming black. One other point in the variability of the pupa has regard to the forward hairs (i) of the abdominal dorsum. The most usual form is perhaps that described, with this hair on the first five segments, and wanting in the others; it does not often show any length on 5th segment, and is more frequently wanting on 4th, 3rd, or even 2nd, and presumably may be entirely absent. When absent, it is, however, usually represented by more or less of a stump, or abbreviated hair, and its site, when absent, is marked by a basal circle or point. It is unusual, however, as happened in the specimen described, for the hairs present to be well developed and the rest to be absent, *i.e.*, merely a basal trace present. It is more usual for there to be one or two intermediate, abbreviated, hairs, as for example, 1st and 2nd, good hairs, 3rd, shortened hair, 4th, very short, 5th, stump, 6th, wanting, or some such formula (Chapman).

Time of appearance.—The species appears to be double-brooded throughout the greater part of its range. In Britain it occurs in June and August, each brood remaining on the wing from two to three weeks. Cambridge says that, in Dorset, the first brood appears in the second week of June, the second, and main, brood, from the beginning to the end of August. At the end of May and beginning of June, 1869, at Zürich (Frey); a fine specimen captured, August 11th, 1903, in a marsh at Ottignies (Crombrugghe). In Germany, there are two generations, the first at the end of May and beginning of June, the second at the end of July and beginning of August; it is reported in June, and again in August, near Wiesbaden (Rössler); in May, and again in August, near Constance and Ueberlingen (Meess and Spuler); it is also recorded, without any suggestion of double-broodedness—in July, near Stettin; end of June and July, near Friedland (Stange); in July, near Parchim (Gillmer); in August, near Bahrenfeld (Sauber); in June and July, in Hanover (Glitz); June and July, near Berlin (Pfützner); end of July, near Frankfort-on-Oder (Zeller); and mid-June on into July, in Silesia (Wocke). In Spain, in May, at Barcelona (Cunì y Martorell). The following dates have been recorded in this country: June 20th, 1857, near Crewe (Thompson); June 10th, 1865, at Woolmer Forest (Barrett); August 23rd-September 4th, 1886, at Wareham (Cambridge); August 23rd, 1886, in the Isle of Purbeck (Digby); August 30th-31st, 1886, at Wareham (Bankes); June 14th-16th, 1887; again August 4th-27th, 1887, at Wareham (Cambridge); August 5th-11th, 1887, in the Isle of Purbeck (Bankes); August 13th, 1889, near Lyndhurst (Holland); August 29th, 1889, at Wareham (Cambridge); August 18th, 1890, in the Isle of Purbeck (Bankes); July 18th, 1891, on Thorne Moor (Porritt); June 4th, 1895, and following days, and again August 4th-5th, 1896, abundant at Wareham (Cambridge); August, 1904, at Claygate (South); August 20th-23rd, 1904, at Wareham; August 24th-29th, 1904, in the Isle of Purbeck; June 24th, 1905, at Wareham; June 28th-July 8th, 1905, in the Isle of Purbeck (Bankes); bred June 15th, 1905, from larvæ collected in the Esher district (South); bred June 18th-29th, 1905, from larvæ collected in the Esher district (Chapman); July 4th-5th, 1906, in the Isle of Purbeck (Bankes).

Habits.—South notes that, on July 25th, 1905, he watched an imago of this species emerge about 12 o'clock (noon). "When first seen, about half the insect was free from the pupa, which was attached to the side of a tumbler; it then remained perfectly still, except for a slight, gliding, forward motion which continued for about three minutes, by which time only three segments remained in the pupal case; then all movement ceased for a few seconds, when, with a sudden jerk, the insect shot forward and downward, alighting on the glass about two inches from the pupa. All the time it was under observation, the antennæ and first pair of legs were free, but perfectly still." Chapman adds that "this describes very well the habit, of this and some other plumes I have observed, of resting during emergence, and of a good deal of wing-expansion taking place during the process, so that it almost looks as if the wing was extended by the process of drawing it out of the pupa-case." Barrett says that "the moth hides during the day among the low-growing herbage—stunted heather, bog-asphodel, cranberry, and short grasses and sedges—on the boggy portions of heaths or the edges of fens, but flies up, if disturbed by a passing footstep, to hide again at a few feet distance; it flies naturally at sunset and after." Bankes observes (*in litt.*) that "the imagines, which only fly on very calm and warm evenings, flit about, amongst the herbage of the bogs on the heath-districts, like gnats, though with a peculiarly jerky flight. They come on the wing some time before sunset, and continue to fly until about dusk, if the temperature remains high, but, when it falls rapidly at sunset, as not infrequently happens, their flight ceases almost immediately. Of the first brood, the only example taken by myself on the wing was netted at 8.40 p.m., on July 8th, though I secured a few others by sweeping, *viz.*, a ♀ at 4.30 p.m., a ♀ at 7 p.m., and a ♂ at 7.30 p.m., on June 24th, and a ♀ at 7.10 p.m., on June 28th. Much experience with the second brood, of which I have netted many individuals, August 5th-31st, shows that all have been captured between 6 p.m. and 7.30 p.m., the most productive time being from 6.15 p.m. to 7.15 p.m., and that their appearance is not affected by whether their haunts happen to be in sunshine or in shadow at the time. Several of both sexes of this brood have been taken by sweeping the herbage between 7 p.m. and 7.30 p.m., after the flight was over. Of the specimens captured on the wing, a very large proportion (probably well over 90%) are males." Cambridge observes that, "on August 23rd, 1886, walking across a bog, at the end of the afternoon, two specimens were disturbed, and a careful search revealed several before darkness came on; working for the species every suitable evening, the insect was found scarcely ever to move of its own accord until about half-an-hour or less before sunset, and for a very short time after; indeed, of its own accord, it was seldom seen flying, generally not flying until disturbed, when it would flutter up, gnat-like, among the bog-grass and rushes, and jerkily fly off, for, at most, a few yards, settling again on a blade of grass, with its two long-spurred hind-legs stuck out, one on each side, in a very characteristic way. On some evenings it would not fly at all; the most favourable kind of evening appeared to be a quiet, dewy, damp one, after a bright hot day." In 1887, however, his experience was entirely different, for whereas, in 1886, it appeared to fly for only a very short time just before, and just after, sunset, yet, of 1887, he says (*Ent.*, xx., p. 326), "although on some of our finest and quietest evenings in August scarcely an individual was seen, it did not hesitate occasionally to fly briskly in the full blaze of a hot sun; a moderately dewy evening appears to draw this little moth out most freely, and the evenings of last August were remarkable for an almost total absence of dew." As pointing to the same habit, Bankes writes (*in litt.*): "The six specimens taken in early July, 1906, were, with one exception, all netted whilst on the wing, in bright sunshine, over heath-bogs, 6.50 p.m.-7.55 p.m. The remaining one was swept up off the herbage, growing in a bog on the heath, at 7.50 p.m." Holland writes (*Ent. Mo. Mag.*, xxvi., p. 87) that, in a boggy hollow, near Lyndhurst, he "netted two specimens of this little plume, at dusk, on August 13th, 1889: it was a very windy evening, and this was the only moth that could be found moving." In Pomerania, near Stettin, the insect is said to fly among *Ledum palustre* (Büttner); near Wiesbaden it flies freely at sunset (Rössler).

Habitats.—The species appears to have been first recorded in Britain in 1851, by Stainton, who notes it as having been captured at Whittlesea, etc., the preceding summer, and described it as "considerably resembling *parvidactyla*, but differing essentially in the deeper fissure and slender second lobe of the anterior wings, and in the third lobe of the posterior wings having no black scales in the cilia" (*Supp. Cat. Brit. Pteroph.*, p. 13). Several were then reported to have been taken "on June 20th, 1857, in a small moss a few miles from Crewe" (*Ent. Wk. Intelligencer*, ii., p. 108). Our more recent knowledge shows it to be confined to the areas where *Drosera* grows—fens, mosses, marshes, etc. It was supposed, half-a-century ago, that the species was confined, in Britain, to the fens of Huntingdon, Cambridge, Norfolk, and Cheshire, but it has since been found to have a much wider distribution. "In Dorsetshire, it has never been found except on the heath district on the eastern side of the county, and, although fairly widely distributed thereon, it, of course, only occurs in actual bogs, or in spots sufficiently damp for *Drosera rotundifolia* to flourish, and is, in any case, excessively local. Numbers of apparently suitable bogs, where the foodplant is abundant, have been worked altogether in vain, or have only yielded the moth very rarely, and only two spots, many miles apart, are known to me where it is not really scarce" (Bankes). When first taken, in Dorset, in 1886, near Wareham, the bog on which the specimens were found was, in some places, over ankle-deep in water (Cambridge). Chapman says that, in the Esher district, the ground is swampy, and not easy, in ordinary seasons, to get about on with comfort; it is peaty, situated amongst heath, and apart from *Sphagnum*, but, at the end of May, 1905, owing to the drought which had lasted for a considerable period before the visit, the ground was not at all boggy, whilst the plants of *Drosera* were very small, with the leaves on the ground, some of the plants not being more than 20mm. across. Barrett notes that, in Woolmer Forest, the insect occurs in a marsh, flying among the long grass, asphodel, etc., the imagines being difficult to see on the wing. He further notes it as "occurring in a small moss some miles from Crewe" (*teste* Thompson). At Lyndhurst it occurs in a boggy hollow (Holland); and, in Yorkshire, on the open part of Thorne Moor (Porritt). Frey records it from turf-moors in Switzerland, *e.g.*, on the Bünzen Moss, near Bremgarten, and very rarely at Katzensee, near Zürich. In Belgium, it is recorded as occurring in a marsh at Ottignies (Crombrugghe). In Germany, it was found on a peat-moor near Frankfort-on-Oder, where *Tipula fasciata*, *sepulchralis*, and *Tabanus plebeius* also occurred (Zeller), and is entirely an inhabitant of peat-moors and swamps (Hofmann); it occurs, near Wiesbaden, in Pfaffenborn, in marshy places, damp mountain-meadows, where *Crambus sylvellus* occurs, flying over peat-mosses at sunset, in June, and again in August; it was formerly common on the meadows at Hengberg, between Schläferskopf and the Aarstrasse, whence, however, it has disappeared since the draining-off of the water by the municipal waterworks (Rössler); this reminds one of Barrett's statement, that it was "formerly common in the fens of Cambridgeshire and Huntingdonshire—Burwell Fen, Whittlesea Mere, Holme Fen, etc.—but, since the draining of the fens, it seems to have died out of these districts"; near Hanover, it occurs in a marshy meadow, behind Hainholz, not rarely (Glitz); near Berlin (in the Grunewald), on the "Fenn," or peat-swamps (Zeller); on a moor near Carolinenhurst, not rare in July, where the moth is beaten out of *Ledum palustre* (Büttner); confined to swamps and moors in Brandenburg (Sorhagen); in a peat-swamp near Riemberg, also on the peat-moors of the Görlitzer Haide, and near Niesky (Wocke); on the turf-moors near Constance and Ueberlingen (Meess and Spuler). In Austria, on the turf-mosses, near Moosbrunn, rarely (Mann).

British localities.—Local and confined to boggy places, but widely distributed. One expects that it will be found in many places where *Drosera* grows. Cambridge: Cambridge—Whittlesea Mere, the Fen district (Stainton), Burwell Fen (Barrett). Cheshire: a moss near Crewe, several (Thompson). Dorset: the eastern side of county—Isle of Purbeck, near Corfe Castle (Bankes), Studland (Digby), Wareham district—Bloxworth (Cambridge). Hants: Woolmer Forest (Barrett), Lyndhurst (Holland). Hunts: Holme Fen (Barrett). Surrey: Haslemere (Barrett), Esher district (Chapman), Claygate (South). Sussex: near Arundel (W. H. B. Fletcher). Yorks: Thorne Moor, near Beverley (Porritt).

Distribution.—North Germany, Lower Austria, Switzerland, England, Holland, Finland, Livonia, French Alps; Catalonia (Staudinger and Rebel). Austro-Hungary: Lower Austria, near Moosbrunn (Mann), the Vienna district (*teste* Hofmann). Belgium: Ottignies (Crombrugghe). Germany: Baden—near Constance, Ueberlingen (Reutti), Silesia—Riemberg, common, Görlitzer Haide, Niesky (Wocke), Kohlfurt (Sommer), Upper Lusatia—near Neukirch (Möschler), Brandenburg—near Grunewald (Sorhagen), Frankfort-on-Oder, Berlin (Zeller), near Hamburg (Sorhagen), Hesse—near Wiesbaden, in Pfaffenborn, Hengberg, between Schläferskopf and Aarstrasse (Rössler), Hanover—behind Hainholz (Glitz), Pomerania—Stettin, Carolinenhurst (Büttner), Mecklenburg—near Friedland (Stange), near Parchim, Hünken Moor (Gillmer). Holland: North Brabant—Breda, Mastbosch, [Soeren, near Dienen] (Snellen). Russia: Livonia (Teich). Spain: Barcelona (Cunì y Martorell). Switzerland: Katzensee, near Zürich, Bünzener Moss, near Bremgarten (Frey).

ADDENDUM I (to page 319).

Since the portion of this volume referring to the *Stenoptiliinae* was printed (*anteà*, pp. 313 *et seq.*), Mr. G. F. Mathew has added (*Ent. Rec.*, xviii., p. 245) the following species to the British list.

Adkinia graphodactyla, Treitschke.

Synonymy.—Species: **Graphodactyla,** Tr., "Schmett. Eur.," ix., pt. 2, pp. 233-4 (1833); Hofm., "Deutsch. Pteroph.," pp. 85-88 (1895); Math., "Ent. Rec.," xviii., p. 245 (1906). **Graphodactylus,** Zell., "Isis," pp. 840-841 (1841); "Stett. Ent. Ztg.," iv., p. 150 (1843); "Linn. Ent.," vi., p. 370 (1852); H.-Sch., "Sys. Bearb.," v., p. 377 (1855); Frey, "Tin. Pter. Schw.," p. 413 (1856); Stoll., "Verh. des Natur. Ver.," p. 215 (1863); Hein. and Wocke, "Schmett. Deutsch.," iii., p. 797 (1870); Glitz, "Nat. Ges. Han.," xxvi., p. 51 (1877); Zell., "Stett. Ent. Ztg.," xxxix., p. 164 (1878); Mann, "Verh. zool.-bot. Ges. Wien," xxvii., p. 500 (1878); Frey, "Lep. der Schweiz," p. 430 (1880); Heller, "Ber. Nat. Med. Ver. Innsb.," xi., p. 161 (1881). **Plagiodactylus,** Frey, "Lep. der Schweiz," p. 430 (*in part*) (1880); Büttn., "Stett. Ent. Ztg.," xli., p. 472 (1880); Snell., "De Vlind.," ii., p. 1037 (1882); Snell. v. Voll., "Sepp's Ned. Ins.," 2nd ser., vol. iv., p. 188, pl. xxxiv., figs. 1-13 (1887); Hering, "Stett. Ent. Ztg.," lii., pp. 225-6 (1891); liv., pp. 117-120 (1893). **Pneumonanthes,** Bütt., "Stett. Ent. Ztg.," xli., p. 472 (1880); [Hofm., "Deutsch. Pter.," p. 87 (1895); Math., "Ent. Rec.," xviii., p. 245 (1906).]

Original description.—*Alucita graphodactyla.* Alis anticis hepaticis, striis longitudinalibus obscurioribus, fimbriis apicis fissuraque albis. Herr Freyer, of Augsburg, discovered this species, recognised by me as undoubtedly new after careful comparison, in the larval stage, when he was wandering among the mountains in Bad Kreith, near Tegernsee, in the beginning of June, 1828. The larvæ lived on the yellow gentian (*Gentiana lutea*), in spun-together leaves of this plant. There were usually ten to fifteen examples in one head. He carried them with him and reared them. The examples kindly committed to me certainly approach the two previously-described species (*tesseradactyla* and *calodactyla*), especially the latter, though I am in a position to bring forward special constant characters. The size is that of *calodactyla*. Head and thorax are brown ; the former bears two fine white longitudinal lines above the eyes. The antennæ are white, ringed with brown. The abdomen is yellow-grey ; here also are exhibited white, but easily discomposed, longitudinal lines. The legs are grey, their spurs whitish. The forewings are beautiful nut-brown, rayed with paler and darker longitudinally, something like fossilized wood. On the disc at two-thirds, in front of the usual fringed fissure, lies a liver-coloured crescent; in front of this, on the main nervure, one notices two distinct dark dots, and above it, towards the costa of the upper lobe, the ground colour is again nut-brown. The costa is very finely white-edged, without dots. The fringes of the hindmargin are also white, but, on the inner margin, they become grey. One does not here notice any black hair-tufts. The thrice-divided hindwings are brown, their fringes duller, likewise without the distinction of scale-tufts. All is nut-brown beneath, though all the margins are edged with whitish, the fringes as above. We may now look forward to the approaching illustration in the above-mentioned friend's valuable *Neuere Beyträge zur Schmetterlingskunde* (Augsburg, at the author's, and at the bookshop of Joseph Wolff) (Treitschke).

Imago.—20mm.-24mm. Forewings brown, darker on the costa ; on the inner margin, around the fissure, and at the base of the upper lobe pale brown-yellow ; with black and white scales arranged in longitudinal rows. The inner marginal spot seldom distinct, the discoidal spot nearly always present. The dots before the fissure are small, separated, one lying directly under the other, and separated from the fissure by a pale, yellow-brown, crescent-shaped space, sometimes dusted with white, which is continued into the pale spot at the base of the upper lobe, by which feature *S. graphodactyla* is easily distinguished from all the other species of the genus; the fissural spots are not rarely continued in more or less lengthened black streaks. In the upper lobe a deep black longitudinal dash usually lies, which is cut by a fine white oblique line extending into the fringes of the upper lobe. This line is only continued extremely rarely into the lower lobe. Two black longitudinal lines are generally present in the lower lobe; all these markings are, however, very variable, and often only indicated. The costa exhibits, above the fissural spots, an indistinctly outlined, almost triangular, shade, which reminds one strongly of the costal triangle of the genera *Platyptilia* and *Amblyptilia*. The costal fringes are more or less distinctly white above the light space at the base of the upper lobe, and from the junction of the pale oblique line of the upper lobe up to the apex ; otherwise dark brown. The outer marginal fringes of the upper lobe are white, towards the inner margin brownish, at the apex of the lower lobe rather extensively pure white, then towards the anal angle dark brown, furnished on both lobes with an uninterrupted dark brown basal line, a second chief distinction of *S. graphodactyla*. Hindwings dark brown-grey, with yellowish-grey fringes, which show, at the apices of the 1st and 2nd plumules, an indistinct dark dividing line. Underside dark brown-grey, the apices of the lobes, as well as those of the 1st and 2nd plumules, dusted with yellowish ;

the fringes at the apex and outer margin of the upper lobe, as well as those of the apex of the lower lobe, white; the white oblique line of the upper lobe often showing through (Hofmann).

Historical account of species.—Freyer found larvæ in 1828, from which imagines were reared and described by Treitschke (*anteà*, pp. 515-516). Imagines were then taken by Fischer v. Röslerstamm and Mann, July 22nd, 1840, as they went up the Schneeberg. These were described by Zeller (*Isis*, 1841, pp. 840-841), whose description reads:

"Alis anterioribus cinereo-gilvescentibus, antice late laciniisque fuscescentibus, puncto geminato ante fissuram lituraque laciniæ anterioris longitudinali fuscis; ciliis circa apicem albis." (Forewings mixed grey and fawn colour, broadly brownish along the costa and on the lobes; a double dot before the fissure, and a longitudinal dash on the upper lobe black-brown; fringes white round the apex). (One ♂ from Fischer von Röslerstamm's collection.) . . . . Very similar to *P. mictodactylus*, and might easily be looked on as a variety of the same; but an uninterrupted brown line runs round the margins of both lobes, and the apex of the upper lobe is bordered with white fringes on both sides. Larger than most examples of *P. mictodactylus*. Head brown-grey; the upper margin of the eye white, and this white colour extends round the small frontal tuft as in *P. mictodactylus*. Antennæ very finely ciliated, brown-grey, with an interrupted whitish longitudinal line, which is especially broad and pale on the lower portion. Palpi formed as in *P. mictodactylus*, pale, whitish on the upperside, as well as on the whole terminal joint. Patagia brownish-grey in front, brownish-fawn behind, body the same; this has dark and faintly whitish longitudinal lines on the posterior segments and beneath. Legs on the upper parts pale yellowish-brown, once or twice white-lined longitudinally; the hind tibiæ outwardly pale brownish, inwardly whitish; first tarsal joint the same, the remaining tarsal joints like the tibial spurs, white. The upper spurs somewhat longer than in *P. mictodactylus*, not equal to each other; the longer greater than half the distance between its base and the apex of the tibia; the terminal spurs rather equal, shorter than the short upper spur, and equal to one-third the length of the first tarsal joint. Forewings pale up to the fissure, purest towards the inner margin, mixed with brown-grey towards the costa, and on the costa quite darkened and brownish. (Of a white margin to the costa, of which Treitschke speaks, I can see nothing.) In the disc before the middle a brown short longitudinal dash. In front of the fissure, and separated from it by whitish scales, lies, in a dark ground, a pair of dark brown dots, one just above the other. The base of the upper lobe is very pale, scaled with whitish, and marked on the costa by a white longitudinal line, not present in *P. mictodactylus*; beyond this the ground colour becomes abruptly dark, and remains so up to the outer margin, except that it is scaled with white in the neighbourhood of this, and at some distance from this there is a fine whitish transverse line (as in *P. mictodactylus* var. *b*); before the line near to the fissure lies a thick black-brown longitudinal dash. The less dark lower lobe has two long, faint, blackish-brown longitudinal dashes. The margins of both lobes, as well as the inner margin of the wing, are bordered by a fine black-brown line of scales which brings the fissure into strong contrast. The fringes of the same are whitish, those at the base of the fissure blackish; the apex of the upper lobe is edged by still purer white fringes; those at the apex of the lower lobe are only whitish, the remainder more or less dark grey, on the inner margin with fawn-coloured scaling at their bases. Hindwings brownish-grey; the plumules, especially the first, a little more obtuse than in *P. mictodactylus*, and darker margined in the fringes at the apex. Underside pale yellowish grey-brown; the forewings with whitish scales towards the very strikingly brown-bordered outer margin; on the costa of the upper lobe lies a short, quite white, longitudinal dash; the transverse line is curtailed in front, and fainter than on the upperside. The fringes much the same as on the upperside. The first plumule very pale fawn-yellow, with scattered brown scaling."

He then adds: "Herr Fischer v. Röslerstamm and Herr Mann met with imagines on July 22nd, 1840, at the foot of the Schneeberg, not rarely, but considered them as rather yellowish-brown specimens of *mictodactylus*, and only collected two examples for comparison." In 1843 (*Stett. Ent. Ztg.*, iv., p. 150), Zeller enumerates it among his captures in the Styrian Alps. In 1852, stating that it was taken on the Sömmering on July 7th-8th, 1842, he redescribed the species (*Linn. Ent.*, vi., p. 370) as :

"Alis anterioribus ochraceo-fuscescentibus, dorso fissura plagaque laciniæ anterioris gilvescentibus, striola media, puncto gemino ante fissuram lituraque laciniæ anterioris fuscis, ciliis circa apicem albis ; ciliis digiti tertii breviusculis (♂ ♀). This species is to be separated from *mictodactylus* and *plagiodactylus*, the most similar species, by the somewhat shorter lobes of the forewings, the black pair of fissural spots being separated by a yellowish space from the fissure, the pale yellowish space at the base of the upper lobe, the white fringes around the apex of the same, etc. The fringes also of the inner margin of the lower lobe are white round the apex ; near their bases they are cut by a brown line, which contains a black spot at the apex of the lobe."

Zeller places this species between *plagiodactylus* (F.-R.), Stainton, and *fuscus*, Retz. In 1855, Herrich-Schäffer described the species (*Sys. Bearb.*, v., p. 377) in his group in which the "fringes close to the base have a sharp, brown, uninterrupted dividing-line." He describes the species as :

"Greyish-red or fawn-colour. The following are black-brown ; a dot in the central longitudinal line of the forewings, two in front of the fissure, of which the first one extends in an evanescent manner to the costa, a longitudinal stripe on the upper lobe divided obliquely by a white dash, or margined outwardly, a white longitudinal dash on costa beyond two-thirds. The terminal half of the fringes of the upper lobe wholly snow-white, those of the lower lobe towards its apex. Hindwings coppery. Examples in F.-R. collection."

In 1856, Frey quoted (*Tin. Pteroph. Schweiz*, p. 413) Zeller's Latin diagnosis from the *Linn. Entomologica*, of 1852, adds "$9\frac{1}{2}'''$-$9'''$" and records it for "Switzerland (Zürich district)." Freyer, in 1858, notes (*Neuere Beit.*, vii., pp. 175-6) that he had not previously described and figured the insect himself (although Treitschke had done so from his notes and specimens captured by him) but that, having found larvæ in early May, 1857, near Augsburg, on *Gentiana verna*, of various ages, he now supplied the omission. He then writes of the larva : "Up to the time it is fullfed it remains in the calyx of the flower, feeding principally on the seed-capsules, and is rarely found in fresh blooms, faded flowers being those usually affected, a habit that greatly facilitates its discovery*." The imagines bred from these larvæ are described as being .—

"Very near to *mictodactyla*. Head and thorax ashy-grey ; the forewings more grey-brown, with four bright grey nervures chequered with brown. The fringes at the apices of the forewing are white in the upper, and brown in the lower, part of the fissure, whilst before them are brown streaks and dots. At the end of the cleft, which is fringed with white, are two black-brown dots, which, with the brown dots, form a lunule, the ends of which run along the veins towards the base, and join a distinct brown spot in the first third of the forewing ; in the upper lobe is an elongate liver-coloured spot, above and beyond which the costa is dusted with white. The hindwings are unicolorous fawn-colour, with fringes of the same hue. The whole of the underside is fawn-colour, with only the fringes at the apex white, as on the upperside. The abdomen is grey-brown, with white lines, and with two brown spots on each segment."

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* After this was written, Frey reported (*Lep. der Schweiz*, p. 430) *coprodactyla* larvæ as feeding in flowers of *Gentiana verna*, and Hofmann independently did the same (*Die Deutsch. Pteroph.*, p. 89). It is, therefore, possible that Freyer's description really did not belong to the species he captured at Tegernsee in 1828, in *Gentiana lutea*, and which Treitschke named *graphodactyla*. Certainly, the larval habits remind one much of *pneumonanthes*, and *graphodactyla*, as well as *coprodactyla*, may feed in *G. verna*.

In 1876, the species was further described by Heinemann and Wocke (*Schmett. Deutsch.*, p. 797) as having :—

"Forewings brownish yellow-grey, dusted with white, on the inner margin and around the cleft lighter yellowish ; a tiny median streak ; a transverse spot, or a pair of dots, just before the cleft, and a longitudinal streak in the upper lobe dark brown ; behind the last is a white oblique transverse line ; fringes around the apices of both lobes white. 4½-5 lin. The species is nearest to *plagiodactylus*, but differs by the stumpier forewings and shorter lobes. The spot at the cleft is separated from the latter by a yellowish space, and generally consists of two dots standing perpendicularly above one another. The longitudinal spot of the upper lobe only reaches to the pure white, strongly marked, transverse line ; beyond this the lobe is yellow-brown, strongly dusted with white. The fringes of the costa white above the spot at end of cleft, brown above the longitudinal streak of the upper lobe ; the outer marginal fringes of this lobe white, with a dark brown border ; the fringes of the cleft white, on the inner angle of the upper lobe, and at the apex of the lower lobe brownish ; the hindmarginal fringes of the latter at the base and anal angle yellowish, at the apex white, also with brown basal line, without prominent spots ; fringes of inner margin pale yellow."

Two years later (1878), Zeller referred certain north German specimens to this species (*Stett. Ent. Ztg.*, p. 164), whilst, in 1880, Frey appears to have described (*Lep. der Schweiz*, p. 430) the species under two names, *viz.*, the type or mountain form as *plagiodactylus*, Sta., and the lowland form as *graphodactylus*, unless, indeed, all his references to the former, except that of "Zürich," are not to the true scabious-feeding *plagiodactylus*. In the "Frey coll." the specimens under both names are all apparently *pneumonanthes*. In the same year, Büttner describes (*Stett. Ent. Ztg.*, p. 472) the north German form under the name of *plagiodactylus*, or *pneumonanthes*, n.sp. Snellen also appears to have dealt with *graphodactyla* var. *pneumonanthes*, under the name of *plagiodactylus*, Sta. (*De Vlind.*, ii., pt. 2, p. 1037), as also did Snellen van Vollenhoven, in *Sepp's Ned. Ins.*, 2nd series, vol. iv., pp. 188 *et seq.*, pl. xxxiv., figs. 1-13, where he gives a first-class account and figures of the species under the latter name. Hering insisted (*Stett. Ent. Ztg.*, 1891, pp. 225-6 ; 1893, pp. 117-120) on the application of the name *plagiodactylus*, Sta., to the north German form. He says (*Stett. Ent. Ztg.*, 1891, pp. 225-6) that "Büttner has queried as a new species, *pneumonanthes*, Schleich, for the simple reason that Snellen (*De Vlind.*, p. 1038) has pointed out that there is not yet agreement among authors with regard to the specific characters of *graphodactylus*, Sorhagen calling the form, from *Gentiana pneumonanthe*, *graphodactylus*, Tr., whilst Büttner calls it *plagiodactylus*." He adds that he sent specimens (captured in August, 1888, at Finkenkrug) to Stainton and Wocke ; the former, he says, declared them to be his *plagiodactylus*, the latter *graphodactylus*. He goes on to state that he considers the north German examples specifically distinct from *graphodactylus* that he has received from Switzerland and Austria, to which two examples from Lombardy, sent by Turati, come nearest. He then adds that "Snellen says (*De Vlind.*, p. 1038) that, in his opinion, 'the *plagiodactylus* of Zeller, Frey, and Wocke, all belong to *graphodactylus*, Tr., or are mixed up therewith.' Snellen adds that 'one cannot describe the forewings of *plagiodactylus*, Sta., as brown. They are coloured almost like *coprodactylus*, Sta., but of a darker tint.' Büttner says (in a footnote): 'It appears to me that *graphodactyla*, Tr., and *plagiodactylus*, Sta. (*i.e.*, var. *pneumonanthes*), are not specifically distinct, but that the latter is a blue-grey variety of the former. The difference, quoted by

Wocke, of the darker base to the fringes of the outer margin, is not constant, and certainly does not denote a differentiation of species.' " In 1893, Hering gave (*Stett. Ent. Ztg.*, pp. 117-120) further details, and described at length the larva found on *Gentiana pneumonanthe.* In 1895, Hofmann had no hesitation in referring the lowland form, *pneumonanthes*, as a variety to the mountain form, *graphodactyla*, Tr. In Staudinger and Rebel's *Catalog*, 1901, 3rd ed., p. 77, the mountain and lowland forms are treated as distinct species, the former from the "Alps, Galicia, and Hungary," the latter from "north Germany, Holland, and ? England." At this time the notion of "England" being a locality was based on the records of true scabious-feeding *plagiodactylus*, the gentian species not being discovered in this country till August, 1906.

Variation.—Herrich-Schäffer notes (*Sys. Bearb.*, v., p. 377) that examples, taken in the Zürich district by Frey, are smaller than those from the Schneeberg, the Sömmering, etc. In 1878, Zeller referred (*Stett. Ent. Ztg.*, p. 164) the north German examples to this species. He says: "On account of a ♂ taken by Dr. Schleich on July 4th, on the island of Wollin, and four ♂ s and two ♀ s which Mr. G. Stange captured from among several specimens seen in the meadows near Spandau, June 24th and 29th, I must consider this species as one also indigenous to north Germany, if it does not possess a specific distinction in that the white transverse line of the upper lobe is also continued on the lower lobe, although it does not touch either of the adjacent margins. The two brown spots are separated from the fissure by a pale space. Perhaps *Gentiana pneumonanthe* is the foodplant in our district." Hering observes (*Stett. Ent. Ztg.*, 1891, pp. 225-6) that "the *graphodactyla* from Switzerland and Austria appear to be specifically different from examples from the north of Germany, to which two examples received from Turati, and taken in Lombardy, approach the nearest." The series of fine somewhat large specimens of this species in the "Frey collection," under the name of "*plagiodactylus*," and taken near Zürich, are exceedingly well-marked, of a pale brownish colour, tinged with darker fuscous-brown, strongly sprinkled with black scales along the nervures and costa, the lobal line and transverse lunule (running through the termination of the cleft) white; the outer-marginal half of the lobes very thickly sprinkled with white scales; the apical and outer-marginal fringes of the lobes pure snowy-white, becoming grey at the anal angle of the lower lobe and along the inner margin; the costa and median area longitudinally white-scaled; a small, linear, black, median dot; a distinct, double, black dot, often united, and often with an inner branch towards the centre of the wing, just inside the termination of cleft; a very conspicuous linear spot in the transverse band of the upper lobe; a narrow, black, outer-marginal line passing between the outer white area and the white fringes of the upper lobe. Hindwings very dark grey-brown, fringes a shade paler than the lunules, markedly paler basally. The specimens in the "Frey collection" labelled "*graphodactylus*" from Zürich, are somewhat smaller, less markedly contrasting between the dark and paler tints, more uniformly greyish-fuscous, the white parts less strongly marked and scaled, the black markings in "*plagiodactylus*" are, in this, only a darker shade of fuscous-brown, and scarcely, if at all, distinguishable from the ground-colour; the fringes of the forewings and the character of the hindwings as in the preceding. One from

Bremgarten, is of the more contrasting tints of "*plagiodactylus*," but without the black marks in the forewings; two others, from the same locality, being very unicolorous. Two from Breslau (Wocke) are remarkably well-marked with white, the ground-colour much lighter, and only the dark dots and streaks of the forewings conspicuous in a fuscous-brown tint. Four examples from Hanover (Glitz) are uniformly whitish-grey, with little brown or fuscous shading; one with only the upper lobal streak and cleft dots faintly marked; the three others with these characters distinctly marked (Tutt, October, 1906). In a long series of the var. *pneumonanthes* examined, taken at Finkenkrug, there is the slightest possible difference in size and markings between the first and second broods. We have before us eleven specimens (nine ♂ s and two ♀ s), takeu June 7th, 1906, and twenty (ten ♂ s and ten ♀ s) taken towards the end of July, 1906, by Dadd. The excess of ♂ s in the first, and of ♀ s in the second, batch, makes the former appear rather larger and more uniformly marked, the latter rather smaller and more contrastingly marked, but actual measurement shows very little difference in size, all the ♀ s being 20mm.-21mm. (except one about 23mm.), whilst the ♂ s vary from 21mm.-23mm. (except one of the early brood which is just 24mm. Comparing two British specimens, ♂ and ♀, loaned by Mathew, one finds that, in tint and markings, they are exactly similar to specimens of the second brood taken by Dadd, at Finkenkrug. The ♀ is smaller and rather better marked than the ♂, but the size of both is somewhat below that of the German specimens, the ♂ being 19·5mm., the ♀ 17·5mm., about 2mm. each less than the smallest examples of the corresponding sex in Dadd's consignment. The proportions of the three colours of which the forewing may be said to be made up, *viz.*, the grey (or whitish) ground colour, the blackish sprinkled costa, and the brownish inner margin, leads to considerable difference in the appearance of individual specimens. In some the whole of the wing-area is essentially grey, the usually dark costa and brownish inner margin being practically obsolete, the dark shade (including the little streak) of the upper lobe, the costal triangle (including the fissural dots), and the white transverse lobal and fissural lines sometimes distinctly marked, but usually only moderately so, making the whole wing-area particularly unicolorous in appearance. This is almost entirely a ♂ form. The second form has the brownish colour of the inner margin spread over the whole of the median area of the wing, occasionally reaching almost to the costa; the grey ground colour is here reduced to the costal and outer lobal areas, and the wing itself has a general brownish or fawn-coloured hue. The normally dark costal and lobal markings are usually ill-developed, but sometimes clearly and distinctly marked; this also is usually a ♂ form. The most striking form is one in which the black scaling of the costa spreads downwards into the middle of the wing absorbing the usual dark markings, and thus making a very conspicuous triangular patch, as in the Platyptiliids and Amblyptiliids; in addition, the transverse white lobal and fissural markings are very distinct, and the snow-white costal tip and outer marginal fringe, contrast against the dark marginal outer edge of the wing. This dark, contrastingly marked, form is usually ♀. Both sexes differ in the distinctness of the discal spot, which, in some, is quite conspicuous, and in others absent, with almost every intermediate form usually, however, present. Similarly there is considerable difference in the conspicuousness of the fissural dots, although both are almost always present and usually separate. The lineola in the upper lobe is apparently always present, but the amount of dark shading that surrounds it varies very considerably. The following are Buttner's original description and Hering and Hofmann's notes on the life-history of :—

a. var. *pneumonanthes* [Schleich], Büttn., "Stett. Ent. Ztg.," p. 472 (1880); Hofm., "Deutsch. Pter.," p. 87 (1895); Staud. and Reb., "Cat.," 3rd ed., p. 77 (1901); Mathew, "Ent. Rec.," xviii., p. 245 (1906). *Plagiodactylus*, Snell., "De Vlind.," ii., pt. 2, p. 1037 (*in part*) (1882); Hering, "Stett. Ent. Ztg.," p. 225 (1891); p. 117 (1893).—*Mimaeseoptilus plagiodactylus* an nov. sp. *pneumonanthes*, Schl. (?).—As large as the smaller (examples) of *plagiodactylus*, and otherwise similar to them, but separated by the black spot, not reaching up to the fissure, but divided from it sharply by a pale, even if narrow, space, and by the sharp whitish transverse line. This commences, as sometimes in *plagiodactylus*, on the costa, and terminates at the inner margin of the upper lobe; it has, however, on the lower lobe, a continuation consisting of two very distinct whitish spots (only in one ♀ is this indistinct). Schleich took several examples near Misdroy, in July, in a swampy meadow on the western shore of the Vietziger See, where *Gentiana pneumonanthe* grew. In similar situations also, with *Gentiana*, six examples (one ♀ included) were caught in the last third of June, near Spandau (Büttner). Larva: The fullgrown larva is 9mm.-11mm. long, pale yellow-brown, with a more yellowish dorsal vessel distinctly showing through the skin. Head and anal segment are pale leather-colour, the mouth-parts darker brown, the thoracic legs still paler than the head, and, like the anal claspers, pale leather-coloured; the ventral prolegs of the ground colour of the body, the crochets of the same, scarcely noticeably darker than the thoracic legs. Dorsal line sharply contrasted, intense green, accompanied, on each side, by a pale yellow longitudinal line, straight and broad; immediately below this runs a finer waved line, and just above the legs another, with somewhat lesser undulations, likewise pale yellow, and running parallel with the upper. The whole larva is beset regularly with short, stiff, dark-coloured hairs; they are somewhat longer on the dorsum than on the sides of the larva (Hering, *Stett. Ent. Ztg.*, 1893, p. 118). Habits of larva: It lives, in the middle of July, in the blossoms of *Gentiana pneumonanthe*, which only betray the presence of the larva by the slightly discoloured, spotted, exterior, and eats out the disc deep into the stalk. Many larvæ bore from the outside into the blossoms through large holes, and seem to change often from one flower to another. Pupation takes place in the usual manner. Pupa: The pupa is, at first, pale yellow-green, and becomes gradually darker on the dorsum, dark violet-brown, on the venter and on the wingcases more purely dark brown, that is, sepia-colour. The coloration appears to be very variable. In shape it is closest to that of *S. pelidnodactyla* and *serotina*. Time of appearance: The imago develops as early as the end of July, after only 10 days' rest in the pupa, and flies up to the end of August; probably there is also a spring brood, anyhow, Stange took some, already very worn, examples on June 24th. Distribution: *S.* var. *pneumonanthes* occurs near Berlin (Finkenkrug), Spandau, Stettin, on the island of Misdroy, also near Breslau, Hanover, and near Karlsruhe (Reutti) (Hofmann).

Hofmann notes (*Deutsch. Pteroph.*, pp. 87-88): "Forewings 8mm.-11mm. It is distinguished from the type by the much purer grey ground colour, while in the latter the brown predominates, and by the less contrast to the rest of the wing of the inner margin, that being only somewhat paler (not yellowish or whitish). The discoidal spot is rarely distinct. The fissural dots are, as in the type, often partly obliterated, or united, or form a transverse streak, the upper one often quite absent; the pale yellow-brown space between the fissural dots and the fissure, as well as the pale space at the base of the upper lobe, is absent. The black longitudinal streaks in the lobes are rarely well expressed, usually both in the upper and lower lobes, they are very indistinct or quite absent. The white, oblique, transverse line of the upper lobe runs on one side into the fringes of the costa, and is continued usually in two very distinct white spots on the lower lobe, while, in the type, these spots on the lower lobe only occur very rarely. The outer marginal fringes of the lobes have, as in the type, a connected dark brown basal line, which, however, is sometimes on the upper lobe, more rarely, also, on the lower lobe, cut through once or twice with pale colour, or is much fainter in places." He adds that "this variety seems up to the present to have been but little noticed, and that it, therefore, probably has a wider area of distribution than is at present suspected."

Comparison with allied species.—Although Chapman notes (*in litt.*) that there is very little difference in the genitalia of *A. zophodactylus*, *A. coprodactylus*, and *A.* var. *pneumonanthe*, yet to us the imaginal facies of these insects seem entirely different (*see* pls. ii. and iii., *anteà* p. 317). *A. graphodactyla* var. *pneumonanthes* is, in the outline of the forewing, especially the apex and outer-margin, the character of its dark markings, and the transverse lobal lines, peculiarly Platyptiliid, and very different from its more slender and pointed-winged allies, and one suspects that Hofmann is not really far wrong in his separation of this from the allied grey Stenoptiliid species. The nearest ally to this species is, Chapman thinks, *A. coprodactylus*. So near is it that Chapman is inclined to consider the two insects to have scarcely reached specific rank. He writes (*in litt.*): "*Adkinia graphodactyla* is probably very closely allied to *Adkinia zophodactylus*, although each falls into a different one of the two divisions, that Hofmann makes of the genus, founded on the absence of the pale space separating the double spot from the division of the forewing. That this distinction is of no great validity is obvious from the circumstance that, of two of Mr. Mathew's specimens before me, one has, on one side, the dark fringe at the bottom of the cleft connected by black scales with the spots, whilst of two *A. coprodactylus* taken at random from those I have secured abroad, one from Fusio has a large black patch at the cleft containing some white scales in a little line, which is all that is left to represent the white band separating the two dots from the cleft." He then adds: "My own belief is, that all the gentian-feeding Stenoptilias are one species, divided into many races (usually distinguishable) according to habitat and foodplant. Of these it may be admitted that *zophodactylus* has reached, or almost reached, specific rank; *pneumonanthes*, also, is a rather distinct form, with a definite foodplant, *Gentiana pneumonanthe*. The gigantic (29mm.) brilliantly-marked form of *coprodactylus* (?), reared from larvæ found on *Gentiana lutea*, at Larche, is equally deserving of subspecific rank (an ordinary form of *A. coprodactylus*, which must feed on *Gentiana verna* or *G. acaulis*, is common in the same locality, and probably not syngamic with it); the ordinary form of *coprodactylus* is usually distinguishable easily, but varies in many features towards *graphodactyla*." Chapman finally notes: "The question, of course, of what is a species, arises. In this case, I only mean to suggest that these are all very close together, closer than we usually allow distinct species to be." As noted above we consider these insects to be specifically distinct.

Habits of larva.—Hofmann says (*Deutsch. Pteroph.*, p. 86) that "the larva of *S. graphodactyla* lives, according to Treitschke and Frey, on *Gentiana lutea*, in June, in spun-together leaves," and states that he himself found the larva formerly in the Allgäu, in spun-together shoots of *Gentiana asclepiadea*, but, unfortunately, did not at that time make any description. In August, 1895, he says, he found its traces commonly on the above-named plant, near Urfeld, on the Walchensee, in situations where the imago was still flying, but the larval webs were either all empty, or occupied by the yellow cocoons of a *Microgaster*. The description of the larva of Freyer (*Neuere Beiträge*, vii., p. 176) as being found at the commencement of May on *Gentiana verna*, he considers, "may equally well belong to *coprodactyla*." One is not quite clear as to this paragraph, for reference to Treitschke's original account (*anteà*, pp. 515-516) shows that it was Freyer himself who gave the latter the information that he found, near Tegernsee, the larvæ of *graphodactyla*, living in spun-together leaves of *Gentiana lutea*, ten to fifteen examples in one head, and it was from imagines bred from these larvæ that the species was named. In this he is followed by Frey (*Die Tin. Pter. Schweiz*, p. 413), but, at the same time, Frey, evidently from first-hand knowledge, also described the larva, under the name of *plagiodactylus* (*op. cit.*, p. 412), that feeds in May and June in the spun-together leaves of *Gentiana asclepiadea*, as belonging to this species. He says that the larva draws together the topmost leaves into a large globular mass, so that affected plants are somewhat conspicuous. These larvæ are green, with dark mediodorsal line, covered with dark long stiff bristles, thickest at the sides, where also are some whitish ones; the legs green. Later, in May, 1860, Freyer found larvæ at Deuringen, near Augsburg, in the flowers of the little spring gentian (*Gentiana verna*), that he thought were the same as those he had found in June, 1828, on *Gentiana lutea*. Zeller remarked (*Isis*, 1841, p. 841) that the larvæ appeared to live on *Gentiana lutea* much in the same way as *Pterophorus hieracii* lives on its foodplant (*Hieracium laevigatum*). These various notes of habits of larvæ feeding on *Gentiana lutea* (Freyer, Frey, and Zeller), *G. verna* (Freyer), and *G. asclepiadea* (Frey and Hofmann), are somewhat puzzling. The foodplant of *coprodactylus* is *G. verna*, of *graphodactyla* (the first reared) is *G. lutea*, of var. *pneumonanthes* is *G. pneumonanthe*, and one is a little puzzled as to these insects (see Chapman's remarks on the imagines, *anteà*, p. 523), although we have no trouble whatever in discriminating *coprodactylus* and *pneumonanthes*. Of the larvæ of the latter insect, which is fairly abundant in north Germany and Holland, and which has been taken in Switzerland and England on *G. pneumonanthe*, there are many notes. Thus Chapman writes: "I received from Mr. Gillmer (November 1st, 1906) a parcel of shoots of *Gentiana pneumonanthe*; the majority of these were about three to six inches long, green and leafy for their upper half, and, like a similar lot examined some ten days ago, not one of these leafy examples afforded a larva. In two only were traces that might have been those of "plume" larvæ found; in both of these the mines ended on the lower cut end, so that the larva had either escaped after the shoot was cut, or was left behind in the root-portion. One portion, however, was cut much lower than the others, and consisted of several shoots attached to a portion of upper root-stock; all the others were separate. One of these shoots was about an inch and an eighth long (29mm.), tender and succulent throughout, and with only a faint trace of green on the unopened leaf-bud at the top. The older shoots were often very woody. In this little shoot was a mark of entry about 8mm. from the top, thence a burrow descended in nearly the middle of the shoot for 16mm., and at the lower end was a larva, head downwards, and possibly continuing the burrow; that it was not doing so, but had taken up its winter-quarters, might be concluded from the way in which its cavity was rounded out at both ends, no silk, however, being found, and especially by some little discoloration at the head-end, of a brownish tint like that of some of the upper part of the burrow, and suggesting that it had not been touched by eating, or otherwise, for an appreciable time. Apart from the presence of the burrow, the shoot seemed healthy and uninjured, and one would have expected it to shoot up next spring about as well as if nothing had happened to it." Later (November 19th) he writes: "I have examined ten more plants of *Gentiana pneumonanthe*, sent by Mr. Gillmer, and found six larvæ. Of these one was in a rather older shoot, *i.e.*, about three inches long, with some leaves at the top, rather a slender shoot, but it had bored a considerable burrow, about a quarter of an inch on one side of the shoot, and nearly as much on the other (if both done by the same larva). This larva was in the first instar. The other five were all in the second instar, and were all in central shoots without leaves, and very little green at the top. In the case of two of these, a neighbouring older, but still small and young, shoot, contained an empty burrow. This seems to imply that the young larva, if the shoot it begins with during its first instar is at all old, *i.e.*, has leaves at the top, quits it and enters a younger, more central, shoot. All the shoots with these larvæ in them were found to have a mark of entry, in one or two cases this seemed too large and recent to have been made by a newly-hatched larva, but since such mark alters in size, etc., as the plant grows, this must be regarded as a matter of rather vague opinion. A stronger point is that these mines were shorter, but wider, than the empty ones in the older shoots, and seemed all to have been made by a second instar larva. The plant appears to have a more or less perennial root, and has the bases of the stems of the season of various sizes, a good many quite young, with leaves at the top, five or six inches (possibly shoots sent up after autumn mowing?). All the shoots seem to come from a central head, of which a root may have more than one, and, up to nearly an inch long, or rarely more, each shoot is within a sheath, and the younger shoots, each in its own sheath, are included with it. In one case, the larva was found in a shoot still within its sheath, and it had not only penetrated this sheath to reach the shoot, but also the sheath exterior to this proper one, *i.e.*, the sheath of the next older shoot. I suspected it of having penetrated a still exterior sheath, being so far down in the heart of the plant, but I had already damaged the plant too much to be able to settle this point" (*in litt.*). So much for the autumn and winter larvæ of the early brood. Of the larvæ of the second brood Hering observes (*Stett. Ent. Ztg.*, 1893, pp. 117-120) that, near Finkenkrug, on July 15th, 1893, he examined carefully the flowers of *Gentiana pneumonanthe*, and "soon found four amongst them, which differed from the sound ones by a slight spotted appearance; on opening the closed blooms, they were found to contain several small light-green larvæ, which had eaten away the base of the fruits, and were more or less deeply hidden in the upper part of the stem; their presence was betrayed by the frass. Another caterpillar, a very young one, must have been hidden in one of the blooms taken home as food. During their confinement the larvæ bored into the blossoms, which were not before attacked, from the outside, making quite conspicuous holes, in fact, they ate freely, and moved from one bloom to another; on July 19th four of the larger ones pupated." Mrs. Mathew discovered the larvæ in Britain, in the middle of August, 1906, near Wimborne, Dorset. Her husband notes (*Ent. Rec.*, xviii., p. 245) that "she collects plants, and, among a number of specimens she was drying, that had been obtained near Wimborne, was a head of marsh gentian, containing several flowers. After they had been pressing for several days, under a considerable weight, she examined them to see if they required placing between dry sheets, and was not best pleased to discover that some of the flowers had been much eaten by a couple of little larvæ, which looked none the worse for having been subjected to such pressure. She brought them to me as she thought they might be something good, as they were feeding upon rather an uncommon plant, and I at once saw they were the larvæ of some kind of 'plume.' . . . . This was about the middle of August, and these two larvæ were then nearly fullgrown. . . . . The larvæ, later, appeared to be rare, for, after several days' careful search among the gentian, which itself was by no means plentiful, I could only find about a dozen, and two or three more were found among the drying plants." Chapman notes (*in litt.*): "It is rather remarkable that Mrs. Mathew's method of discovering the species in Britain seems to be a very usual way of meeting with it elsewhere. Two years ago Mr. Wheeler sent me living pupæ (which emerged on the way), which he discovered on stems of a bunch of marsh gentian placed in water. This year Mr. Sich gave me the remains of a male found in a similar way, and these three are, as it happens, the only sources of my pupa-cases of the *pneumonanthes* var. of *A. graphodactyla*. These, and other pupæ of *graphodactyla*, show that, though the larva is apparently well hidden in the somewhat folded-up flowers of the gentian, it leaves them for pupation, but does not travel far, no doubt naturally fixing itself up on the stem of the plant on which it has fed." Dadd notes (*in litt.*): "Larvæ were found feeding on the flowers and seed-vessels of *Gentiana cruciata*.* The large blue flowers of this plant are fairly common at Finkenkrug, and round holes bored in the bells first drew my attention to the larvæ, which I at first expected to find to be an *Eupithecia*. They devour principally the stamens and seed-pods, apparently never touching the bell except when entering or leaving a flower. When fullfed they emerge, and, selecting a spot either on the outside of a flower or a leaf of the foodplant, spin a slight web of white silk, and change to a pupa in the course of two or three days." Crombrugghe de Picquendaele notes the larvæ in great numbers at Heide; he says that they live in the flowers of *Gentiana pneumonanthe*, and are adult at the commencement of July. He adds that he once found a larva as late

* Finkenkrug is the place where Hering found larvæ on what he called *Gentiana pneumonanthe*, no doubt the same locality as that worked by Dadd, whilst Stange found the larvæ at Finkenkrug and Spandau on *G. pneumonanthe*, so one is inclined to suggest that the "two" foodplants here noted are really the same species. Of course there is no reason why the larva must be confined to one species of gentian only; one would suppose it would eat any species; still most of the authorities seem to suggest that the various species of *Adkinia* have specialised to certain species of gentian.

as August 11th, 1905, and that, probably, also, there is an early brood of larvæ which are fullgrown in May. Gillmer observes (*in litt.*) that he obtained larvæ in abundance on the Wörnitz (Mosigkauer Haide), in Anhalt; he collected the flower-heads, leaves, and stems of *Gentiana pneumonanthe* on July 14th, 1906, for eggs of *Lycaena alcon*, which were abundant thereon; the larvæ were quite hidden in the flowers which they perforated, leaving the flowers, when fullfed, over the period from July 16th until early August. Wheeler found larvæ towards the end of August, 1902, at Bouveret, feeding on the flowers of the same plant, usually, though by no means exclusively, inside them. In Hanover, the larvæ are to be found in the flowers of *Gentiana pneumonanthe* in July (Glitz), similarly in Silesia (Wocke), whilst Sorhagen says that the larvæ are to be found, in Brandenburg, in the beginning of May, and again in July, in the flowers and in the seed-capsules of *Gentiana verna*,* *G. lutea*, and *G. pneumonanthe*. Kaltenbach appears simply to copy Frey, for he says that the larvæ of *plagiodactylus* (=*pneumonanthes*) feed upon *Gentiana asclepiadea* in May and June, the larva drawing together the summit-leaves of the plant into a considerable bunch, with silken threads, so that the plants affected by the larvæ easily catch the eye. Hartmann, Steudel and Hofmann, and other authors also, only copy this statement.

Larva (*pneumonanthes*).—*First instar:* The first stage larva is 1·7mm. to 2·3mm. long, according to extension; the head is nearly black; the thoracic plate and anal plate conspicuously dark; the rest of the larva, including the hairs, spiracles, etc., is white or transparently colourless; most of the tubercles, however, show a dark point. There are a few very short hairs on the head. The prothoracic plate has three hairs (on each side) in front, the middle the shortest, a large central one in back row, inner one small and well forward; one at outer posterior angle wanting or too small to be detected; three hairs on prespiracular, lower one very long (0.12mm.), posterior one quite minute (0.01mm. or less); on meso- and metathorax four pairs of hairs, the second of first pair 0·18mm. long, first 0·8mm.; of second pair, first nearly 0·2mm., second 0·04mm.; of the third, first 0·1mm., second 0·03mm.; lower pair 0·5mm. On the abdomen the hair on tubercle i is rather stouter than that on ii, but those of i, ii, and iii, all about 0·1mm. long; i and ii widely apart, iv and v level, very close together, the posterior about 0·1mm., the front one about 0·3mm. long; there are two very long hairs on the 9th abdominal (ii and v ?), and another on the anal plate (0·16mm.), there are six or seven altogether on each side of the anal plate; no hair representing tubercle vi is present, and I cannot discover vii. Prolegs on cylindrical props about 0·05mm. high and with four hooks, claspers seven. The skin-surface is generally quite smooth, but, over the lateral region of the prothorax, and on the sides of the meso- and metathorax, there is a sparse coating of very fine sharp spicules; these recur again in the anal region; here and there in the intermediate region near the spiracles are some skin-points in the form of small transparent nodules (November 19th, 1906). *Second instar* (hybernating stage): The little larva

* This is the foodplant of *S. coprodactylus* (*teste* Frey, *Lep. der Schweiz*, p. 430); probably, therefore, it was copied from Freyer (*Neuere Beiträge*, vii., pp. 175-6).

is nearly 3mm. long, white, with brownish-grey head and anal plate, and small fuscous plates to the tubercles. The hairs are rather long and dark. Seen from above, the hairs of tubercles iv and v are conspicuous, the posterior (iv) about 0·25mm. long, directed slightly backwards, the front (v) a little forward, about 0·1mm.; that on tubercle i is about 0·11mm. long, on ii 0·3mm., and their bases are well apart; the hair on iii is about 0·2mm. All these have brownish-fuscous plates, and are themselves slightly dark-tinted, and continue thick to the extremity, without being actually swollen at the tip. The spiracles are also conspicuous dark circles. On the meso- and meta-thorax are the usual four pairs of hairs on each side; the first pair trapezoidal, on a common base, common rather by the extension of the bases than the approach of the hairs, which are well apart, and much like tubercles i and ii of the abdominal segments as to length. The second pair reversed trapezoidal, on a common base, the lower (front) hair the longer. The third pair has an extra (third) hair, all on separate bases, the accessory (upper posterior) the shortest. The fourth pair is near the legs, the lower (posterior) hair the longer; (0·2mm); these have separate bases. The prothoracic plate has the usual six hairs on each side. The end ones of the lower row and the middle of the upper being long ones, the others not half their length. The hairs on the last segment are long; two on each side of the 9th abdominal are 0·3mm., apparently representing tubercles ii and iv. The dark anal plate has three hairs on each side, and one very long one is just outside it, with shorter ones along the posterior margin of the segment and on the bases of the claspers. The prolegs carry seven or eight strong brown hooks, the anal claspers eight that are decidedly larger. On tubercle vi is a hair about 0·11mm. long at posterior margin of segment; the three hairs of vii are all strong for this tubercle, about 0·08mm., 0·09mm., and 0·12mm. long. There is a small hair internal to these, but I cannot find it on the segments with prolegs. The general surface is covered with fine, rounded, skin-points, apparently wanting along the posterior borders of the segments. The feature of the larva is the marked colour of the head, anal plate, spiracles, tubercular plates, and hairs. There is no trace of any sort of secondary hairs. The diameter of the head is about 0·45mm. [It is highly probable that it is fullgrown in the second instar. It is, with the highest probability, the larva of *S. graphodactyla* var. *pneumonanthes*. It was taken on the ground in the Wörnitz (Mosigkauer Haide), in Anhalt, where this species was abundant last July and August, but it may be some other gentian-feeder, or even *zophodactylus*] (Chapman). *Fullgrown larva:* Pale green, with a darker green dorsal line, below which is another dark subdorsal line, bordered on each side by a pale greenish-white line, the lower edge of which is rather indented; spiracles minute, white, in a black ring; the anal segments somewhat attenuated; the 2nd segment much smaller than the others; head pale yellowish-brown, clouded with darker reticulations; the whole surface covered with a pile of short pale brownish hairs, with longer ones in groups of two, three, or four, arranged along the sides and back. In some larvæ, the dorsal stripe is tinged with purple, and the general colour a yellowish-green (Mathew, August 25th, 1906). Length ½in. Colour grass-green. Head, anal claspers, and prolegs somewhat yellowish; the face is smooth, mottled with brown markings; eyes black. The whole body is covered with very short black bristles, these being, however, so small, as only to be observable with a lens. Besides these short bristles, which clothe the body, each tubercle is defined by a long brown hair, which is generally curved backwards. The spiracles are brown and somewhat prominent. There are slight indications of two dorsal and lateral stripes; they are, however, very faint, slightly paler than the ground-colour, and broken up at each segmental division (Dadd, July 20th, 1906). The fullgrown larva 10mm. long, green; head yellowish, mouth-parts red; four points inconspicuously marked on the first segment, of which the two median are almost obliterated; dorsal vessel inconspicuous; stigmata black; two lateral whitish streaks on each segment; valve yellowish; subdorsal whitish; hairs on back whitish, on sides black (Crombrugghe de Picquendaele). [Bluish-green in colour, with a dark dorsal line, whilst three white lines run below each other along the sides. Head paler with darker reddish dots. The dorsal area is pale red, and conspicuously cut by a darker red dorsal line in some examples, while at the side, centrally, a red line sometimes replaces a white one. The tiny larvæ are completely and thickly covered with fine hairs (Freyer, from larvæ found in early May, 1857, near Augsburg, on *Gentiana verna*).]

Pupation.—Larvæ found at Finkenkrug were fullfed on July 19th, 1893, when they surrounded themselves with a silken web, attached partly to the box in which they were confined, and partly to the leaves; in this web the larvæ pupated, the pupal stage lasting ten days. One larva was observed about 11 a.m., and, whilst being examined under a lens, movements of the front of the body towards the anal segment took place frequently; at 4 p.m. it hung from the silk web, and already showed, by the complete contraction of the body, the pupal form within, in particular, the more pointed character of the abdomen, the bent position of the head, the bulging pro- and mesothorax, and the more conspicuous dorsal vessel. The true legs reached forward as a support. The supporting pad of silk was most dense at the anal attachment. The larva remained in this position till late at night on the second day, but, by the morning, metamorphosis had taken place, and a light yellow-green pupa was there, which, however, changed colour before night. During metamorphosis the larva had curved itself so that the pupal dorsum had been turned towards the glass (on which the silken pad of the one examined was spun) instead of the venter, but this was only temporary, for, later, it was observed that the pupa was in its normal position, and so remained until emergence took place (Hering). The pupa is suspended by the anus, and further, by some bristles on the under surface of the 8th abdominal segment. These latter ensure the pupa a rigid position, so that, even if turned upside down, the pupæ remain erect. In one case, where I forcibly dislodged these bristles from their hold, the pupa always hung head downwards (Dadd). Gillmer says (*in litt.*): "The larvæ leave the flowers of *Gentiana pneumonanthe* when fullfed, and spin up on the leaves, stems of plants, or the walls of the breeding-cage in which they may be kept, suspending themselves vertically. The larvæ are green when fullfed, and the pupa also is at first green, with a purple-bordered wing-case; the pupa, however, gradually darkens as it matures, the colour becoming more and more reddish; the pupal stage lasts about fourteen days. Mathew observes that the larvæ he obtained at Wimborne were placed in a large glass-topped box with some flowers of gentian, into which they crawled, but, in a day or two, they came out, spun pads of silk on the glass, and, in about forty-eight hours, changed to pupæ, hanging head downwards. Chapman says that "the larvæ leave the flowers for pupation, but do not travel far, no doubt naturally fixing themselves on the stems of the plants on which they have fed, probably like *A. zophodactylus* in an inverted position quite near the flowers (this can, of course, as with *A. zophodactylus*, apply only to examples of the summer brood); nearly all my specimens are on bits of round stem, as the other species of the genus so frequently are, and those of *A. zophodactylus* are so commonly in this position, that we may call it almost the invariable rule in that species." [Freyer says: "When fullfed the larva leaves its hiding-place and takes up a position either on the stem of the foodplant, or on the stem of some other plant near, or on something on the ground, or a culm of grass, and on this fastens itself by the middle (?) and anus, and thus pupates." (This refers to the larvæ found feeding near Augsburg on *Gentiana verna*.)]

Foodplants.—*Gentiana lutea* (Freyer), [*G. verna* (Freyer),] *G. asclepiadea* (Frey, Hofmann), *G. pneumonanthe* (Zeller). [Frey notes (*Lep. der Schweiz*, p. 430) *Gentiana verna* as the foodplant of *coprodactylus*, *G. asclepiadea* as the foodplant of *plagiodactylus* (=*pneumonanthes*), and "gentians" generally for *graphodactyla*. There is little doubt that the *plagiodactylus* and *graphodactylus* of the "Frey coll." are, so far as his own captures are concerned, the first and second broods of the latter species. Sorhagen says (*Die Kleinschmett. Brandbg.*, pp. 4-5) the larvæ feed in the capsules of *Gentiana verna*, *G. lutea*, and *G. pneumonanthe*. This is probably obtained from Freyer, who recorded *graphodactyla* (*teste* Treitschke) from *G. lutea* at Bad Kreith, and from *G. verna* at Deuringen, near Augsburg.

Pupa.—The pupa of *graphodactyla* exhibits, in its form, no aberration from the type of the genus; it is pale yellowish-brown, darker on the wing-cases, and has, on the abdomen, several dark brown, faint, longitudinal lines, that is, one in the mediodorsal region, two on each side above, and one, very broad and darker, below the lateral flange (Hofmann). [The following descriptions, taken from a dead pupa and an empty case of *A.* var. *pneumonanthes* from Mr. Mathew, are, therefore, from authentic English material, but might, so far as I can tell, have been as satisfactorily made from *A. graphodactyla* or from English *A. zophodactylus*.] The empty pupal shell is about 11mm. long, the dead pupa about 8·5mm.; the latter is, however, obviously one that was a starveling, and the moth probably died inside it, instead of emerging, for some such reason. It is cylindrical, *i.e.*, not flattened in any way; a transverse section of, say, the 5th abdominal segment would be a circle. It is also very smooth, no hump, spines, or hairs (without considerable magnification) being present. It has a definite beak, the ventral line from the end of the free appendages being quite straight, and meeting the equally straight line of the front of the pupa at its point. This front line is only straight if taken in profile, the anterior ends of the dorsal flanges then filling up what is really a curve over the thoracic dorsum if the actual middle line be followed; the beak, when magnified under a hand lens, is seen to be really rounded, with no sharp point as in pupæ that have to break open a cocoon, etc. (as in Ægeriids for instance); still, the undersurface and front meet here, at an angle of about 85°. The thorax (at the middle of the mesothorax) is broader and higher than any other part of the pupa, but so slightly that it would be almost correct to say it is of the same width from here to the 3rd abdominal. There is, however, a slight tapering in this length, but no bulbousness of the thorax as in the pupæ of some Stenoptilias. The width at the 3rd abdominal segment is about 1·5mm., of the 4th abdominal segment (without appendages) hardly less, and it thence tapers slightly to the end of the 6th abdominal segment, and then more rapidly to the point of the cremastral spine. From the nose-spine to the end of the 3rd abdominal segment, to which the appendages are fixed, is 5mm.; beyond this, the free appendages (maxillæ and second and third tarsi) extend 2mm., and are accompanied by the special wing-tips for nearly half the distance. The first tarsi reach to the end of the 3rd abdominal segment (to the end of the wings, without tips); the antennæ 1·5mm. less. The maxillæ disappear beneath the first legs a little higher up, at 2·6mm. from their base, to reappear again in the free appendage-process. The first femora do not appear, and only the minutest, narrow, triangular piece of labium. The mandibles meet in the middle line for a short distance; the labrum is thus short and obtuse, but with a sharp point. There appears to be one (very minute) hair on the face; none are detected on the labrum or at the antennal bases. They may, however, be present, as, in these unmounted specimens, those on the eye-covers are quite invisible till got into profile. The eye-covers have two hairs of approximately the length already given; the covers are circular, apart from the flat edge against the antennæ, and have the eye-facets as fine points round the margin. The small prothoracic piece, tolerably closely attached to the mesothorax, is connected (on dehiscence) to the eye-piece by a long membrane, of which a slight fold may be the dorsal head-piece; the prothorax, membrane, and eye-piece (as in the dehisced pupa, not stretched out but bent and twisted) are about 0·65mm. in length, divided so that, of five parts, two are prothorax, two membrane, and one eye-piece. The prothoracic spiracle-cover (on mesothorax) is like those of others of the same genus, forming a little arched hood (longest in line of incision), beautifully ornamented with microscopic spicules or hairs, which differ a little in size and arrangement from one end of the cover to the other. The mesothorax opens by a dorsal suture on dehiscence; the metathorax remains undivided. The dorsal ridges hardly affect the prothorax, but cross the mesothorax, are rather wide apart and high in front (where they have already been alluded to as giving a straight outline to the front), lower and approximate, towards the metathorax. On the metathorax they begin a little further apart than they were at the posterior border of the mesothorax, and gradually get further apart till they terminate before the posterior border of the 3rd abdominal segment. They are low and rounded, but still quite pronounced. There is a slight hollow, placed dorsal to the wings, deepest at the 1st abdominal segment, where it would form a waist, but that it does not affect the dorsal line appreciably. The wings are rather polished, but show some of the neuration. In this, and in a good many other "plume" pupæ I have examined, the wings contain a large number of the imaginal scales, torn from the wing in emerging, so that the resulting moth, even when quite fresh, was by no means perfect. The hindwing extends to beyond the spiracle of the 2nd abdominal segment, and, though looking very narrow, being curled into the hollow, is really fairly wide, very nearly 0·2mm. at base, the forewing being about 0·8mm. The prothorax has two hairs, the mesothorax two pairs, the metathorax three, that might represent i, ii, and iii. The 1st abdominal segment has tubercle i on the ridge at the front margin of the segment, ii a long way back on ridge; the 2nd abdominal has i on ridge, about middle of segment, ii on ridge, 0·4mm. behind i, iii above spiracle. The 3rd abdominal segment has i and ii much closer together, iii above, and then iv + v below, spiracle. The following segments, 4, 5, 6, and 7, have these, and also vi, lower and towards posterior border of segment, and two hairs lower still, representing vii; the 8th has all the tubercles from i and ii down to vi, and there are several on the 9th abdominal. In this particular pupa, the dorsal hairs (i and ii) are 0·18mm. apart, on the 4th abdominal segment. All the hairs are very small, curved, and clubbed, as already noticed. The last segments, 8th, 9th, and 10th abdominals, are inclined to be flat beneath, and also carry ridges above, so that they are quadrangular in section; the upper surface narrower than the lower. The 8th abdominal segment is very narrow ventrally, and the flat surface reaches up to it. There is the usual group of cremastral hooks at each end of the surface, and the anal scar is rather prominent on it centrally. The front group of hooks consists of two portions, one on each genital eminence; each portion has about 40 hairs, each nearly 0·2mm. long, with a hook set back closely to the stem, and with but little terminal enlargement. The hairs of the anal patch are much more numerous, but their appearance is identical. On the dorsal aspects of the abdominal segments the sculpturing consists of about 18 or 20 ridges, running transversely, but not always all the way across. They are fairly straight, with no lateral ridges, and are quite smooth on the top, the circular pits, that thickly sculpture the spaces between, not reaching to their tops, and producing little or no irregularity on their flanks. Ventrally, there are similar ridges less marked, but more numerous (say 26 across a segment), and a little encroached on by the fine sculpturing, which here, especially in the middle line, and to the front of the segments, changes from pits to minute skin-spicules (Chapman). The pupa is about half-an-inch in length, is long and slender in build, and reminds one strongly of a butterfly pupa, particularly that of *Thais*. The head is very much depressed, the top of the thorax, the nosehorn, and the shoulders forming prominences, which cause the superficial resemblance to butterfly pupæ; the wing-cases are long and slender, the legs so long that they project quite an eighth of an inch beyond the tips of the wings; at the lower extremity (from the tips of the wings) they are free. The median abdominal segments seem to be all free, as, although, when undisturbed, the pupa remains rigid, it will twist violently sideways when interfered with. As before mentioned, a remarkable fact about this pupa is the presence of hooked bristles on the 8th abdominal segment, these enabling the pupa to maintain a rigid stretched position similar to that assumed by many Geometrid larvæ. Unfortunately, I have only a small magnifying glass (16 times), and could not examine them in detail, but they appear to be a small clump of short stiff bristles with curved points, and easily attach themselves to the silk spun by the larva on the surface of the leaf (Dadd). [Abdomen slender, ending in a sharp point; along the edge of the wing it is dark green, with darker streaks; the abdomen light green or yellowish, on which the markings of the larvæ are visible; these markings and streaks are, as a rule, red-brown (Freyer, from pupæ obtained in early May, 1857, near Augsburg, on *Gentiana verna*).]

Variation of pupa.—In colour the pupa is dimorphic, the colour apparently being in relation to the surface to which it is attached, though this is not invariably the case, those attached to leaves being mostly green, those on the stalks and petals purplish-brown, and even almost blue-purple on the flower-heads. The green pupæ have always a red spot on the back of the thorax, and many are more or less mottled with reddish-brown spots (Dadd). The pupa in itself appears not only individually to be coloured very variably, but it likewise changes its colour daily, so that at the outset it is lighter and variegated, but gradually becomes unicolorous and darker on the back, on the whole dark violet-brown, on the ventral side and the wing-covers more of a pure dark brown *i.e.*, sepia colour. In its shape it comes nearest to those of *S. pelidnodactyla* and *serotina* (Hering).

Comparison of pupæ of Adkinia graphodactyla, pneumonanthes, zophodactylus, bipunctidactyla, and Stenoptilia pterodactyla.—The pupæ of *A. graphodactyla* and *pneumonanthes* seem to be absolutely identical. The difficulty is to be sure of any grounds for not adding that they are identical also with that of *A. zophodactylus.* The comparison is made with empty pupa-cases, which are much more satisfactory for the purpose in nearly all respects, except that of the colour of the living pupa, nor can I discover any difference between them and that of *A. coprodactylus.* I have many pupa-cases of *A. zophodactylus*, but only about a dozen of *graphodactyla* and *pneumonanthes* together. This is probably the reason that I find no pupa of the latter with any colouring, whilst a few of *A. zophodactylus* have a broad band of brownish tinting on each side above the spiracles; the others, however, are like *A. graphodactyla.* After examining the pupæ for a very long time, the only differences I can find are very minute ones, in the lengths of the hairs, and in the closeness together of tubercles i and ii. The pupæ of *Stenoptilia pterodactyla* (*fuscus*) and *Adkinia bipunctidactyla* differ more conspicuously in the lengths of the hairs. The hairs are definitely whiter, and the tubercles closer together, in *pneumonanthes* than in *zophodactylus.* The hairs are, perhaps, also a little more curved. The following comparative table gives some details:

Species.	Length of hairs on eye-covers.	On tubercles i and ii on 4th abdominal.	Width apart of i and ii on 4th ab. seg.
A. zophodactylus ..	0·045mm.-0·050mm.	0·050mm.-0·055mm.	0·14mm.
A. var. *pneumonanthes*	0·038mm.-0·040mm.	0·040mm.-0·042mm.	0·09mm.
A. bipunctidactyla	0·10mm.-0·12mm.	0·15mm.-0·16mm.	0·12mm.
S. pterodactyla ..	0·08mm.-0·09mm.	0·10mm.-0·16mm.	0·14mm.

It seems also as if the wing-tips down beside the free appendages were wider at their bases in *A.* var. *pneumonanthes*, and more slender in

A. zophodactylus, and that the length of the appendages beyond was rather less. This difference, however, seemed not quite securely to separate itself from various others that at first seemed promising, but were found, on further examination, to be individual, and to occur in both species, or possibly to be errors of observation. The most disconcerting circumstance of all, however, is that the differences in measurements between *zophodactylus* and *pneumonanthes*, given above, as to the dorsal tubercles, are from continental *pneumonanthes* compared with British *zophodactylus*, and that Mr. Mathew's *pneumonanthes* give measurements (so far as they can be got without injuring the specimens) that agree with the English *zophodactylus*, or are even on the other side of them from the continental ones. My final conclusion, therefore, is that no pupal distinction can be drawn between the two species. The pupa of *A.* var. *pneumonanthes* seems to be fractionally smaller than that of *A. zophodactylus*, but the difference is slight, and with the curved, empty, cases, accurate measurement of a sufficient number to be of any use is impossible. The larger specimens of *A. pneumonanthes* (of the spring brood)†, taken by Mr. Dadd near Berlin, would certainly be larger than any English (summer brood) *zophodactylus* pupæ I have (Chapman).

Time of appearance.—The species is no doubt double-brooded, occurring in May-June, and again in August. Stange says that he captured it near Spandau and Finkenkrug, on June 24th and 29th, 1878, whilst Hering bred imagines from July 29th, 1893, onwards, also from Finkenkrug (the same locality), so that Sorhagen has no hesitation in calling it double-brooded, the imagines appearing in June and again in August. We have here also a long series under observation, one part (11) captured by Dadd, at Finkenkrug, on June 6th, 1906, and the other part (20), at the end of July, 1906, respectively. Frey's records (*Die Tineen und Pter. Schweiz*, p. 112) of *plagiodactylus* (=*pneumonanthes*) in June and July near Zürich, and *graphodactylus* in August, suggest also the two broods of the same species. Wocke, for Silesia, gives mid-June and early September, Freyer records it in June from larvæ found in the very commencement of June, 1862, near the Tegernsee. August alone is given for Hanover (Glitz); beginning of August, near Regensburg (Schmid); July, for the Rhine Provinces (Stollwerck); July and August, in Baden (Meess and Spuler); July and August, in Bavaria (Hartmann, one of whose localities is Tegernsee, whence Freyer bred it in June); July, in Württemburg (Steudel and Hofmann), etc. Hering says: "Like Snellen, I do not doubt that the species has a spring brood, examples of which, in some instances, *e.g.*, the imago caught on July 15th, 1893, overlap the second generation; at all events the larva of this early brood cannot have the same life-history as the later one, because, with us, *Gentiana pneumonanthe* only comes into bloom at the beginning of July," etc. Crombrugghe records it as occurring in great abundance in July and August, 1901, at Heide, in Belgium; he notes one larva as late as August 11th, 1905, which gave an imago quite at the end of August. He thinks there is a spring brood. Fologne also records it as occurring in August at Genck, and at Calmpthout. Other details that may be noted are: Imagines, July 22nd, 1840, not rarely about the foot of the Schneeberg (Mann and Fischer v. Röslerstamm); on the Sömmering,

† The larger specimens (imagines) of these spring *pneumonanthes* are 23mm. in wing-expanse, exactly the same size as the largest of the Berlin summer brood (see *anteà*, p. 521).

July 7th and 8th, 1842 (Zeller); [bred June 23rd-30th, 1857, from larvæ found near Augsburg, in early May, on *Gentiana verna* (Freyer).] In Germany it is recorded after mid-August, 1888, near Finkenkrug (Hering); July 4th, 1878, on the Island of Wollin (Schleich); June 24th and 29th, 1878, in the meadows near Spandau and at Finkenkrug (Stange), a record that shows that, in the Berlin district, the insect is double-brooded, since imagines emerged July 29th, 1893, from larvæ from Finkenkrug that had pupated on the 17th (Hering), a fact since confirmed by Dadd (*suprà*). Imagines emerged freely from July 30th to the middle of August, 1906, from larvæ taken July 14th on the Wörnitz (Mosigkauer Haide), in Anhalt (Gillmer). Imagines emerged from September 15th-19th, 1902, from larvæ found at Bouveret, on the shores of Lake Geneva, at the end of August (Wheeler). The first moth reared from the Wimborne larvæ, taken by Mathew, in 1906, appeared on August 29th, the next on the 31st, and so on up to September 20th. On September 1st he netted an imago on the ground whence the larvæ came, and on the 4th two more were beaten from mixed herbage in the locality where the gentian occurred.

Habits.—Mathew says that on September 1st and 4th, he beat one or two of the moths during the day from a mixture of coarse herbage growing in a boggy place; he adds that, when disturbed, the moth only flies for a short distance and settles again on a stem of grass or some other plant, and it is very easy to catch; it probably flies gently at dusk. Gillmer says that the "plumes" which emerged in the breeding-cage between the end of July and the middle of August, 1906, were not observed to pair. By day they hung about the breeding-cage, on the curtains of the room, etc., with their wings spread out horizontally, but, at dusk, they commenced to fly and tried to get into the open air, and this would seem to be their natural time of flight. Of the imagines which Freyer found near Augsburg, and which we have already noted as being possibly *coprodactylus* (since the larvæ fed on *Gentiana verna*), he writes: "This species has a light floating flight, and is to be found sitting on grass-blades, at the end of June and beginning of July, in forest meadows."

Habitats.—The species is distinctly addicted to the marshes in its more lowland localities (probably also in the mountains). It was first found by Freyer among the Bavarian mountains at Bad Kreith, near Tegernsee. It was then found on the Schneeberg (Mann and Fischer von Röslerstamm), and the Sömmering (Zeller), and then locally in Switzerland, in mountain-meadows, and in the woods on the mountains on either shore of the lake, at the beginning of August, in the neighbourhood of Zürich (Frey). Hofmann says that the true *S. graphodactyla* occurs mostly in mountain regions; it is found in Upper Bavaria (Tegernsee, Urfeld), in the Allgäu, in the Austrian alps (Schneeberg, Sömmering, etc.), in the Tyrol, Carniola, and in Switzerland near Zürich. Its reported occurrence near Regensburg, he says, as well as in North Germany, rests on its confusion with *S.* var. *pneumonanthes*, Büttn., or some other species. This latter is recorded as occurring in marshy meadows in various parts of Germany. Hering observes that, on July 15th, 1893, Dr. Schleich and himself found it in a dry bog-meadow, near Finkenkrug, where there were, besides many bushes of *Myrica gale*, a few plants of *Gentiana pneumonanthe* in bloom, among which a worn specimen of *Stenoptilia pneumonanthes* (*plagiodactylus*) was captured.

Attention being directed to the blooms of the gentian, some peculiarly spotted flowers were found to be attacked by the larvæ of the same species. Schleich himself had long before this reported the capture of the species in a swampy meadow on the western shore of the Vietzig Lake, near Misdroy; and Stange, in the marshy meadows near Spandau (comparatively near Hering's Finkenkrug locality). Gillmer found it in a wet meadow near the Mosigkauer Haide, in the Dessau district. The place is very wet, and the water oozes up as one walks over it in the summer as well as autumn. The meadow is mown in July, so that the larvæ have to be nearly fullfed at this time in this locality, or they might possibly be destroyed, unless, as was the case with Mathew's larvæ, the cut flowers retain sufficient freshness for some time to serve for food. It is difficult, at the end of October and early November, to search such a wet locality, but Gillmer was so far successful that he obtained plants containing tiny larvæ, which, on arrival in England, were discovered by Chapman mining in the foodplant, the young shoots made by the gentian, since the summer mowing, being at this time about 18cm. in length. In the Rhone Valley, Wheeler found the insect in flowers of *Gentiana pneumonanthe* growing abundantly at Bouveret, at the southeast corner of the Lake of Geneva. The locality is at the end of a huge, partially-drained marsh, which is, however, quite dry in autumn. Of the British locality, Mathew notes (*in litt.*) that it is a moist boggy heath in East Dorset, where the foodplant is not at all abundant.

British localities.—Undiscovered in Britain till 1906. Probably in most places where *Gentiana pneumonanthe* occurs. Dorset: near Wimborne (Mathew).

Distribution.—Widely distributed, but local, occurring in Austria, Germany, Switzerland, Belgium, the Netherlands, ?Italy, and England. Austria: Hungary, Galicia (Staudinger and Rebel, "Cat."), Lower Austria—near Hainfeld, on the Sömmering (Rogenhofer), the Schneeberg Alps, Lackerboden, Heuplacke, etc. (Mann), the Sömmering (Mann and Fischer von Röslerstamm), Tyrol—Glockner district, Val Popena (Mann), Brenner, Serles, Monte Bald, Trafoi, Franzenshöhe (Heller), Styrian Alps (Zeller), Upper Carinthia—at the fort of the Fünfspitz (Zeller). Belgium: Genck, Calmpthout (Fologne), Heide, very abundant (Crombrugghe de Picquendaele). Germany: Hanover—near Hanover (Reinhold), near Misburg, not rare (Glitz), near Göttingen (Jordan), Rhine Provinces—on the banks of the Ahr (Weymer), Hesse—near Cassel (Neumeyer), Thuringia—near Sömmerda (Jordan), Anhalt—on the Wörnitz, Mosigkauer Haide (Gillmer), Brandenburg, rare—Spandauer Haide (Büttner), Finkenkrug (Hering), near Spandau (Sorhagen), Silesia—near Breslau, Bruschewitz, Oels district (Wocke), near Görlitz (Sommer), Bavaria—Urfeld on the Walchensee, the Allgäu dist. (Hofmann), near Regensburg (Schmid), Niederaschau, Oberaudorf (Hartmann), Bad Kreith near Tegernsee, Augsburg, near Deuringen (Freyer), Baden — Thalmühle, Geisingen, Herrenwies (Meess and Spuler), Pomerania—Isle of Wollin, Misdroy near Stettin (Schleich), Hamburg—Hamburg (Sauber), Württemberg—Eisenbach (Steudel and Hofmann). Italy: Lombardy (Turati *teste* Hering). Netherlands (Snellen). Switzerland: near Zürich—on the Uetliberg (Frey), Bremgarten (Frey collection), [? Degersheim and Gäbris (Müller)], Rhone Valley, near Bouveret (Wheeler).

ADDENDUM II (to page 39).

Hybridisation in Lepidoptera.

Sphingides. 1*a*. [To p. 24.] Eumorpha hybr. pernoldi (*elpenor* ♂ × *euphorbiae* ♀), Jacobs, *Iris*, xviii., pp. 321-7, pl. ix., figs. 1-4 (1906).—Bred 1905, from eggs, the result of a pairing that took place in confinement. Imago.—Superficially observed, gives one the idea of a reddish *E. elpenor*, separated, however, at once from this species by (1) a conspicuous dark stripe on forewings, commencing at third costal spot, and running parallel to the oblique band, common to most

Eumorphids, into the inner margin; (2) the absence of the red abdominal mediodorsal stripe; and (3) the presence of a dark hind-marginal band on hindwings. Expanse 50mm.-62mm.; smaller than average *elpenor*, distinctly smaller than *euphorbiae*. Head pale olive-green, bordered with reddish on each side; antennæ of same length as those of *elpenor* and *euphorbiae*, but intermediate in bulk; above greyish-white, reddish at base, brown below on the pectinated side. Thorax pale olive-green. Patagia bordered interiorly with reddish, less intense than in *elpenor*, but white-bordered exteriorly more conspicuously than in *elpenor*, though less so than in *euphorbiae*. The red thoracic stripes peculiar to *elpenor* scarcely recognisable. Abdomen slender, of the same colour as the thorax above; the anal segment (red in *elpenor*) olive-green; the red mediodorsal line quite absent; the sides pale red; the upper olive-green portion narrower than in *elpenor*, thus making the red sides more conspicuous; on each side of the 1st segment a black spot, as in *elpenor*, but much larger and more intense; anal tuft strong, of the same colour as abdomen. The forewings intermediate between the more slender ones of *elpenor* and the broader ones of *euphorbiae;* the ground colour of a more or less pale carmine-red; the costa bordered for three-fourths of its length with pale olive-green; at the base for about one-fourth, and again beyond the middle up to the apex, this border is enlarged into costal spots; the basal spot more elongated than in *euphorbiae*, and not so sharply circumscribed; the second spot may be looked on as a combination of the second and third spots in *euphorbiae;* in the apical portion of this spot (in the place where, in *euphorbiae*, the third costal spot arises) is a small dark spot, from which, to the middle of the inner margin, runs a pale olive-green stripe, slightly bent inwardly about the middle, and of an even width of about 2mm. From the apex of the wing runs the characteristic Phryxid band, widening as it reaches the inner margin; in colour pale olive-green, its inner margin parallel with the first-mentioned stripe, about 3mm. distant, regular in outline, whilst the outer margin is irregular, but conspicuous owing to its dark colour, and joins the inner margin near the anal angle; the band is narrower than in *euphorbiae*, and approaches the form of that of *hippophaes*. The space between the band and the wing-margin is slightly darker than the red ground colour; it is broader than in *elpenor*, but not quite so wide as in *euphorbiae*. A black dash bordered with white hairs lies at the base on the inner margin, intermediate in size between those of the parents. The red line on the extreme costa, present in *elpenor*, is here wanting. The outer marginal fringes short, of the colour of the outer margin. The hindwings of the hybrid are intermediate between those of the parents, both in shape and coloration, as also is the black basal portion; along the outer margin, about 1mm.-2mm. distant, runs a blackish band, terminating before reaching the anal angle; this band, totally absent in *elpenor*, is a trait from *euphorbiae*, although neither so broad nor so bright as in that species; the colour of the space between the basal spot and marginal band, and between these and the margin, is red, like the ground colour of the forewings; at the anal angle where, in *euphorbiae*, is a conspicuous white spot, which is absent in *elpenor*, the colour is faint light reddish. Fringes white. . . . . . Pl. ix., fig. 4, represents an asymmetrically marked aberration. . . . . Among the other examples bred is one in which all the red coloration is absent, the red being represented by pale grey; the markings are pale olive-green as in the type, but confused on the left forewing; hindwings crippled. All the moths bred are ♂s. LARVA (pl. ix., fig. 1).—Head brown; a reddish dorsal stripe from head to caudal horn; on both sides of this a velvety-black stripe, and a similar one above the legs. The space between these stripes is sprinkled with innumerable fine yellow and reddish dots, and similar, but much finer, dots occur in the black bands. These dots are so arranged that five narrow black bands are formed on each segment, which run also across the reddish dorsal stripe. On each segment, at the lower margin of the black, longitudinal, dorsal stripes, is a pale yellow spot. Those on the first four segments are larger than the rest. Spiracles white, oval; immediately below each is a suffused red spot. On the 8th abdominal segment there is the slightly-curved black horn, with only the extreme tip white. At the base of the horn, on both sides, is a large yellow spot, extending into the base. The length of the horn is intermediate between that of *elpenor* and *euphorbiae*. Legs blackish, red-brown in the middle, sprinkled with very many flesh-coloured dots. The larva beneath is flesh-coloured, and sprinkled, except in the incisions, likewise with fine dots. The larva appears shagreened, by reason of the innumerable dots. It approaches nearer to that of *euphorbiae* than to that of *elpenor*. The enlargement of the metathorax and 1st abdominal segment, noticeable in *elpenor*, is not to be observed. PUPA (pl. ix., fig. 2).—Brownish-grey, darker on the most prominent parts of the segments, the wing-cases, and on the dorsum. The cephalic parts are less pronounced than in *elpenor*, though more sharply modelled than in *euphorbiae*. The cremaster terminates in a point broad at the base, and turned sharply downwards. The spines on the abdominal segments of *elpenor* are only weakly expressed in the hybrid pupa (Jacobs).

3*a*. [To p. 24.] THAUMAS hybr. DENSOI (*vespertilio* ♂ × *euphorbiae* ♀), Muschamp, *Ent. Rec.*, xviii., pp. 237-8 (1906).—Two ♂ and two ♀ moths emerged after three weeks of pupal life. The females are full of eggs. The ground colour of the forewing is of the *vespertilio*-grey, with, in two cases, a yellowish-pink shading combining with the grey; the bands exist as in *euphorbiae*, but are greatly diminished in breadth and in length. The hindwing is the hindwing of *vespertilio*, but with a broader pink outer margin. The underside is much pinker than in *vespertilio*, which it resembles with regard to the grey marginal bands of the hindwing. The abdomen and thorax strongly resemble those of *euphorbiae*. However, in two insects, the 3rd abdominal black band is visible as in *vespertilio*. LARVA.—*First stage:* Ground colour light yellowish-green, head rather darker, with a little intermixture of olive. Caudal horn from 0·2mm. to 0·3mm. long. Anal segments, and prolegs, darkish green. The larva of *vespertilio*, in this stage, has the ground colour light yellow, the head of the same colour, anal segment rather darker. The setæ are exactly the same in the three different larvæ. No caudal horn. The larva of *euphorbiae* has the ground colour light olive-green, the head and base of prolegs being of a very dark olive-brown colour. Caudal horn from 0·5mm. to 0·6mm. in length. *Second stage:* The larva of *densoi* differs from that of *euphorbiae* in that the yellow-grey subdorsal line is very much more clearly indicated, and the white spots are prominent. The ground colour is nearer that of *vespertilio* at the same stage. The shield on the head is black, and the prolegs vary from green, as in *vespertilio*, to black, as in *euphorbiae.* The stigmatal line is more distinctly marked than in *euphorbiae,* less so than in *vespertilio.* The caudal horn is short and stumpy, relatively the same length as in the first stage; exceptionally, in a very few cases, it is completely missing (in not one case was it wanting in the first stage). *Third* (*and final*) *stage:* The larva of *densoi* varies in the adult stage very much more than in the first two stages, but is, altogether, within the broad limits of the *euphorbiae* larvæ, from which, however, it differs with regard to the length of the caudal horn. In no case was this horn more than one-half the size of the caudal horn of *euphorbiae,* and, in several cases, it did not exist at all. In the course of the last stage the larvæ were attacked by the fatal "flacherie," and, in spite of every care, 90 per cent. perished. Pupæ.—These are rather nearer *vespertilio* than *euphorbiae* in size and general appearance; the black markings (almost non-existent in *vespertilio*) are clearly defined, though not so dark as in *euphorbiae.* To obtain these hybrids several *Thaumas vespertilio* ♂ s and *Hyles euphorbiae* ♀ s were placed, in June, 1906, by Dr. Denso, in one side of a silk-covered cage, and, on the other side, separated only by a fine silken screen, a few *H. euphorbiae* ♂ s and *T. vespertilio* ♀ s. Of the former, two *euphorbiae* ♀ s paired at once with *vespertilio* ♂ s, and subsequently laid respectively 108 and 97 eggs. No pairing, however, took place between *vespertilio* ♀ s and *euphorbiae* ♂ s. The eggs all hatched, and the larvæ at first did well, feeding hungrily on *Euphorbia,* and continued to do so up to the final stage (Muschamp).

Attacides. [To p. 27.] Saturnia hybr. caspariі* (*hybrida* ♂ × *pavonia* ♀), Frings, *Soc. Ent.*, xxi., p. 25 (1906).—Imago.—Very close to *S. pavonia;* the ♂ antennæ rather more expanded and body rather more robust. The basal transverse line of forewings not nearly so strongly angulated, sometimes nearly straight, as in *spini;* the second sinuate line runs nearer to the base as in *hybrida-minor.* Forewings of ♂ rather of a grey-brown, not so bright a brown as in *pavonia,* though they retain the admixture of red in the disc. The coloration of the hindwings is very interesting; in one example the hindwings are of the pale grey of *spini,* but, in some others, they attain the intensity of a rather pale *pavonia,* these two forms being connected by intermediates. Sometimes the base and disc are orange, but the hindmargin dusky-grey as in *hybrida-minor.* The underside varies from almost as deep an orange as *pavonia* to quite a grey colour. The ♂ hybr. *casparii,* therefore, connects *hybrida-minor* and *pavonia*

* The parentage of this hybrid is given as *hybrida-minor* ♂ × *pavonia* ♀. As we have already noted (*anteà*, vol. iii., p. 297) *S.* hybr. *hybrida* (or as it was later called *hybrida-minor*) has never yet been recorded as reared in confinement, and its existence is assumed only on the strength of captured specimens. Frings, unfortunately, does not say whether Caspari obtained his ♂ parent, for this crossing, in confinement, or whether it was captured wild. It really is a most important detail, as some *pavonia* exhibit usually-considered *spini* characters. Frings himself notes that two of the generally accepted differences between *spini* and *pavonia* are not to be relied on, *viz.*, (1) *Basal line*—a ♀ *pavonia* bred from a pupa taken at Bonn, with basal line exactly as in *spini* ♀; he has also captured a similarly marked ♂, and has seen others from Budapest, Russian Poland, and Ferrara. (2) *Abdominal bands*—♀ s from Rhenish Prussia often have the pale abdominal bands as broadly and strongly white-ringed as those of *spini.* On the other hand, examples from Dalmatia possess no white rings.

by all conceivable intermediates†. A ♂, with deep wine-red hindwings, and forewings deeply flushed with dark red above and beneath, can only be looked upon as an aberration. The ♀ of *casparii* has the antennæ more strongly-pectinated than *pavonia*, the body more strongly-tufted, and the white rings broader. The discs of both wings mostly show a strong admixture of red scales. Many ♀s had no eggs; some a few normal-looking eggs, and others many, but not so many as the average of *pavonia*. Though one might not have supposed it, the black *spini*-like larvæ yielded all the forms, even those most closely approaching *pavonia*. The hybrid *schaufussi* (=*bornemanni* × *pavonia*) naturally comes closest to *casparii*, but ♂s have less of the brown ground colour of *pavonia* in the forewings, the ♂ *schaufussi* exhibiting more of the greyish-red of *bornemanni*. Eggs were obtained in 1905 by Caspari, who shared them with Frings; 62 per cent. of the eggs hatched, and both Caspari and Frings reared imagines. Larva.—*First instar:* The black larvæ not separable from those of *S. pavonia*. *Second instar:* Black, shiny (inherited from *spini*), about two-thirds with the reddish-yellow lateral stripe of *pavonia*, the rest quite black. *Third instar:* The majority unaltered; a few exhibit a row of pale yellow spots above the reddish-yellow stripe; the lateral stripe often quite absent; several with the fine whitish-grey hairs of *spini*. *Fourth instar:* Very variable; a few still quite black; most with a dark or pale yellow lateral stripe; many with green spots; in some the green was so abundant as to make them inseparable from *pavonia* in the same stage. Head black, marked with green. Tubercles shiny black (seldom yellow or pink); hairs often whitish, as in *spini;* some marked laterally, and round the tubercles, with rusty-yellow. *Fifth instar:* Ground colour mostly a peculiar dirty, dark, olive- or black-green, not at all like the clear green of *pavonia*, which occurred in a single individual only. This dirty green was sprinkled with irregular spots and stripes of light green. However, the broad black saddles, with sulphur-yellow, or more rarely reddish, tubercles, resembled those of *pavonia* larvæ. Three-quarters of the larvæ had the broad, continuous, black dorsal stripe of *hybrida-minor* larva*, and usually black markings about the spiracles and the two tubercles above the spiracle. These were occasionally formed into a broad, black, longitudinal stripe, leaving only two rows of green spots on the dorsum. A few had these stripes so extended that the larvæ appeared black, but even then the saddles were visible by their deeper velvety black. These last were either black, or black-green, beneath. Anal claspers black or green, but always with a green stripe. Head black with a green frontal triangle, or green with black marks. Even those of the *pavonia* type had traces of the black dorsal stripe. Two only were without a trace, so that they only differed from *pavonia* larvæ in the dirty, darker, green ground colour. Only a few of the darker specimens were glossy. The segmental elevations were not so tall as those of *spini*, agreeing much more with those of *pavonia*. Asymmetry of the markings of the larvæ was most noticeable; many had only one side of the head yellow. It is very striking that the tendency of many of these hybrid larvæ is far stronger towards the doubtless phylogenetically very old *spini* form than towards that of *hybrida-minor* or *pavonia*, although the larvæ

† This appears to be a very strong statement on the facts.

* This distinctly suggests that Frings knew *hybrida-minor* larva [see footnote preceding page (p. 539)].

possess only 25 per cent. of *spini* blood; some specimens differed, indeed, only very slightly from *spini* larvæ. Cocoons.—The cocoons mostly agreed completely with those of *pavonia*, but one specimen with that of *spini*. The pupæ only differed from those of *pavonia* in the ♂ antenna-case being somewhat more expanded, reminding one of *spini* (Frings).

Geometrides. [To p. 29.] Hybrid Zonosomas.—Head notes (*Ent. Rec.*, xviii., p. 47) that, between 1901 and 1904, he obtained pairings of *Zonosoma orbicularia* ♂ × *pendularia* ♀, the reciprocal cross *Zonosoma pendularia* ♂ × *orbicularia* ♀, also *Zonosoma orbicularia* ♂ × *annulata* ♀, and its reciprocal cross *Zonosoma annulata* ♂ × *orbicularia* ♀, and lastly *Z. orbicularia* ♂ × *porata* ♀. All these produced fertile eggs and larvæ, and, although the larvæ of the last-named cross unfortunately died when nearly fullfed, owing, apparently, to the very wet weather that occurred whilst they were being reared (in the open in sleeves), the others produced imagines in due course, that of *annulata* ♂ × *orbicularia* ♀, however, only one cripple in 1904. Of the others we note:—

1*a*. [To p. 30.] Zonosoma hybr. orbiculo-pendula (*orbicularia* ♂ × *pendularia* ♀).—This hybrid follows distinctly the ♂ parent in its general appearance, and would be difficult to separate from *orbicularia*. It has, however, something of the pale colour of *pendularia*, and the fine mottling or peppering that characterises *orbicularia* is greatly reduced, the ground colour being more uniform, although not nearly approaching that of *pendularia*. The general direction and position of the markings of the two parent species being much alike, it is difficult to seize on any very definite characteristics shown by the hybrids in these directions; but the reduction of the red median band, the character of the dotted basal line of forewings, and the dotted median line of hindwings, appear somewhat to approach rather those of *pendularia* than of *orbicularia*; so also does the transverse submarginal shade of the forewings, when present; the median shade of the forewings also is incomplete, reaching from the inner margin to just beyond the ocellus, as in *pendularia*. Tutt Coll., 3 ♂s, 3 ♀s. In June, 1902, Head obtained a pairing of *orbicularia* ♂ × *pendularia* ♀. Nearly all the ova were fertile and produced larvæ, and between four and five dozen imagines emerged in July and August, 1902; two pupæ that lived until July, 1904, died without emerging.

1*b*. [To p. 30.] Zonosoma hybr. pendulo-orbicula (*pendularia* ♂ × *orbicularia* ♀).—This hybrid is much more characteristic of *pendularia* than *orbicularia*, and is much more intermediate in its appearance and general character than its reciprocal *orbiculo-pendula*. The specimens under examination are two ♂s, and, although much more uniform in the ground colour of the forewings, owing to the reduction of the peppering, or mottling, that characterises *orbicularia*, they still have the ground colour rather of the darker shade that characterises the latter species. They are ill-marked, and, in this respect, resemble *pendularia*: so also do they in the thick marginal dotting round the edges of all the wings. An occasional *pendularia* character is most marked, *e.g.*, the development of a submarginal shade on the hindwings, for the development of which the dotted median transverse line in the hindwings of the hybrid is placed nearer the central ocellus than in *orbicularia*, and, in this respect, follows *pendularia*, in which there is usually a markedly greater space between the dots and the outer margin than is the case in *orbicularia*. One cannot help noticing the somewhat marked similarity between this hybrid and the *sub-roseata* form of *pendularia* taken by Woodforde near Market Drayton. Of this cross, Head obtained a pairing in June, 1901, the eggs hatching, and larvæ feeding up, and the imagines emerging at the end of July, 1901. Only about 25 per cent. of the eggs were fertile, and very few imagines were reared from this brood. The imagines bred exhibited scarcely any variation.

1*c*. [To p. 30.] ZONOSOMA hybr. HEADI (*orbicularia* ♂ × *annulata* ♀). —All the wings are white, tinged with ochreous, and sprinkled with minute dark grey specks, which give them a slight greyish appearance; there are two dark purplish-grey, transverse, zigzag lines, which more or less coalesce, the outer line being nearly black. The discoidal spots are clear and well defined; between the discoidal spot and the base of the wing there is also a third faint, zigzag, dark grey, line, and a row of black dots on the outer margin of all the wings. The fringe is of the same colour as the wings. The head, thorax, and body, are also of the same colour as the wings. Maddison coll. (Head). Two pairings of this hybrid were obtained, one in 1902, the other in 1903. Very few of the ova hatched, and only about a dozen imagines were reared in 1902, and seven in 1903. The eggs were in each case laid in June, and the resulting larvæ fed up quickly, the imagines appearing at the end of July. Head also reared the reciprocal cross of *Z.* hybr. *headi*, obtaining a pairing in 1903. Few of the eggs, however, were fertile, and only two of the resulting larvæ produced pupæ. Both of these went over the winter; one emerged, deformed, in 1904, and the other one died.

4*a*. [To p. 31.] NYSSIA hybr. MERANA (*zonaria* ♂ × *lapponaria* ♀), Burrows, *Ent. Rec.*, xviii., p. 132 (1906).—The male presents the appearance of a dark suffused *N. zonaria*, thus following the rule of resembling the parent of the same sex. There is an entire absence of the orange costal streak on the forewing, so distinct in *N. lapponaria*. The wings are not transparent, but well scaled, perhaps a trifle whiter than in *N. zonaria*. The subterminal line is completely different from that of the male parent, in which it is distinct, unbroken, and direct. In the hybrid the line is distinct enough, but wavy, following the female parent, *N. lapponaria*. The central lines enclose a darker shade, striking enough, but I have seen *N. zonaria* which approach it closely in this way. The hindwings do not show the marginal shade which is so distinct in *N. zonaria*, but are crossed by two dark lines, only indistinctly marked in *N. lapponaria*. The female hybrid is entirely without the series of orange spots on the central line peculiar to *N. lapponaria*, the female parent, and is also without the transverse bands of the male parent. The rudimentary wings are perhaps a trifle more developed than in *N. zonaria*, and about the same as in the case of the female parent. The down upon the abdomen is not very different from that of the female *N. lapponaria*. The specimens were obtained by Mera, who crossed, in the spring of 1905, a ♂ *Nyssia zonaria* and ♀ *N. lapponaria*. The eggs proved fertile, and the resulting larvæ pupated in due course. The females emerged much earlier than the males on the whole, several appearing in early January, but pairings of the hybrids were later obtained, yet no ova resulted, although the ♀ s went through all the actions of oviposition (Burrows).

13. [To p. 35.] CABERA hybr. FLETCHERI (*pusaria* ♂ × *exanthemaria* ♀).—A brood of some eighteen specimens of this hybrid emerged in 1892 from a crossing obtained by W. H. B. Fletcher in 1891. Four ♂ s and eight ♀ s under examination show distinct sexual differences, and the sexual dimorphism is as marked in ground colour, amount of speckling, antennæ, body, shape of wings, etc., as in the parent species. The imagines themselves may be said to be excellent intermediates between the parent species, the ground colour approximating rather to the whiter tint of *pusaria*, the more abundant speckling directly indicating *exanthemaria*, whilst the brownness of the transverse lines also points in the direction of the latter. There is some variation in the markings of the specimens *inter se*, one ♂ and seven ♀ s having a very distinct angulation in the middle line at the position of the discoidal lunule, two ♂ s and one ♀ showing the two basal lines united, as in *C. pusaria* ab. *rotundaria*, and one ♂ only having the three transverse lines more or less typical of the parent species.

14. [To p. 35.] OPORABIA HYBRIDS.—Allen asserts (*Ent. Rec.*, xviii., pp. 85-89) the specific distinctness of *Oporabia christyi*. He says that it breeds perfectly true. At the same time he says it pairs readily with *O. dilutata* in confinement, and the progeny is fertile. He has obtained pairings of ♂ *christyi* × ♀ *dilutata*, and ♂ *dilutata* × ♀ *christyi*. Some of the offspring might pass for *O. christyi*, and some for *O. dilutata*, but most of them partake of the external character of both. They exhibit all the tendencies to variation which occur in the two species. He does not think that *O. dilutata* and *O. christyi* ever pair in a state of nature. In the few doubtful specimens taken at large, the difficulty of determining the species has seemed to be due merely to bad condition. A few attempts to pair *O. christyi* and *O. autumnata* have failed. [Compare *anteà*, pp. 46-47.]

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