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VOL III.

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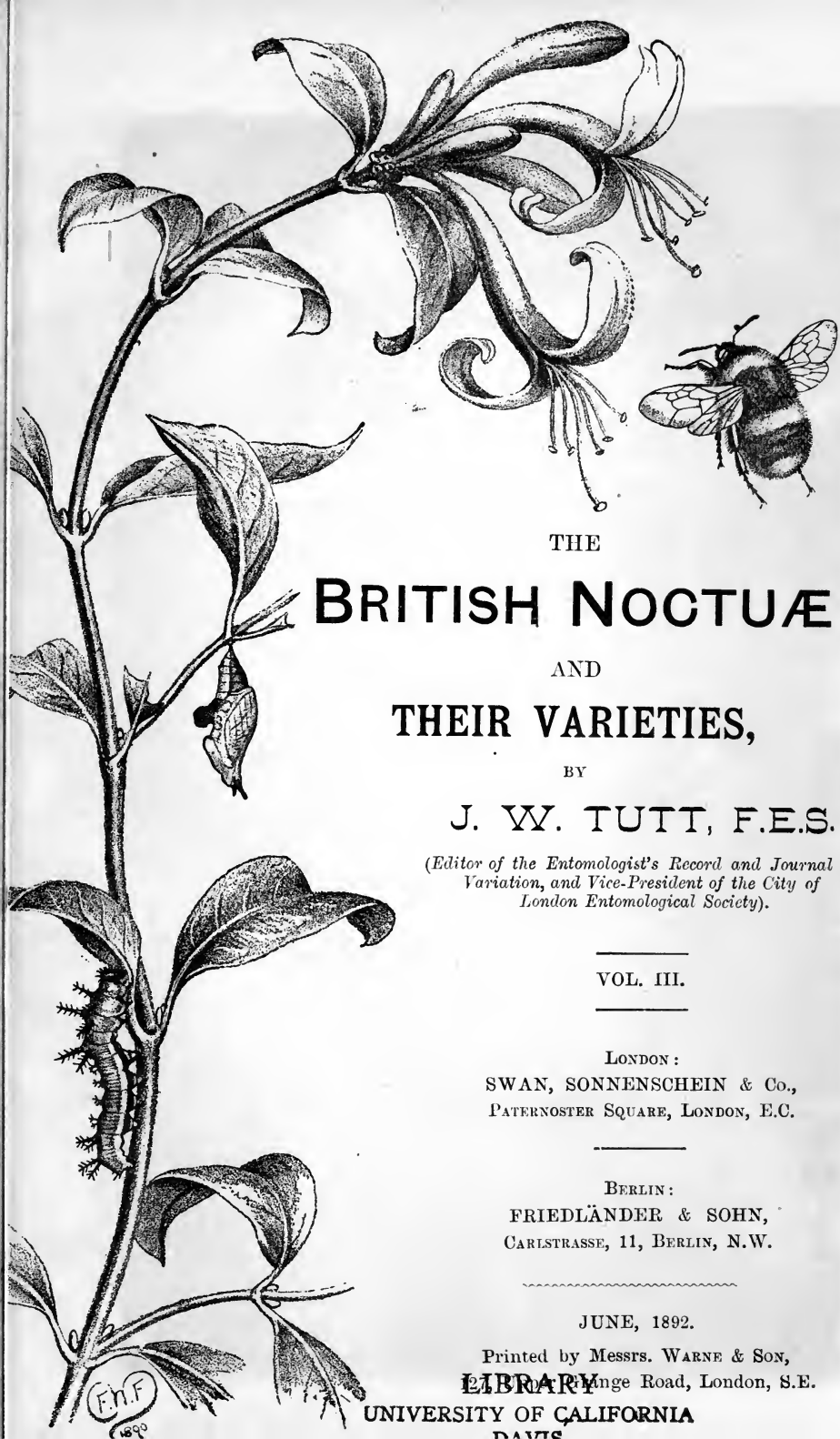

THE

BRITISH NOCTUÆ

AND

THEIR VARIETIES,

BY

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INTRODUCTION.

It must have been noticed by those lepidopterists who have read the previous volumes of this work that I have repeatedly referred to species as being "sexually dimorphic," in other words, that certain sexes are to be readily distinguished by some characteristic trait which is generally evident even on a superficial examination. Throughout the animal kingdom, there are a large number of species, the sex of which can be determined readily, apart from the sexual organs, by some external structure or conformation which strikes the most casual observer. On the other hand, there are species which have no outward visible signs of their sex, which can be determined alone by the special sexual organs with which most animals are provided. Lepidoptera are not behind-hand in this respect, and there are many external characters by means of one or more of which the sexes may be definitely distinguished without the examination of the sexual organs. These external signs of sex have been termed "secondary sexual characters." To these secondary sexual characters the term "antigeny" is applied by Scudder, and comprises all "those accessory peculiarities of either sex which are not directly connected with generation."

Of these characters in lepidoptera we find a large variety. In fact, in some species or other almost any portion of the body may be so modified as to become such, and thus we find the antennæ, legs, thoracic crests, abdominal crests, the wings as a whole, the nervures, etc., all modified in particular species so as to become "secondary sexual characters," whilst wing markings and colour are also in many instances requisitioned for the purpose.

Darwin in his "Descent of Man" has treated the subject of "secondary sexual characters" very fully, and Geddes and Thompson write:—"Among invertebrates prominent secondary sexual characters are rarely exhibited outside the great division of jointed-footed animals or arthropods. There, however, among crustaceans and spiders, but especially among insects, beautiful illustrations abound. Thus the great claws of crabs are frequently much larger in the males; and male spiders often differ from their fiercely coy mates, in smaller size, darker colours, and sometimes in the power of producing rasping sounds. Among insects, the males are frequently distinguished by brighter colours attractively displayed, by weapons utilised in disposing of their rivals, and by the exclusive possession of the power of noisy love-calling. Thus, as the Greek observed, the *Cicadas* "live happy, having voiceless wives." Not a few male butterflies are pre-eminently more beautiful than the females; and many male beetles fight savagely for the possession of their mates" ('Evolution of sex,' p. 6). Darwin argued that these "secondary sexual characters" originated first of all in slight variations, that these variations were of advantage in what he termed "sexual selection," a phrase adopted to define the advantage due to actual selection, not by nature but by the other sex, so that the individuals possessing advantageous variations

were utilised in copulation and gradually outdistanced those without such, in other words "on the advantage which certain individuals have over others of the same sex and species in reproduction," whilst the words in which he sums up the means through which, probably, "sexual selection" has led to the development of "secondary sexual characters" are as follows:—"It has been shown that the largest number of vigorous offspring will be reared from the pairing of the strongest and best-armed males, victorious in contests over other males, with the most vigorous and best-nourished females, which are the first to breed in the spring. If such females select the more attractive, and at the same time vigorous males, they will rear a larger number of offspring than the retarded females, which must pair with the less vigorous and less attractive males. So it will be if the more vigorous animals select the more attractive, and at the same time healthy and vigorous females; and this will especially hold good if the male defends the female, and aids in providing food for the young. The advantage thus gained by the more vigorous pairs in rearing a larger number, has apparently sufficed to render sexual selection efficient."

It may be well now, to run cursorily over the various "secondary sexual characters" presented among our British lepidoptera with a view to drawing further attention to a most interesting subject.

(1). ANTENNÆ.—It strikes one at once that sexual differences in the antennæ are not to be found in our British butterflies except in the most minimised form. Slight differences in length and stoutness are found in certain species of the *Argynnidæ*, *Papilionidæ* and *Pieridæ*, but these are so slight as to be almost unnoticeable. Amongst the *Sphingidæ*, there is a distinct difference, those of the males being more decidedly ciliated than those of the females. In the *Sesiidæ* and *Zygænidæ* there is again but little difference, whilst among the *Bombyces*, made up as it is of so many unequal groups, there is very considerable variation. The *Hepialidæ*, which do not really belong to this sub-division at all, have simple antennæ without sexual difference; the *Lithosidæ* and *Euchelidæ* present slight differences, the *Chelonidæ* stronger ones, whilst in the *Cochliopodidæ*, *Liparidæ*, *Bombycidæ*, *Endromidæ* and *Saturniidæ* the differences are very great. The differences are fairly well developed in the *Depranulidæ*, *Dicranuridæ*, and *Notodontidæ*. Amongst the NOCTUÆ, PYRALES, CRAMBITES, GEOMETRÆ, TORTRICES, TINEINA, etc., there are considerable differences, the antennæ varying much in closely allied species, and showing how intimate certain phases in the development of the antennæ are with the habits of particular species. The power that certain species have of finding their mates is well-known, and it would appear that all species have this power more or less developed in some form or other. Generally the male, by means of some special sense, finds out the female, but it is beyond doubt that the female frequently asserts an external and direct attractive influence over the male. This is termed "assembling" by lepidopterists. The way in which a virgin female of *Bombyx quercus*, *B. rubi*, *Endromis versicolor* or *Heterogenea limacodes* will, in the day-time, attract considerable numbers of males to them is well known, and it is therefore necessary to examine the habits of some of the species, to get some general idea of its action. We notice that the species just mentioned, constitute a class of insects the males

of which fly freely during the day, whilst the females remain hidden. It therefore becomes necessary for the male to have some special means to detect and find out the hidden female before his flight is over so that copulation may take place. If we examine the two sexes of these species we are at once struck with the fact that the antennæ of the male are covered with strongly developed pectinations, and that those of the female are comparatively simple. In Tortrices which fly during the daylight, and in which the female is comparatively inactive and retired, we find the same character highly developed in the male. Examples that occur to me are *Amphisa prodromana, Ptycholoma lecheana, Clepsis rusticana, Batodes augustiorana, Grapholitha obtusana, Stigmonota perlepidana, Catoptria ulicetana, Tortricodes hyemana,* and many others may be mentioned, whilst of species which fly at dusk and assemble freely *Caberà pusaria, C. exanthemata, Iodis vernaria, Cheimatobia brumata, Aspilates gilvaria, A. citraria* and *A. strigillaria, Amphidasys prodromaria, Stauropus fagi, Spilosoma mendica,* the Noctuid genera *Pachnobia, Tæniocampa,* &c., at once occur to my mind. Here then is a distinct development of a special organ associated with a special habit of the species, to wit, the pectinated antennæ of the male, associated with an ability of the male to seek out and find the female when more or less hidden. When these facts first came to light it was generally assumed that the antennæ enabled the male to find the female by increasing his power of vision, but it is well known that the male frequently retains the power even when the female is completely hidden in a box &c., and I have known the male to fly repeatedly to the spot where a female has been confined. It would appear, therefore, that the male is most probably guided by scent and that the antennæ are specially devised for the reception of an attractive odour given off by the female. It is remarkable that where both species are equally active, and the sexes fly freely together in the daytime, the antennæ are never specially developed, at least not to my knowledge, and that in such cases the "secondary sexual characters," where such exist, are generally connected with the colour, markings, etc., of the wings. For example, both sexes of the butterflies fly freely together and there is no special antennal development, so also do the species in the genus *Zygæna,* and yet in the allied genus *Ino,* where the females remain resting on the grass stems etc, whilst the males buzz or fly about, the modification in the antennæ at once takes place and those of the males become strongly ciliated. In some species, where the ciliations in the male are slight, the antennæ of the female are generally quite filamentous, perfectly simple and unciliated ; but when the pectinations in the male are decidedly well-developed and strongly pectinated, the female also has traces of the ciliations or pectinations. It must be remembered, too, that it is only in those species in which both sexes have simple antennæ that the sexes conform to each other in this respect, and it, therefore, would appear to be a fair deduction that the antennæ of lepidoptera were originally simple and that the pectinated character has been acquired owing to the actual necessity of the development of a sense by means of which the males shall find the females. Mr. Poulton, in his paper 'On the morphology of the Lepidoperous pupæ,' says that the female had them and lost them, but it is more difficult to suppose that the female should have had

them and lost them, when there appears to have been no real reason for her to have them and no use that she could make of them, than to suppose that the male has acquired them, and that, in such cases as these in which the female now more or less has them, the male has transmitted some tendency in the direction of their development to the female. We can hardly leave the subject of antennæ without referring to those of the *Adelidæ* consisting of the genera *Nemophora*, *Nematois* and *Adela*. So different are they in the sexes, that early authors separated them by their antennæ alone as different species. Dr. Chapman informs me that *Incurvaria muscalella* is structurally very near *Adela*. The males of the former have pectinated antennæ, those of the latter long ones. It may, therefore, be supposed that the long antennæ of *Adela* are simply the result of a method of increasing the antennal surface, as pectinations do in some other species. It may be a new and artistic method, possibly it is an old and antiquated one.

(2). Scent Glands and Patches.—Having referred to the fact that insects probably use their antennæ as one of the sets of organs by means of which the males search out the females, and that this is probably done through the sense of smell, it becomes clear that there must be some scent given off by the insects by means of which the opposite sex is attracted. The work of Fritz Müller has made us conversant with special organs in which scent is produced (although he himself hardly indicated their use in any sexual relation) and these are divided by Scudder into three classes :—(1). "Extensible glands on the abdomen," as are found in *Anosia*, in the *Euplœinæ* and *Heliconinæ*. (2). "Tufts or pencils of hairs found on various parts of the body including the legs and wings." Fritz Müller found a pencil or tuft of long hairs near the front margin of the hind wings of the male in the *Ithyonida*, and although the same organs are found in the female, they are neither so large nor so well-developed and the vanilla-like odour given off by the male is not so strong or noticeable. In *Prepona*, a tuft of black hairs on the hind wings gives out an odour, whilst, in one of the species *Thaumantes* (belonging to the *Morphinæ*), pencils of hairs called "scent-fans," are situated on the upper surface of the hind wings near the base. Similar tufts, giving out a jasmine-like smell, occur in a species of *Catopsilia*, and Müller also records a faint odour in some of the higher *Hesperidi*, which comes from pencils of hairs found in the hind tibiæ of the male. This brings us close to a case in our own fauna in which an odour is given off from the aborted hind tibiæ of the males of *Hepialus hectus* ('Ent. Rec.' &c., vol. iii., p. 77). (3). "Clusters of scales." These according to Scudder, appear to be confined to the male sex. Niceville states that *Antirrhea* (one of the *Satyrinæ*) gives out an odour from a collection of scales on the hind wings at the anterior base of the upper surface, the area being covered by the fore wings, whilst Scudder gives many other examples. Taken in connection with the power which certain butterflies and moths possess of being attracted by the opposite sex, generally, although by no means universally, the male by the female, these scent glands undoubtedly show, if they do not positively tend to prove, a distinct sexual use which may now be readily understood. The power of "assembling" in British moths especially, is so well recognised that it is almost useless to recall special instances, but I would call to mind

that most writers on the subject, notice that only certain atmospheric conditions are suitable for the purpose. I have myself noted that warm evenings with a little wind are most suitable for the "assembling" of moths such as *Iodis vernaria* etc., a condition one might suppose favourable to the diffusion of the scent. Writing of "assembling" with *Amphidasys prodromaria*, Mr. Hope Alderson says:—"I have seldom found the same ♀ of much use on the second night" and "one slightly windy night I attracted a good number of males, and took the same ♀ on the following evening, which was quite mild and warm contrasted with the previous one. I waited by the bag fully two hours without any result" ('Ent. Rec.,' i., p. 18). These statements appear to point conclusively to two facts,—first, that the males are attracted by some scent, or why should not a virgin ♀ be as attractive on the second night as the first; secondly, that the odour is only of brief duration in this species and soon disappears. Two dozen male *Stauropus fagi*, were attracted on one evening by a single female by the Rev. Bernard Smith ('Ent. Rec.,' vol. i., p. 67), whilst almost every record of "assembling" gives some hint as to some odour being the attraction. Thus Mr. J. E. Eastwood records the capture of nine males of *Bombyx rubi* in a few minutes, attracted by a female *in cop.* which proves that "sight could not have led the males there," whilst Mr. Robson records male *Hepialus sylvinus* flying down to the sand, to a spot whence a female had emerged, the scent probably remaining sufficiently to attract the males, and Mr. A. Robinson refers to the fact that species of *Sesia* will not attract the males unless "restless" and "excited." Possibly here, the scent is only diffused by the movement of the wings. This would account for the fact that "restless" females attract readily, whilst lethargic females fail to do so. It is beyond question, at any rate, that these scent receptacles or glands are of direct sexual value, and that certain butterflies and moths do emit odours. Scudder says that they are "in a large measure confined to the male sex, and are emitted through microscopic canals, which course through microscopic glands at their base within the wing membranes." On the contrary, in moths, I believe they are chiefly confined to the female sex, and I will take Scudder's own illustration to prove my point. He says:—"Since these insects emit odours, they must also be able to perceive them. The males of certain species among the *Bombycidæ* will, of an evening, enter in great numbers an open room, within which a female of the same kind has been disclosed from its cocoon, entirely out of sight and often at a great distance from her visitors. It is plain, that in instances of this kind, known to every entomologist and too numerous to mention, the sense of smell must be the sole directing agent" (pp. 1051-1052). Just so, but surely it will be granted that it is the females in these cases that attract the males. It is the females that are hidden. It must be the scent from them that guides the males to their hiding places. In many of these instances, certainly, there is no odour which is perceptible to us, but it appears beyond question that they have a delicate sense of smell by means of which they can detect odours altogether inappreciable as far as we are concerned. But the male does sometimes attract the female. It is the male *Hepialus hectus*, that gives out its pineapple scent whilst gently hovering, and attracts the female, which, when she comes within the scented area, flies against

and touches him, the two at once dropping to the ground to pair. Messrs. Barrett and Robson have both recorded observations connected with this. The females of the allied *H. lupulinus* and *sylvinus*, however, stand on a grass stem and appear only to exert their attractive influence on the males (quite an inversion compared with *hectus*, and yet following the general rule), when, with rapidly vibrating wings, they apparently give out an odour which speedily attracts their mates.

The presence of these scent glands and patches being beyond doubt, it now becomes necessary to classify them. It would appear that they might be readily sub-divided into the following 3 classes:—(1). By the ♀ to attract ♂, rarely (if ever) perceptible by man. It is very possible that this scent which appears to be common to most species, is in direct connection with the primary sexual organs, but not certainly so. In those species as *Hepialus lupulinus* and *H. sylvinus*, in which the female usually rests with quivering wings to attract the male, it is very probable that special organs are actually used to secrete certain odours, and that the movements of the wings help in the diffusion. (2). By the ♂ to attract ♀ as in *Hepialus hectus*. This has already been fully dealt with and is a most remarkable case. (3). By the ♂ to charm ♀ who is discovered by vision, the special scent glands being microscopic and often grouped into special organs in various positions in different groups. This takes place in most butterflies where "sexual selection" probably occurs more frequently than in moths, in fact, it must be a very rare occurrence in the latter. Butterfly courtship (as we suppose it) is pretty well recognised, the ♂ finds the female by sight then flutters around her, pursues her, endeavours to charm her and often fails, having to repeat the process over and over again. It has been suggested to me that it is quite possible that the male odours from the scent structures before mentioned, add a hypnotic influence to the others exerted by the male over the female. It would seem also that almost all butterflies (♂) are scented by "androconia" and that the various patches etc. are special arrangements, or, as it were, local developments of these. (4). By both sexes to repel enemies. This, and No. 3, are the chief cases to which Fritz Müller draws attention. He assumes that the special scent glands found in both sexes are of this character, and it is very possible that his view is correct.

(3) Absence of Wings.—In other families where there is a vast disparity between the sexes, it is usually the female which is the more highly developed, but in lepidoptera, the complete or partial absence of wings is generally (always?) associated with the female sex when such a phenomenon occurs. Apterous and semi-apterous females are therefore well known in this order and we will now look at some instances. The British genera which exhibit this peculiarity most strikingly are as follows:—*Orgyia* in the *Liparidæ*; *Phigalia* and *Nyssia* in the *Amphidasydæ*; *Hybernia* and *Anisopteryx* in the *Hybernidæ*; *Cheimatobia* in the *Larentiidæ*; *Tortricodes* in *Aphelidæ*; *Lemnatophila*, *Exapate*, *Diurnœa* and *Epigraphia* in *Epigraphiidæ*; *Talœporia*, *Psyche*, *Solenobia* and *Psychoides* in *Psychidæ*. The females of the species in these genera are remarkable not only for the fact that they are apterous or semiapterous, but that their bodies, compared with those of the males, are exceedingly large, and it becomes evident that

the quantity of food etc., which has gone to the production of the wings and external structures in the male has been utilised in the development of an excessive reproductive system in the female, and it is also noticeable that most, if not all, apterous and semiapterous females are capable of producing a large number of ova. In relation to this matter of size Dr. Chapman has pointed out that *Orgyia antiqua* female larvæ have one more moult than the male larvæ.

It is a recognised fact that all animals have some means of escape from their enemies, and that the female requires such special means more than the male. It is also noticeable that many of the apterous and semiapterous species occur in the winter or early spring when the trees are bare and when the males become exceptionally conspicuous. The females also of such as occur in the winter or early spring, move about rapidly from place to place and hide in nooks and crannies into which the male with his wings could not possibly enter. On the other hand, the females of *Orgyia, Psyche* etc., emerge in the summer, are scarcely able to crawl at all, have scarcely any means of locomotion, do not hide in crannies etc., but lay their eggs and practically die in the spot where they emerge. Here then are two distinct groups which require separate consideration. They, however, resemble each other in having similar means of planting their young in the world. They produce many ova. Those that emerge in the spring or winter lay their eggs in the crannies of the bark, twigs etc., at a time of the year when they are much exposed and have to leave them largely to fate. The great number of eggs they lay is their only chance in the struggle for existence and they accordingly lay them. But herein the two groups differ. The females of *Nyssia, Hybernia, Anisopteryx, Exapate*, etc., search for these crannies to lay their eggs; but a suitable egg-laying place for the female has to be found by the larva in *Orgyia*, still more being left to chance in *Psyche* where the supply of ova, however, is practically unlimited owing to the parthenogenetic reproduction which takes place in this group.

Let us look now at a few details in certain species which can be taken as characteristic of the rest. *Orgyia antiqua* flies rapidly in the sunshine at a time when insect-eating birds are most abundant, his rapid flight undoubtedly aiding him in protecting himself. The female with her large body cannot possibly be protected in this way. To fly with the rapidity of the male she would require an immense wing area owing to the weight of her body. She, therefore, has to hide, and the hiding place is provided when she is in the larval stage. Her wings are useless and would betray her. In her apterous condition, seated on her pupal web after emergence she looks so exactly like a spider that only practical entomologists recognise her; she lays her eggs in the web and never stirs. To carry the matter a step further, the eggs hatch a few at the time throughout the season, so that it is scarcely possible for a whole batch to fail as they might sometimes do if they all hatched together owing to climatic causes &c. As an example of the "Winter Moths" let us take *Anisopteryx æscularia*. The male of this species is wonderfully protected. With its slender body appressed closely to a twig, and its wings folded carefully round it, it is almost impossible to detect him. The female with its large body would become very conspicuous in a similar position.

It has also to seek for a place to lay its eggs. Wings would keep it on the outside of the thick bushes and hedges it frequents, but the absence of wings and its well-developed legs enable it to crawl rapidly over the twigs of its food-plant in search of a suitable twig on which to lay its eggs, and to hide during the daytime in such corners and crevices as the trees and bushes afford. Males of *Diurnœa fagella* appear to have but little protection beyond that which their colour give them in connection with the resting place they choose. The female again with its large body, would with wings be still more conspicuous. But the female rarely appears to emerge before dark, and then crawls rapidly up the tree-trunks where the males are resting and copulation then takes place. By the morning the females are gone, probably to the upper branches where they hide and lay their eggs, and are rarely seen again, the more conspicuous males remaining still on the trunk below. The habits of *Psyche* are essentially different. Protected by their cases as larvæ, the males on emergence fly rapidly in the sunshine, and fall down into the grass or herbage when disturbed or when the sunshine fails, and in this way receive some measure of protection. The females, on the other hand, are but little different to the larvæ and remain in their cases. The males are provided with strongly pectinated antennæ to enable them to find the females, but their time of flight, and I believe the period of their existence is very limited, and it happens that the females are able, without copulation, to lay large numbers of fertile eggs and to produce parthenogenetically, vast numbers of offspring, although it is assumed, and I believe rightly, that males are never produced from the parthenogenetic ova and larvæ. It may, of course, be urged that in a state of nature under this arrangement, the ♂ must inevitably become extinct in a few generations, and in some species they may probably have almost done so. But there appears no reason to suppose but that parthenogenetically-derived females may be fertilised by a male so as to produce a further supply of males and the production of a very few males per year would necessarily be sufficient to keep that sex from becoming positively extinct. It is remarkable that in most species of *Psyche* and their allies, however, that a large proportion of cases give nothing but females, an occasional male being all that one usually breeds out of a very large number. Here then is a class distinct in itself, and differing from *Orgyia* on the one hand, and *Hybernia*, *Nyssia* and *Diurnœa* on the other; but the analogy between *Psyche* and its allies and *Orgyia* is much stronger than between either of these and the other genera just mentioned. The analogy between *Nyssia*, *Hybernia*, *Diurnœa* etc., is, however, very close indeed. To sum up then. It is the character of *Orgyia* to spread itself about by wandering in search of a place to pupate in. It has also found out that the eggs passed the winter more safely and were better protected by being laid on the cocoon or web, the web keeping them away from wet surfaces &c. The eggs, also, are largely protected by their hard shell, although they are severely attacked by a minute hymenopterous parasite. The necessity that the genera should lay a large number of eggs is, therefore, self-evident. The female had no actual use for wings and they gradually atrophied, possibly because they had not only become useless, but would actually serve to attract

enemies rather than otherwise, possibly because nature expended the energy and force necessary to produce them in providing a large supply of ova, nature never expending force in useless directions. *Psyche*, of course, is somewhat analagous, until we reach the point that it lays its eggs *in* the case and can reproduce itself parthenogenetically. In *Hybernia, Cheimatobia* &c., the matter is different and probably the female is apterous for greater facility in hiding. When the leaves are off the trees, insectivorous birds have an immense advantage, and they have also to search in the winter much more keenly for a supply of food. The males are protected by their resemblances to dead leaves &c., the females with their large bodies could not thus readily protect themselves (compare the sexes of *A. æscularia* in nature). At the same time they produce very many eggs and the use of almost all energy in this direction may have some effect. These females are also active walkers etc., and can get into crannies and so on, quite the reverse to those of *Orgyia* and *Psyche*. The two classes in fact, appear to have nothing in common in this direction. Before leaving this subject, it would, perhaps, be well to mention the case of *Biston hirtaria*, a species closely allied to the apterous genera *Nyssia* and *Phigalia*. This is a species the female of which has much the habits of the apterous species, crawling over the trunks of trees, rarely flying, and laying its eggs in crannies &c. There is frequently a tendency to partial atrophy in this sex, and its connection with the apterous condition of its allies has been mentioned by more than one writer. Possibly I should not leave the females of *Psyche* without some further reference to their wonderful power of parthenogenetic reproduction, but a full account of parthenogenesis would evidently be out of place here.

Geddes and Thomson say, referring to the essential difference between the male and female *Coccus* :—"This is not a mere curiosity of the entomologist, but in reality a vivid emblem of what is an average truth throughout the world of animals—the preponderating passivity of the females, the predominant activity of the males;" and again he writes :—"Throughout the class of insects there are numerous illustrations of the excellence of the males over the females, alike in muscular power and sensory acuteness. The diverse series of efforts by which the males of so many different animals, from *Cicadas* to birds, sustain the love-chorus, affords another set of illustrations of pre-eminent masculine activity." The females of *Psyche* reach among insects the extreme development of passivity. As larvæ, pupæ and moths the females never leave the cases which serve as a protection during the larval and pupal stages and as a *nidus* for the ova of the imago.

(4). Size.—In close connection with the consideration of apterous and semiapterous females, is that of size. We have before noticed that some species lay but few eggs, and take great care of them, whilst others lay large numbers and leave them largely to chance. In the first group we find the females differing little in size from the males, and in some genera *Acronycta, Orrhodia* &c., there is little even in the relative sizes of the abdomina to tell which specimens are males and which females; but among those species which lay a large quantity of eggs, we find some whose females fly actively, whilst others are

comparatively lethargic. Where the females are lethargic, the larger body necessary to the development of a large number of eggs is not accompanied by a correspondingly larger wing area, but in a small measure, the conditions of the apterous females are followed and the wings are frequently comparatively small. Many such examples readily occur as in *Lithosia pygmœola, Euchelia jacobœæ, Nemeophila russula, N. plantaginis, Ino statices, Nudaria senex, Setina irrorella, Cœnobia rufa, Tapinostola fulva, Chortodes bondii, C. arcuosa, Stilbia anomola, Acosmetia caliginosa, Hydrilla palustris, Rusina tenebrosa, Epione parallelaria, Halia brunneata, Scodiona belgiaria, Selidosema ericetaria, Ematurga ato maria, Aspilates strigillaria, A. gilvaria, Mesotype virgata, Cledeobia angustalis, Scopula alpina, Chilo phragmitellus. Crambus salinellus, Eridopsela fractifasciana, Catoptria cœcana, Aphelia osseana, Pleurota bicostella* and very many other species besides. In those mentioned, however, there can be no doubt that the less activity of the females is accompanied by a more or less atrophied condition in the development of the wings, or the wings are not developed proportionately to the extra development of the body. But this condition of things is the exception, and only shows us the connection between habit and actual effect. In lepidoptera, generally, the females are not particularly lethargic but almost as active as the males, and hence the females with their proportionately heavier bodies have a greater wing area, and are altogether larger than the male. To write the names of those lepidoptera in which this is so, would mean writing a large part of the British fauna. I will therefore only give a few examples. Among the butterflies, *Apatura iris* is perhaps the most striking illustration, whilst among the moths *Endromis versicolor, Saturnia carpini, Lasiocampa quercifolia, Bombyx quercus, rubi, castrensis, neustria, Eriogaster lanestris, Odonestis potatoria, Cossus ligniperda, Zeuzera pyrina, Hepialus sylvinus, velleda, Arctia caia, Ocneria dispar, Heterogenea limacodes, Stauropus fagi, Nonagria typhœ, N. lutosa, Neuronia popularis, Angerona prunaria, Metrocampa margaritaria, Cataclysta lemnata, Paraponyx stratiotata, Galleria mellonella, Melissoblaptes bipunctanus, Aphomia sociella, Ptycholoma lecheana, Sciaphila nubilana, Orrhotœlia sparganella, Leioptilus microdactyla* etc., are striking examples from the different families, which illustrate this general rule. The females of *Arctia caia, Spilosoma lubricipeda, S. menthastri* and many other species just mentioned, pair where they emerge, or after a very trifling flight. They then lay a batch of eggs where they pair, and so are much lightened for the future flights they take, and this appears to occur very frequently in large and heavy-bodied moths even with a good wing expanse. Geddes and Thomson write:—"Among insects, the more active males are generally smaller, and often very markedly," although it is doubtful whether they understood to what actual extent this was so. It will be thus seen that "size" is frequently a marked secondary sexual character, although the greater or less size may belong to either sex in different families. Geddes and Thomson consider this difference of size due to a more sluggish conservative habit of body in the female, but does this really reach the root and basis of the subject. Is not this a self-evident statement rather than a real probing as to the actual cause? In our insects, is not the larger size of the body of the female due essentially to the large size and weight of the ovisacs

and space occupied by the ova compared with the rest of the body, and the greater wing area due to the positive necessity of larger structures to carry the greater weight when the female shall fly for the purpose of oviposition, and still further would "a sluggish conservative habit of body" affect the size of the imagines at all, considering that this (size) is positively determined in the larval stage, long before the perfect insect has a separate existence and therefore "conservative habits" to indulge in? I fail to see its effect in our lepidoptera, as the larvæ which produce females, as a rule grow somewhat larger than those which produce males, but I have never noted any difference in habit in the larvæ which produce the different sexes, except in one instance, that of *Orgyia antiqua*, and then in that species, the female larva wanders about immense distances to pupate, but its more active habits do not prevent it producing a moth with an immense body compared with that of the male. As to difference in the size of the larvæ which are to produce males and females, Dr. Chapman has recorded that *antiqua* female larva has one more moult than the male larva, and that the male nevertheless is longer in pupa than the female. Probably this occurs in other species.

(5). SHAPE.—The shape of the wing is occasionally a secondary sexual character and is sometimes very marked, although it must be confessed that shape is generally rather comparative than absolute and to a certain extent dependent on sexual variation in size. The male *Lycœna astrarche* is narrower-winged than the female; in *Hepialus sylvinus* and *H. velleda*, the wings of the female are larger and broader; in *lupulinus* and *hectus*, longer but narrower in comparison than those of the males; whilst in *Neuronia popularis*, *Galleria mellonella* and *Aphomia sociella*, the wings are much broader and more ample in the female; the female of *Nonagria neurica* has a more pointed wing, and so usually has the female of *Viminia albovenosa*. The same character is essentially well-developed in *Chilo phragmitellus*, *mucronellus* and *Cledeobia angustalis*, but whilst the first mentioned generally has the pointed character allied to a greater wing area, the last has the wings much less ample in the females than in the males. The females of *Chortodes arcuosa*, *Stilbia anomola*, *Hydrilla palustris*, *Rusina tenebrosa* and *Scopula alpina* have small square wings compared with the exceptionally full and ample wings of the males. Although striking instances of difference in the shape of the wings in the two sexes are comparatively rare among our British species of lepidoptera, some of the tropical butterflies give examples which are extreme. Among the American lepidoptera Scudder mentions that *Chlorippe* in the female has "the hind wings full and rounded, while those of the male are angulated, the outer margin being nearly straight;" the fore wings of the male of *Strymon titus* have "pointed tips and the hind wings have the inner angle sharply defined, while in the female, both the tip of the fore wings and the inner angle of the hind wings are broadly rounded." I have before mentioned that sexual difference in shape is to a great extent coincident with sexual difference in size. This is especially noticeable among our Bombyces, among the NOCTUÆ,—*Neuronia popularis*, *Noctua umbrosa*, *Hydrilla palustris*, *Agrotis cinerea*, *Rusina tenebrosa* being examples,—whilst the difference in the shape of the wings of the males of *Galleria mellonella* and *Aphomia sociella* are very re-

markable, the broad winged females having lost almost entirely the angulations on the margin which are so conspicuous in the males of these species.

(6). Scale Patches in the Male.—Besides the "scale patches" referred to in certain "hairstreaks" under the head "venation," Scudder also records them in certain species of the genus *Eurymus* (*Colias*) at that "part of the base of the hind wings which is always covered by the fore wings." In the males of *Anosia plexippus* and some of its allies "next the middle of the lower median vein of the hind wings" there is a thickening of the membrane coarsely covered with black scales. In *Laertias philenor*, the inner border of the hind wings of the male is folded back upon itself, concealing what Scudder calls "some pure white floss-like scales and hairs which are apparently exposed at the will of the creature when it is moving forward in its flight." But we have illustrations in our own fauna. Take for example the *Argynnidæ*. In *A. paphia*, if we compare the males with the females, we find the nervures of the fore wings densely clothed with scales, so dense in fact as to give a very decided appearance of thickening to the nervures of the whole of the wing. The same holds good with *A. adippe*, and it is remarkable that in a male specimen which Dr. Chapman brought from the Pyrenees, the character was more marked than is usual in the males of this country. Then there is the tuft of black scales in the centre of the fore wings, extended into the form of a longitudinal streak, so characteristic of some of our "skippers" as in *Pamphila sylvanus*, *linea*, *lineola* and *comma*, whilst Scudder says that "a faint oblique patch of minute and crowded lustreless scales, accompanied by long silky hairs, is often seen crossing the wings of some of the *Satyridæ* or "meadow browns." Indeed we might readily find numerous further examples among our own fauna. The males of *Eucosmia undulata* have a striking patch of scales on the hind wings, whilst thoracic crests and crests on the abdominal segments are frequently better developed in the male than in the female. Certain genera of Noctuæ too, have a remarkable pencil of scales coming out from the abdominal part of the first segment. This was first noted by me in a species of *Mamestra*, but as I made no note at the time, I will quote an observation recently made by Dr. Chapman on *Xylophasia rurea*. He writes:—"In a male *X. rurea* that emerged to-day, I found a remarkable plume of hairs under the abdomen on each side. It took its origin from a small fleshy projection immediately behind the first abdominal spiracle, apparently its posterior lip, passing in a waved line towards the middle line beneath, and then outwards again. The ends of the hairs were enfolded in a slit in the side of the fourth abdominal segment at about the spiracular line. When set free from this slit the extremities spread out somewhat in the fashion of a fan" (*in litt.*). Then there are again the scale tufts which are so strikingly characteristic of the "fan-footed waves," a portion of the genus *Acidalia* in which the hind tibiæ of the males are developed into pencils of hair. Such are found in *Acidalia bisetata*, *remutaria* etc. Similarly developed tufts occur on the front legs of certain Deltoides, as *Herminia cribralis*, *H. barbalis*, *H. tarsipennalis* etc., whilst the anal tufts characteristic of *Scotosia rhamnata*, *vetulata* etc. appear to be so intimately connected with the primary sexual organs that they should hardly find place here.

(7). Folds of the Wing Membrane.—These are not at all of uncommon occurrence in the males of certain species, and are frequently closely connected with scale patches, the peculiar fold in *Laertias* on the inner border of the hind wings of the male which covers a patch of scales, having been already referred to. In our British families, the Tortrices exhibit the character most markedly along the costa of the fore wings. In the males of many species in this group the membrane is folded back on itself and thus increases the wing expanse very strikingly. This character is not even of generic value, the males of most closely allied species being without or with this peculiar development, although Wilkinson founded his division *Plicatæ* on the character. It is remarkable, however, that the males of most of the folded species are remarkably active and the greater wing expanse may thus be of service. Such examples occur in many species of the genera *Tortrix* and *Dichrorhampha*, *Ptycholoma lecheana* etc. Closely allied to the folds of membrane on the margins of the wing is the presence of an extra winglet or lobe attached to the base of the normal hind wings in the species of the Geometrid genus *Lobophora*. These are of the same membranous structure as the hind wings, and in *L. sexalisata* and *hexapterata* are fringed and very conspicuous. These two species also fly very rapidly in the evening over the tops of tall bushes etc., and as the hind wings are unusually small, the suggestion at once occurs that the extra wing area is needed to aid their flight.

(8). Venation.—We occasionally find the venation giving traces of sexual dimorphism, but venation is in itself so variable a factor that many exact experiments are needed to show which aberrant forms are due to chance, and which are the result of sex. In genera such as *Aphomia* where the cell of the fore wings differs in size, there is a distinct sexual difference in the venation. Scudder says:—"The difference in the direction of the veins of the wings in the sexes is slight, and concerns the point of origin of one or two of the upper branches of the sub-costal vein of the front wings; but occasionally it is very marked, as in many of the "hairstreaks," where the branches of the sub-costal vein near the end of the cell are thrown far out of place to accommodate a patch of peculiar crowded scales. This patch itself, moreover, is a feature of the males alone and occurs in many "hairstreaks," where the position of the vein is not altered" (p. 872).

(9). Legs.—Sexual dimorphism frequently exhibits itself in the structure of the legs. I have previously referred to the development of tufts of scales on the hind legs of certain species in the genus *Acidalia* and to somewhat similar tufts on the fore legs of the species of *Herminia*. The aborted hind legs of the male of *Hepialus hectus*, which is supposed to be a scent gland, has also been previously mentioned. In many species, as *Lobophora*, the spurs on the hind legs of one of the sexes are absent or aborted, whilst the essential difference in the structure of the fore legs of the sexes in the *Erycinidæ*, *Lycænidæ*, and *Nymphalidæ* is well known. Scudder says:—"Sexual dimorphism shows itself in the legs,—in the proportional length of the different pairs in the two sexes, in the special development of certain joints, in the appendages and in the clothing. It appears remarkably in the appendages of the two higher families of butterflies *Nymphalidæ* and

Lycænidæ, and especially in the latter family, where the terminal appendages of the fore legs are nearly or quite lost in the males, and are as conspicuous as on the other legs in the female. I have not discovered that the differences in the leg-joints follow any general law, although there are few of our butterflies whose sexes do not vary in this particular; this form of antigeny is also most conspicuous in the *Lycenidæ*. The males of certain Chrysophanidi (*Chrysophanus* etc.), also present another curious feature in the tumid swelling of the basal joint of the middle and hind tarsi. Finally the fore legs of the males of *Nymphalidæ* are frequently furnished with a spreading brush of hairs; or, in other butterflies, the thighs and shanks of the middle and hind legs are supplied with curious pencils or fringes of stiff hair, which appear to have the same significance as similar adornments in higher animals" (pp. 873-874). There is also the excessive difference in the legs of apterous species of the nature of *Orgyia* and the *Psychidæ* (not *Nyssia*, *Hybernia* etc.), in which there appears to be no need to walk, and in which nature certainly has expended no waste energy in providing them with legs suitable for the purpose.

(10). Colour.—By far the most striking secondary sexual character found in lepidoptera is that of colour. It is, of course, particularly noticeable in, but by no means confined to, the day-flying species. Many species have the males brilliantly coloured in comparison with the females, but frequently both sexes are equally brilliant or the reverse, but I cannot call to mind a single instance in which the female is more brilliantly tinted than the male, although Scudder mentions a South American genus where this is so. According to Darwin, this excessive beauty on the part of the males in those species in which it occurs is due to "sexual selection," the females having "by a long selection of the more attractive males, added to their beauty or other attractive qualities," whilst he further states, that in instances where "the males have acquired their present structure, not from being better fitted to survive in the struggle for existence, but from having gained an advantage over other males, and from having transmitted this advantage to their male offspring alone, sexual selection must have come into action." Now we are met on the threshhold with the question—Has our study ever exhibited any illustrations that females in any way selected or made a preference in selecting their mates, or that "females select the more attractive males" at all? I doubt it most positively in the case of moths, and to a large extent even in butterflies. But that there is some little action in particular instances seems very probable, and it is in certain butterflies that this takes place more frequently than in others. In *Pieris*, one frequently sees a male flutter around a female, fail to win her affections at once, and repeat the operation, and generally fly away altogether. I have generally assumed that in such cases the female has already been fertilised; but assuming this is not so, I have, even in the common *P. rapæ*, where this is so noticeable, seen a male pair with a female before her wings have become dry. However, it is impossible to deny that some preference may, in some instances, be shown by the female and that "sexual selection" thus occurs. It must be further borne in mind that it is in butterflies especially that the males are more brilliant than the females, running into other colours and even sometimes taking

other patterns. Amongst moths, however, cases of "sexual selection" must be very rare, although the observations of Dr. Chapman and Mr. Robson, go far to suggest that the female of *Hepialus humuli* positively selects a male which is either conspicuously large or white. However, I do not believe that "sexual selection" is so widely or extensively carried on by female lepidoptera as has been generally supposed. Certainly in those lepidoptera which have come under my notice it is not so. I have repeatedly observed that females, as soon as they have emerged from the pupa, and before their wings have become fully developed, have paired with the first male that has offered itself, the sexual attraction having overcome all sexual preference, which could hardly exist in females just emerged and with their wings undeveloped. One finds wherever any species abounds, as in the various *Lycænæ*, wretched little males in copulation with large well-developed females and *vice versa*, whilst dozens of well-developed specimens are everywhere around. In fact, the ordinary quiescent condition of the female compared with the male at this time, leads one rather to suppose that the female is generally quite a passive agent in the matter, although I am quite ready to grant that when attractive-looking males do pair with well-developed females, heredity will stamp the characters of such a male and female on the offspring. I quite agree too, with Geddes and Thomson, when they write that if "a casual variation, advantageous to its possessor (usually a male) in courtship and reproduction becomes established and perfected by the success it entails," then "'sexual selection' is only a special case of the more general process of 'natural selection,' with this difference, that the female for the most part takes the place of the picking and choosing which is supposed to work out the perfection of the species." Whilst Darwin thinks the beauty of male insects &c., is due to selection on the part of the female, Wallace considers that the sober colours of female insects are due to "natural selection" and have been the means of their preservation, since it ("natural selection") has eliminated those individuals of the latter sex that are most gay by making them conspicuous to their enemies. In other words, as Geddes and Thomson put it:—"Darwin starts from inconspicuous forms, and derives gorgeous males by "sexual selection;" Wallace starts from conspicuous forms, and derives the sober females by "natural selection;" the former trusts to the preservation of beauty, the latter to its extinction." I cannot certainly bring myself to believe in the ability of the female to carry out "sexual selection" to the extent assumed by Darwin. At the same time I believe to the fullest in "natural selection;" and really the study of at least some of our lepidoptera is greatly in support of Wallace's view of it. No group of our butterflies exhibit more marked characters than the *Lycænidæ*. In those species where both sexes are alike, both are generally brilliantly coloured, as in our common *Polyommatus phlæas*; in those species where the sexes are permanently different (dimorphic), the female is of the duller colour; but in those species in which there is a transition state, the male is the constant, the female the inconstant element, as in *Lycæna corydon*. In this species, the male is always blue (or in southern countries approaching white), whilst the female varies in tint, from a brilliancy almost equal to the male to a dull sooty-black with no trace of blue in it, and this is the

most common form. *Lycæna icărus* and *L. adonis* present a range of sexual variation identical in character. According to Darwin's theory, we have in these species, to assume that the males and females were all originally brown or black, that blue has been gradually assumed by the male until such a point has been reached that it is positively permanent and invariable, and that it has then transmitted the colour, in part, to the female. Here we are at once met with this difficulty. Brown or black being the original colour, there must always have been and still be a strong hereditary tendency for this original colour to be present in some way or other, but as a matter of fact it never occurs in the male, and it is difficult to suppose a species, shown to be in a transition state as regards the female, never to show traces of reversion in the male. On the other hand, Wallace's hypothesis that the more brilliant was the original colour receives almost certain confirmation. By his hypothesis, that sex (♂) which remains constant, is the one which is assumed to be of the original colour, and the large percentage of dark females is sufficient to show the power of "natural selection," whilst the large number of females with blue in them is satisfactorily explained by supposing simple hereditary influence and reversion at work. Certainly the more conspicuous blue coloration is a disadvantage to the female, and I altogether incline more to a general acquiescence in Wallace's view than to that of Darwin. There is still another point. The greater number of *Lycænid* species, especially in tropical countries, tends to have the dimorphism less marked, and the males and females are then more or less equally blue. Such is also the case with our own *Lycæna ărgiolus, L. arion, L. bœtica* &c. There is no opposite result as we go north, for although a few species, as *Lycæna astrarche*, have both sexes of the characteristic female form, yet they are so in every latitude, and it must be borne in mind that the males of *icarus* etc., are as constantly blue in Shetland and Scandinavia, and the females as variable as with us. In *Argynnis, Colias* &c., the same holds good, the male is the permanent, the female the variable form.

It appears to me that colour in relation to the sexes may be classified as follows:—(1) Male smaller and darker (more strongly coloured and scaled) than the female, *e.g., Bombyx quercus*. (2) Male larger and paler than the female, *e.g., Agrotis cinerea*. (3) Male smaller and paler than the female, *e.g., Hepialus humuli*. (4) Male larger and darker than the female, *e.g., Epione vespertaria*. Of these, I take it Nos. 1 and 4 are practically identical, and whether they belong to Nos. 1 and 4 depends on the habits of the female, the more active females going to Class 1, the more lethargic to Class 4. These would I think together comprise a very large percentage of the British fauna. In Class 2 the female is smaller, and unlike the few females that fall in Class 4, generally produce proportionally fewer eggs. They fall, too, largely among the Noctuæ and species that rest on or near the ground and hence much of the prevailing dark tint in the females is probably due to "natural selection;" it must also be considered that the tint of the male though paler is often richer than that of the female, in which case it is of the same genetic value as the colour in Class 4. Class 3 is generally due to some individual pecularity, explicable in the case of *H. humuli* by "sexual selection," in the case of *Fidonia piniaria* by "natural selection," most of the instances in this class probably coming

under one of these two heads; at any rate it appears the male is small and pale in this group by special selection in relation to some special habit. At the same time such species as *B. neustria* falling in Class 3, actually belong to Class 1, the pigmentation of the male, though pale etc., being richer than that of the ♀. As to the richer colours in the males of Class 1 it may occur in this way. Each individual succeeds in elaborating so much colour. The male generally being smaller is able to concentrate it more, the larger female has to spread it, *e.g.*, in one or two species of the *Hybernidæ* that have measureable wings as ♀'s, these are usually much darker than those of the males, and it was very remarkable that when Dr. Chapman and I searched for *Diurnæa fagella* this year we found the females darker than the males. This looks as if the male could dispose of the excess of pigment in his larger wings the female being unable to do so. It must be understood however, that it is not intended here to suggest that each ovum during its life produces so much colour, and that when it is decided that it is to be say a ♀ (of large size) it has then to spread that colour over a larger area, but that such a tendency is inherent; probably when the female first grew a larger wing, the membrane was slightly expanded, without increasing the number of scales and therefore became paler than the male, and *vice versa* in those females with smaller and darker wings. In Class 2 where the scales in the ♀ become more concentrated, one can understand that if "natural selection" found some advantage in this the female would become larger and paler constitutionally. In Class 2 also, as *Euthemonia russula, Agrotis cinerea, Agrotis puta, Rusina tenebrosa, Lithosia pygmæola* etc., although we find the female smaller and darker we have to bear in mind that the paler males, like many butterflies (*Lycæna*) &c., are in reality more richly coloured and have a greater amount of pigmentation, and if we accept Wallace's theory that the darkness of female coloration in these butterflies is due to "natural selection," it becomes much more easy to accept the same theory (and I think it is really the true one), with regard to these moths; and if the males here are really more richly coloured although in reality paler, it quite agrees with the physiological explanation of the origin of the matter which I propose offering. Not that any general rule is likely to meet each individual case but certainly a general explanation appears now to be becoming quite possible. It is quite probable that once the colour has been actually set up as a distinct secondary sexual character as in *Bombyx quercus, B. rubi* etc., and the habits of the sexes differ very much, "natural selection" steps in, and the sexes tend to vary independently, almost as if they were different species, but less readily no doubt, each attempting as it were to carry the other with it. Summarising then, I think that Classes 1, 4 and 3 (in part) have almost the same origin. Class 3 (in part) consists of special cases. Class 2, females darker because smaller, *i.e.*, larger males require more energy for wing membrane. Now it appears to me that the explanation of these "secondary sexual characters" relating to colour, are to a certain extent and at any rate in particular instances, explicable on physiological grounds. Every field naturalist is aware that the larvæ of the sexes are not very different in size and that large larvæ frequently produce males, and small larvæ, females. It is also now fully recognised that colour is probably the result of sur-

plus energy stored up in the larval stage and differentiated in the pupal stage. It appears to be abundantly clear that the energy stored up by the female larva has more outlets, so to speak, than that of the males, and the formation of the ovaries and ova &c., really a large part of the female imago, must absorb a very large percentage of such energy. In some species, already referred to under the head of "apterous and semiapterous females," the demand is so great as to absorb even that part which normally goes to form the wing membranes, scales &c., but apart from these extreme cases, the reproductive system normally makes a large call to which there is nothing corresponding in the male. The surplus energy in the male must therefore be utilised in other directions, of which ornament, as exhibited by colour etc., appears most certainly to be one, and it is remarkable that in a very large percentage of cases, as in *Lycæna icărus, corydon* and *bellargus* only the most robust female specimens are tinged or affected with the blue colouring which we have now grown accustomed to look upon as particularly connected with the male. The female *helice* var. of *Colias edusa* may be looked upon also as a female form in which there is a minimum of surplus energy to form pigment. I would also notice that the only male in which I have observed a tendency to this colour was small and undersized evidently a product of constitutional conditions. With regard to colour as a secondary sexual character Geddes and Thomson write:— "That the male is usually brighter than the female is an acknowledged fact." This certainly is so in lepidoptera. They then say:— "But pigments of many kinds are physiologically regarded as of the nature of waste products." This also appears to be so in lepidoptera, restricting the term "waste products" to that "surplus energy" which is not utilised in the muscular and sensory structure of the organism. "Abundance of such pigments, and richness of variety in related series, point to pre-eminent activity of chemical processes in the animals which possess them. Technically expressed, abundant pigments are expressions of intense metabolism. But predominant activity has been already seen to be characteristic of the male sex; these bright colours, then, are often natural to maleness. In a literal sense animals put on beauty for ashes, and the males more so because they are males, and not primarily for any other reason whatever." These authors appear to me to have traced the actual facts through to their last degree and then failed, and their last statement is altogether un-understandable, and begs the whole question. The cause of "secondary sexual characters" seems to be neglected for there must be a reason underlying the whole which shall explain the origin of these characters better than stating "that the males put on beauty because they are males." Is their own suggestion, indeed, that the cause of these characters is to be found in a physiological explanation quite compatible with such a statement? If the pigments are of the nature of "waste products," is the reason not to be sought here? I do not doubt that the inherent tendency of these characters to develop in the male is present, but the "surplus energy" or "waste products" in the male organisation, compared with those in the female, seem to me the primary cause and to point to the fact that the material utilised for the development of ova &c., in the female, is modified in the male

to form pigments and other secondary sexual characters. Perhaps no insect will make this clearer than the purely dimorphic *Epione parallelaria* (*vespertaria*). The female is lethargic, has a large abdomen and produces a large supply of eggs, the wings are small and pale yellow in colour. The male is active, has a slender body, with large ample wings of a rich orange colour with purple borders. The larvæ of the males and females are of about equal size, the male excels in wing membrane and richly developed pigment, the female excels in the size of the abdomen. Is it not evident that the surplus matter in the male is utilised here in a given direction? *Fidonia atomaria* presents in the South of England a parallel case, the female large-bodied, with small wings of a whitish ground colour; the male slender-bodied, with ample wings of a rich ochreous-brown, sometimes almost orange in colour. In localities where their food is sparse, as on some of the Scotch moors, the males have no such active surplusage and closely resemble the females, the dimorphism being but little marked. There is of course a double action here, as the ♂ rests on the top of the heather, the female hiding nearer the ground, the latter being, also, more sluggish and retiring. The colour of the ♂ accords better with the heather foliage, that of the ♀ with the stones and undergrowth, but however much this "natural selection" and "heredity" will account for the intensification of a protective coloration, it will not explain its origin, which is, I believe, purely physiological. *Endromis versicolor*, *Bombyx quercus*, *Angerona prunaria*, *Chilo phragmitellus* are instances amongst very many others, in which the female is larger (owing to heavy body) but has much paler pigment than the male. But a paler pigment does not *always* mean a less highly developed one, although probably it does so in the cases just quoted, in fact, some striking instances of pale colours richly pigmented occur to me, *e.g.*, *Bombyx neustria* (yellow males); *B. castrensis*, in which the male is more richly pigmented and better scaled, and even brighter in general appearance although paler in coloration than the female, but such cases hardly appear to affect the general question, as they belong essentially to the same class as those previously mentioned in Class 1. I look on "bright coloring or rich pigmenting" as "a natural expression of the male constitution" only so far as the fact that a male larva well-fed, compared with a female larva equally well-fed will have a surplus of material which is utilised in the development of certain tendencies, present *ab ovo* in the organism, and which tendencies, well developed, become secondary sexual characters.

The influence of "sexual selection" in producing the brilliancy of male coloring, is admitted as a minor factor by Geddes and Thompson and so also is the "natural selection" of Wallace, and there is no doubt that both are factors, the former indirectly, and more, however, generally as the result of chance than through any selective faculty possessed by the female, although occasionally as in *H. humuli*, selection probably takes place; the latter more directly and actively as the result of every-day conditions tending to the survival of the fittest, by the protection of those females which are sober-coloured and unattractive, which are passed over by their enemies, and which therefore stamp their character more certainly on each successive brood by heredity. But the real basis must be sought for in the

peculiar physiological conditions of the sexes, and the necessity in one rather than the other, of utilising all the material for actual nutritive and vegetative processes in the female, leaving a surplus in the males, which, applied to the more actively reproductive organism (if we may so term the males compared with the more passive females), results in the production of distinctly secondary sexual characters. We find, however, as previously mentioned, examples where the smaller male is better scaled and more brilliantly coloured although paler as in *Bombyx neustria* ; and in cases where the female is smaller and darker, the male, having expended more energy in the formation of extra wing membrane, has less for pigment, but, at the same time, the pigment of the males in these cases is usually richer than that of the females, *e.g. Agrotis cinerea, Pachnobia leucographa* etc. With regard to colour as a secondary sexual character, Scudder, after quoting a large number of cases in which the sexes differ, says :—"It is not a little remarkable that in all these examples, and, indeed, in very nearly all that have come under my notice, this sexual diversity is displayed only upon the upper surface of the wings and almost invariably upon the fore wings. We might perhaps anticipate the restriction of the characteristics to the fore wings, and upon the upper surface the complication of colorational design is greater in butterflies on these than on the hind wings ; yet this same reasoning makes their restriction to the upper surface the more striking, since the under surface of the hind wings of butterflies is usually more variegated than any other part" (p. 531). One hardly likes to suggest that Scudder only made a superficial examination of the undersides but it seems probable. Where sexual colour dimorphism exists on the upper sides, it is so palpable that one cannot fail to note it, but on the undersides, the nice gradations of tint and shades of a hue responding to environment are exhibited in almost every species. In our few British butterflies we have many illustrations, and, where the undersides present no variation in the sexes, we find, as a rule, that the females are as active as the males, and that both are equally well protected by their coloration responding to their surroundings,—*e.g. Thecla rubi, T. w-album* &c. On the other hand *Melanargia galatea, Erebia blandina, Thecla betulæ, Lycæna corydon, L. icarus, L. bellargus* etc., exhibit strong and striking sexual colour dimorphism on the under surfaces, and it would not be difficult to make up a very long list of species thus varying. But such cases as these appear to me to be to a much greater extent the direct result of "natural selection" than does the colour variation of the upper sides. There is one particular phase of colour as a "secondary sexual character" that cannot be passed over. I refer to *Hepialus humuli.* Normally, the female is yellow or orange with red markings, the male pure glossy white, which has gained for it its popular name of "ghost." The males hover in the early evening and are remarkably conspicuous, frequenting open spots where they may be readily seen. This hovering and its connection with its white colour was explained by Dr. T. A. Chapman, who observed that the female flew against the male and then dropped, the male immediately following her down and pairing with her. I cannot help again remarking that here "sexual selection" comes into play, and the case is the more striking considering how rarely moths show it.

There is yet another phrase in the work of Geddes and Thomson which is best discussed as a whole than in parts. It is as follows :—"Brilliancy of colour, exuberance of hair and feathers, activity of scent glands, and even the development of weapons are not and cannot be (except teleologically) explained by "sexual selection," but in origin and continued development are outcrops of a male as opposed to a female constitution. To sum up in a paradox, all secondary sexual characters are at bottom primary and are expressions of the same general habits of body (or to use the medical term *diathesis*), as that which results in the production of male elements in the one case or female elements in the other." I quite agree with these authors that these secondary characters cannot be explained by the direct action of "sexual selection," but is it sufficient to say that they are simply the results of a male as opposed to a female constitution. In lepidoptera at any rate there appears to be some very good ground for supposing that these are transmitted from generation to generation, sometimes more perfectly developed than others, but still certainly transmitted. It is not so evident that secondary sexual characters are at bottom primary, except in the general way that they always accompany the primary sexual characters, a fact that makes them secondary characters, neither is it so clear that because an organism has in it the special requirements to develop a particular sex, which will be accompanied by other characters, that these latter are produced in the same way and on the same basis, although the two happen to be coincident in the same organism, for if we look on these ornaments from Wallace's standpoint as the "natural product and direct outcome of superabundant health and vigour," it is quite possible to assume and imagine a condition sufficiently differentiated to produce primary sexual characters without the superabundant energy necessary to produce the secondary characters. I really am not quite clear that in insects they are expressions of the same general habit of body, although I quite recognise the intimate connection between the two, but at the same time, of one thing I feel certain, that they are only the indirect outcome of maleness, inasmuch as only the male normally, in lepidoptera at least, has sufficient surplus energy to develop such secondary characters, the great mass of energy in the female necessary for the perfection of the ovaries and ova reducing the quantity left for such characters to a minimum. In cases where the females are in a transition state, as in some *Lycœnæ* (females developing blue scales, &c.), the females, although frequently possessing some of the male colour, are as frequently without it, the result probably being more or less directly dependent on nutrition.

(11). Secondary Characters connected with Oviposition.—These organs are so closely connected with the primary sexual characters that they should properly be omitted, but the interest attaching to them is so great, that this must be my excuse for briefly referring to them. They were recently discovered by Drs. Chapman and Wood, and consist of an apparatus, by means of which the females of certain moths cut out a pocket in a leaf and lay their eggs in the pocket within the substance of the leaf, or, otherwise, puncture a hole in a stem &c., in which to lay the egg. This apparatus was detected simultaneously by these two observant entomologists—Dr. Wood having made his observations on *Micropteryx semipurpurella*, Dr.

Chapman on *M. purpurella*. Observations were afterwards made on *M. unimaculella*, *Incurvaria muscalella*, *Adela*, *Nemophora*, *Lampronia*, *Nematois*, *Pancalia*, *Tinagma*, *Glyphipteryx* and certain *Coleophoræ*. With regard to the apparatus with which the females of *semipurpurella* are provided, Dr. Wood states that it "lies within the abdomen, is placed above the viscera and works free in the general body cavity. It consists of two pairs of strong, black, chitinous rods, reaching from the anal extremity, two or more segments upwards. To the proximal end of each rod are attached powerful muscular bands, which pass backwards and are inserted in or near the underside of the last dorsal plate. The distal ends of the lower pair of rods are united to the last ventral plate, and their use is to open the anal orifice, afford an anchorage in the surface of the leaf at the commencement of the operation of cutting the pocket, and later on to advance the point of the ventral plate within the orifice of the pocket and keep it on the stretch. The upper pair of rods are united to the corners of a very beautiful and complicated instrument, which we may call the knife blade. Its extremity has very much the shape of a surgeon's lancet, but instead of the cutting edge, it is armed on each side with a fine saw. Its use, and, up to a certain point its mode of action by the alternate working of the rods, are so self evident that it is unnecessary to dwell upon them. The knife is provided with a sheath, and both are concealed within the abdomen when not in use." Drs. Wood and Chapman then found that the females in *Glyphipteryx* and certain species of *Coleophoræ* were provided with an ovipositor, "very similar in outward appearance to the fore-going, and like them rigid, yet highly elastic, and capable of being freely protruded. In form it was flat, broad, thin and pointed, but in spite of its lancet-like shape, it was incapable of cutting, and had evidently been designed to enable the insect to place its egg within an unopened floret." Since then *Lampronia*, *Adela* and *Nemophora*, have been added to the list of those with the leaf-cutting apparatus, and probably *Nematois*, *Pancalia* and *Tinagma*. In *Adela* and *Nemophora*, the end of the knife is conical or trowel-shaped, and is used to scoop out a hole in a stem &c., in which to place the egg. In *Lampronia*, the knife is chisel-like, and the egg is laid in the receptacle of the flower. The way in which the whole complex arrangement connected with oviposition has been worked out in these insects, reflects the greatest credit on the industry and observation of the two gentlemen who have done it.

There are many other minor "secondary sexual characters" that have been purposely left out, and several facts relating to the headings discussed which might have been inserted. In a paper of this kind the difficulty is to keep so wide a subject within bounds, and this is why so many matters, highly interesting in themselves, but not bearing particularly on variation, have been neglected.

THE BRITISH NOCTUÆ AND THEIR VARIETIES.

Class :—NOCTUÆ, Linn.
II. Sub-Class :—GENUINÆ, Gn.
5. Family :—*Orthosidæ*, Gn.

Orrhodia, Hb. (*Glæa*, St.).

THE first two species in this genus offer an almost parallel instance to *Cuspidia psi* and *tridens* in the difficulty with which they are distinguished, but like those species, the larvæ show certain points of distinction, which have been worked out by Dr. Chapman ('Entom. Mo. Mag.,' xxvi., p. 86). The essential superficial differences between *vaccinii* and *ligula* (*spadicea*), consist in the broader wings of the former, the more pointed apex, the more concave outer margin, the generally darker ground colour, and the more or less developed pale subterminal band in the latter. There are, nevertheless, certain specimens, presumably of the former species, which present in different examples, and sometimes in the same example, the different points which characterise the latter, and small unicolorous specimens of *vaccinii* may easily be confounded with *ligula* (*spadicea*) even by the most careful observers. Of this genus Guenée writes :—"The species in the genus *Cerastis* (= *Orrhodia*, Hb.), have many varieties strongly different from the type, whilst on the other hand, the species are very nearly allied to each other. This genus requires, therefore, a deep study, a knowledge of the earlier stages being absolutely indispensable. Without this one may easily take, for distinct species (as many authors have done), certain varieties of *vaccinii* or of *erythrocephala*, whilst he may not distinguish *spadicea* from the former species or *veronicæ* from the second" ('Noctuelles,' vol. v., p. 378).

Orrhodia, Hb., *vaccinii*, Linn.

This is a very variable species, the ground colour being in some specimens almost yellow, in others, bright red, whilst in others, it is of a dark red. There is also considerable difference in the intensity of the dark transverse markings on the wing, and this produces a great deal of variety in the superficial markings or marblings present. In some species, too, the central area of the wing is strongly marked with blackish, whilst another character is noticeable in the nervures being sometimes excessively pale. On the other hand, the wings are frequently of a distinct unicolorous hue with no defined markings. Guenée says of this species :—"Superior wings of a dull yellow, tinged with reddish at the base, on the costa and in the terminal space, and spotted with the same colour on the disc, with the nervures and the subterminal space of the ground colour. Median lines distinct, waved and toothed, pale, lined with darker, parallel except the lower part

of the elbowed line. The subterminal line replaced by a series of dark dots. The lower part of the reniform and often the orbicular, filled in with slaty-black. Inferior wings blackish, tinged with red, with the fringe unicolorous red, and a median dark line also tinted with red" ('Noctuelles,' vol. v., p. 379).

The type is thus described by Linnæus:—"*Ph. Noctua vaccinii* spirilinguis, alis ferrugineis obsolete nebulosis puncto strigaque postica septempunctata fuscis." "Alæ superiores supra triste ferrugineæ, obsolete-nebulosæ; in medio puncto majusculo nigro, postice ante marginem striga ex punctis 7, minimis, fuscis. Subtus, corpus et alæ ferrugineæ striga fusca. Alæ superiores subtus et inferiores supra nigricantes" ('Fauna Suecicæ,' 320), whilst Treitschke writes:—"*Vaccinii* is in size not quite so large as *tragopogonis*. The ground colour of the fore wings is either yellowish rust-brown with darker lines and regular markings (the ordinary forms), or the ground colour is somewhat redder, with the transverse lines bluish (= var. *spadicea*) or the ground colour may be deep rust-brown with grey transverse lines. A more beautiful var. of the latter has a yellowish-mottled band and reniform outlined in yellow. Still another has the band whitish, the latter is Esper's *ligula*. The *spadicea* in Schiffermüller's collection is also a variety of *vaccinii*. Esper quite correctly classed (table 82) several of these varieties as belonging to the principal species" ('Die Schmet.' &c., vol. v., pt. 2, p. 403). The dark almost unicolorous *polita* of Fabricius and Guenée, is identical with the dark reddish-brown Linnæan type with the markings almost obsolete. Of this Guenée writes:—"Of an unicolorous ferruginous-red, with the markings almost obsolete and very dark, the stigmata and fringe concolorous" ('Noctuelles,' vol. v., p. 380). Of the type, Staudinger writes:—"Fere unicolor." Of the variation in this species Humphrey and Westwood write:—"This is a very variable species, measuring about or rather more than $1\frac{1}{4}$ inch in the expanse of the fore wings. These have a shining appearance, giving the greyer parts a bloom. The ground colour of the fore wings is dark red-brown, the apical portion more tinged with orange. Near the base of the wing is a small short transverse grey striga, with another more curved preceding the stigmata, and a third, beyond the outer stigma, much undulated. The chief veins are also greyish. The stigmata are orange with a darker centre, the outer one black behind. Parallel with the apex is a sub-marginal dark striga preceded by a row of small reddish-brown punctures, and the extreme margin is varied with small conical darker patches: the under wings are tawny-grey, with reddish-fulvous cilia. The species varies, however, very greatly in the colours of the fore wings, some being almost uniform reddish-brown, and others much darker. Guided by the great practical knowledge of Mr. H. Doubleday, respecting this tribe of insects (see 'Entomologist,' I., p. 262), we have given the "dark chestnut" ('*Noct. spadicea*, Haw.) and "netted chestnut" (*N. polita*) as varieties of this species. Mr. Stephens ('Illust. Haust.' Supplement, vol. iv. p. 389) indeed, as well as Boisduval, had entertained the same opinion; but Mr. Doubleday specifically separates the *submigra* next described. The variety named *polita* is described by Haworth as very similar to *vaccinii*, but with the wings browner, with the strigæ and veins reticulated with ashy scales, whilst *spadicea*

is described by Haworth as having the fore wings of a nearly uniform subcastaneous colour, very slightly clouded with brown, the costa near the tip with a few small whitish dots. The true *spadicea* is, however, as I believe, identical with the following species (*subnigra*). (See Guenée in 'Ann. Soc. Ent. de France,' for 1841, p. 243)" ('British Moths,' pp. 148-149).

The following is an attempt to tabulate the principal forms:—

1.—Yellow-ochreous, with reddish transverse lines = var. *ochrea*.
2.—Yellow-ochreous, marbled with red and pale nervures = var. *variegata*.
3.—Bright reddish or chestnut, almost unicolorous = var. *rufa*.
4.—Reddish or chestnut, with dark transverse lines = var. *spadicea*, Hb.
5.—Reddish, with paler subterminal area, and pale nervures = var. *mixta*, Stdgr.
6.—Dark reddish, almost unicolorous = var. *vaccinii*, Linn.
7.—Blackish-red, almost unicolorous = var. *unicolor*.
8.—Base and central area blackish-grey, extreme outer margin = var. *suffusa*.
9.—Whole area blackish-grey, with pale nervures = var. *obscura*.

a. var. *ochrea*, mihi.—This is the most ochreous variety of the species. It is the var. **C** of Guenée, who writes:—"The wings are entirely yellow, with only the transverse lines and outer margin reddish. Stigmata concolorous with the rest of the wing" ('Noctuelles,' vol. v., p. 380).

β. var. *variegata*, mihi.—This variety differs from the former in being more marbled with reddish and having the nervures paler than the ground colour. Guenée's var. **D** belongs here. This is described as:—"Smaller, of a bright yellow, marbled irregularly, especially in the centre of the wing, with dark ferruginous, in which many of the markings are lost. The inferior wings much paler, with the costa and the fringe ochreous" ('Noctuelles,' vol. v., p. 380).

γ. var. *rufa*. mihi.—This is of the same bright reddish ground colour as vars. *spadicea* and *mixta*, but with the markings almost entirely obsolete. It is a comparatively common variety, and frequently supposed to be *ligula*.

δ. var. *spadicea*, Hb.—This is the red form with distinctly darker transverse lines. Hübner's fig. 179 may be described as:—"Anterior wings bright red with two dark double basal lines; the stigmata outlined in paler with the lower half of the reniform dark; a costal streak passes from the costa to the reniform, being continued to the inner margin as a wavy line. The elbowed line beyond the reniform is blackish, a series of short lineolar dots on hind margin. Posterior wings, dark grey, with a pale base" ('Sammlung europ. Schmet.' &c., fig. 179). Of this var. Dr. Staudinger writes:—"Al. ant. plus minusve nigro-fasciatis" ('Catalog,' p. 118). The transverse lines are as frequently dark fuscous or blackish-brown as black.

ε. var. *mixta*, Stdgr.—This more variegated variety, which is the *vaccinii* of Hübner, is named by Staudinger from Esper's 'Die Schmet. in Abbil.' &c., pl. 161, fig. 5. Staudinger describes it as:—"Al. ant. exterius (et in medio) dilutius fasciatis" ('Catalog,' p. 118). Esper's

figure has the costal area and transverse lines dark red brown with the subterminal area and central area ochreous. Hübner's fig. 177 is of a reddish-brown, but much paler between the elbowed line and outer margin. This form has almost always very pale nervures.

ζ. var. *unicolor*, mihi.—This is the extreme obsolete form of this species and very difficult to separate from *ligula* and its vars. It is unicolorous blackish-red, but has the nervures rather paler. There are thus three almost unicolorous vars. in this species (1) bright reddish = var. *rufa*, (2) dark reddish = *vaccinii*, Linn, (3) black = var. *unicolor*. The greater width of the wing and the absence of the concavity below the apex on the outer margin, separates this variety from the next species.

η. var. *suffusa*, mihi.—This is one of the most striking varieties of *vaccinii*, and has the ground colour of the normal reddish-ochreous showing on the extreme outer margin, and less clearly on the base, but the central area, around the stigmata, of a deep slaty or greyish-black. It appears to be a rare variety. Occasionally the black occupies the whole area of the wing from the base to the elbowed or subterminal line. I have seen such a specimen belonging to the Rev. J. Greene, as also one or two others.

θ. var. *obscura*, mihi.—The whole area of the wing has lost its ochreous or reddish ground colour and become of a greyish or greyish-black tint, the nervures, outlines of the stigmata &c., being generally very pale. The variety is rare.

Orrhodia, Hb., *ligula*, Esp.

This is the species known as *spadicea* in England, the name *ligula* being that commonly used in all countries on the Continent. It is the *spadicea* of Guenée who writes:—"This species, which is very distinct from *vaccinii* may be recognised by the following characters: the superior wings are most pointed at the apex and hollowed out more distinctly on the outer edge; of an uniform deep ferruginous colour, with the lines of a deep reddish-brown; often shaded with ashy-grey. The inferior wings are of a deep blackish, sometimes paler on the outer edge, but always traversed by a pale median line; with the fringe reddish" ('Noctuelles,' vol. v., p. 381). The type is very rare in Britain, specimens rarely occurring with a white subterminal band, the white of the Continental forms being here generally replaced by bright ochreous. As Staudinger remarks, that part of Treitschke's extract (quoted under *O. vaccinii*), refers to typical *ligula* when he says:—"forma nigricans, exterius albido-fasciata." The type is described by Esper as:—"Alis deflexis superioribus fusco-rufescentibus; ligula marginali repanda alba, punctis nigris divisa" ('Die Schmet in Abbildungen' &c., p. 595). Esper then goes on to say:—"Ground colour dark red-brown" &c., whilst the figure to which this description refers, has "the narrow and pointed anterior wings of a dark, almost black coloration, with a transverse white band in contact with the subterminal, the nervures pale, breaking up the transverse lines" (*l. c.* pl. 166, fig. 3). The principal forms appear to be the following, the ground colour in all being of a dark chestnut or dark ferruginous, sometimes very strongly inclining to black:—

1.—Pale basal and elbowed lines, pale nervures, whitish subterminal band = *ligula*, Esp.

2.—Unicolorous, except greyish-white subterminal band = var. *polita*, Hb.

3.—Pale outline to stigmata, pale nervures, ochreous (almost orange) subterminal band = var. *ochrea*.

4.—Unicolorous, except ochreous subterminal = var. *subnigra*, Haw.

5.—Unicolorous, subterminal obsolete = *subspadicea*, Stdgr. = *polita*, Dup. = *spadicea*, Haw.

a. var. *polita*, Hb.—Like the type this has a greyish-white subterminal band, but unlike the type has no pale nervures &c., these being (if developed at all), darker than the ground colour. The form is therefore very unicolorous. Hübner's figure may be described as follows :—"Anterior wings very dark reddish, almost unicolorous, with the four ordinary transverse lines dark, slightly tinged with slaty-grey, the stigmata indistinct. Hind wings dark grey, base paler, a darker transverse line, lunule indistinct" ('Sammlung europ. Schmet.' &c., fig. 178). Staudinger writes of it:—"Nigricans plus minusve cinereo-marmoratis" ('Catalog,' p. 119). This author therefore makes the essential difference between the type *ligula*, and var. *polita*, consist of the white subterminal fascia of the former, and the ashy-grey fascia of the latter. This is the *brigensis* of Boisduval, of which Guenée writes :—"The superior wings appear more oblong; they are of an ashy colour, more or less washed with reddish, with all the designs obliterated. The inferior wings are equally ashy, with the fringe almost concolorous." Guenée then goes on to say:—"This form presents numerous subvarieties. Sometimes specimens are entirely of an ashen colour; sometimes the basal and subterminal spaces are blackish, whilst the median and terminal areas are tinged with red; at other times, the red extends over the whole wing, being mixed with the ashy colour, giving such specimens a clear violet tint &c." "Valais" ('Noctuelles,' vol. v., p. 382). It is very rare in Britain. I am indebted to Dr. Chapman for a specimen of this variety. I have seen others captured by Capt. Robertson, near Winchfield.

β. var. *ochrea*, mihi.—This and the following appear to be the more ordinary forms of the species taken in Britain. The anterior wings are of a deep reddish-black, with pale nervures and a distinctly broad ochreous subterminal band, making the variety very striking. My specimens have come from Brentwood. This variety always seems to run very near to the var. *suffusa* of *vaccinii*, and it is sometimes most difficult to separate this form from the allied species, the shape of the outer margin being almost the only guide.

γ. var. *subnigra*, Haw.—This is the commonest form of the species in Britain. It is like the former in having a broad, ochreous subterminal band, but has no pale nervures &c. My specimens have come from Clevedon, Hartley Wintney &c. Haworth's description of this variety is :—"*Noctua* abdomine maris subdepresso, alis castaneo-nigris fascia pallida postica subinterrupta, ex maculis confluentibus" ('Lepidoptera Britannica,' p. 234). Humphrey and Westwood figure this form (rather unsatisfactorily), on pl. xxx., fig. 8, and write of it (*subnigra*) :—"This species is rather smaller than the preceding (*vaccinii*), measuring $1\frac{1}{4}$ inches in the expanse of the fore wings, which are of a

chestnut black colour and shining. Some specimens have nearly all the markings obliterated, except the black patch in the outer stigma, and a row of reddish lunulated spots, but very indistinct towards the apical margin, as in our figure 7. Mr. Haworth's description and Mr. Curtis's figure represent a strong variety in which the two basal strigæ are more distinct, the stigmata reddish, followed by a pale undulated and much curved striga, several minute white dots on the costa, and a pale ochre subapical bar with six or seven ferruginous spots. But the character of the species appears to consist in the difference of the fore wings which have the apex more produced and pointed. The hind wings, are ochreous-brown with a darker fascia and the cilia ochre. It is a comparatively rare species, which appears in the perfect state later in the season than *G. vaccinii*" ('British Moths,' p. 149).

δ. var. *spadicea*, Haw.—This is the most unicolorous form of the species, being of a deep reddish-black with obsolete markings. Haworth's description is:—"*Noctua* abdomine depresso, alis fusco-spadiceis vix nebulosis, stigmate postico basi fusco." "Subspadicea alæ anticæ fere unicolores, at paululum fusco subnebulosæ, costa postice punctis paucis pallidioribus ut in plurimis" ('Lepidoptera Britannica,' pp. 233-234). Staudinger renamed the variety *subspadicea*, although I do not see his reason. He also extends the description very much, and writes:—"Rufa sive brunnea, sæpius albido reticulata" ('Catalog,' p. 119). This is also the *polita* of Duponchel, vol. vi., p. 124. This variety has been much confused with *O. vaccinii*, var. *unicolor*, and is so by Messrs. Humphrey and Westwood, who figure the latter as the *spadicea* of Haworth, although they quite correctly refer their figure to *vaccinii* as a variety (*ante*, p. 2).

Orrhodia, Hb. (*Cerastis*, Tr.), *erythrocephala*, Fab.

This generally rare species in Britain, varies considerably on the Continent, although the greater number of specimens are either of a whitish-grey = var. *pallida*, reddish-ochreous = *erythrocephala* (the type) or purplish-brown and more mottled = var. *glabra*. All the different forms are recorded from the south coast of Britain. Fabricius' description of the type is as follows:—"*Noctua* cristata alis deflexis ferrugineis cinereo fuscoque undatis: macula posteriori nigro punctata, capite rufo." "Alæ rufescentes cinereo fuscoque undatæ. Costa baseos cinerea. In medio maculæ ordinariæ, quarum posterior punctis aliquot marginalibus atris. Posticæ fuscæ margine ciliato cinereo. Subtus anticæ limbo cinereo, posticæ cinereæ puncto strigaque undata fusca" ('Mantissa,' p. 176).

α. var. *pallida*, mihi.—The anterior wings are of a pale whitish-grey, without the reddish or ochreous of the type, the transverse lines and stigmata being indistinct, although the lower part of the reniform is generally dark. This form appears to be as common as the type on the Continent.

β. var. *glabra*, Hb.—Hübner's figure of this variety may be described thus:—"Anterior wings of a dark purplish-brown, with two pale double basal lines; stigmata outlined in yellowish; a pale shade along the costa from complete basal line to reniform; a transverse ochreous line from the reniform to inner margin; elbowed line ochreous; subterminal ochreous (almost band-like). Posterior wings

dark grey, paler base" ('Sammlung europ. Schmet.' &c., fig. 438). Of this variety Guenée writes:—"Differs from the type in having a very dark violet-brown tint, especially in the median and terminal spaces, and part of the basal space." He further adds:—"Treitschke supposed that this variety was distinct from *erythrocephala*, and that the larvæ also differed, that of *glabra* having, he said, a white stigmatal line wanting in the former. I have reared both forms in numbers from the same larvæ, and have formed an entirely different opinion" ('Noctuelles,' vol. v., pp. 383-384). Esper, in 'Die Schmet. in Abbildungen,' pl. 162, figs. 3-4, figures var. *glabra* as a var. of *vaccinii*. Staudinger says of this variety:—"Al. ant. obscurioribus, costa, maculis, 2, fasciaque antemarginali griseis" ('Catalog,' p. 118).

Dasycampa, Gn., *rubiginea*, Fab.

Our specimens of *rubiginea* vary considerably in the quantity of the red colour in the central area of the wing, and the number of black dots present. Usually, the redder the specimens, the fewer the black dots, until one reaches a dark red form with the black dots practically absent. The lower part of the reniform makes a very striking black dot. The orbicular is generally 8-shaped, with both the upper and lower parts filled in with darker. The type is described by Fabricius as:—"*Noctua* lævis alis deflexis flavis ferrugineo undatis: punctis nigris sparsis." "Alæ anticæ flavæ strigis plurimis undatis ferrugineis. Puncta nigra plurima, imprimis versus apicem. Posticæ fuscæ margine fulvo" ('Mantissa,' p. 142). Guenée also describes the species as "jaune-fauve" in colour. Esper describes the red-brown form as *tigerina*, but I do not find that any author notices an unicolorous form.

a. var. *tigerina*, Esp.—Esper's description of this redder form is:—"*Noctua* spirilinguis lævis, alis deflexis fulvo-ferrugineis, strigis duabus fuscis, punctisque numerosis nigris," whilst his figure (3) to which the description refers, is also "reddish-brown in colour" ('Die Schmet. in Abbildungen' &c., pl. 123, fig. 3). The fig. 4 of Esper is grey. I have seen no specimen like it. Hübner's fig. 183 is a dark reddish brown form like Esper's *tigerina*.

β. var. *unicolor*, mihi.—An extreme form of *tigerina*, but without the characteristic black spots sprinkled over the fore wings. These are of an almost unicolorous red-brown. I am indebted to Mr. Mason of Clevedon for my British specimen of this variety.

Scopelosoma, Curt., *satellitia*, Linn.

This common species varies somewhat in ground colour, but in Britain is almost always of a reddish tint, shaded more or less with fuscous, extreme forms inclining to blackish. The orbicular is generally absent or slightly reddish, whilst the reniform is either white, orange or red. The description by Linnæus is as follows:—"*Noctua* spirilinguis, alis deflexis: superioribus subgriseis puncto flavo inter punctula duo alba." "Alæ superiores supra griseæ strigis aliquot repandis fuscis, in medio alæ. Punctum flavum inter puncta duo nivea minutissima, quorum exterius visum fere fugit. Posteriores supra fuscescentes. Subtus omnes glaucescentes cum striga fusca et in inferioribus lunula fusca" ('Systema Naturæ,' xiith, 855). The

type is described by Linnæus as having a white reniform. There are two other forms, one with yellow (*flavo*), and one with red (*rufo*), which terms might be prefixed to the Linnæan name for distinction. This grey type form is comparatively rare in Britain, our forms being reddish. Guenée describes the species as "reddish-yellow." Taking therefore the dark greyish fuscous forms as the type, I would call our redder form var. *rufescens*.

α. var. *rufescens*, mihi.—This is the ordinary British form, with the anterior wings of a red ground colour. There are (3) sub-varieties, *albo*, *flavo* and *rufo* in which the reniform is white, yellow and red respectively. I would prefix these terms to the varietal names. Sub-var. *flavo-rufescens* would be Guenée's var. **A** of which he writes:—"The reniform stigma of a saffron-yellow colour" ('Noctuelles,' vol. v., p. 386).

β. var. *brunnea*, Lampa.—Lampa simply describes his variety as:—"Framv. grundfärg rödbrun" ('Entom. Tidskrift,' 1885, p. 76). This probably refers to the darkest of our red forms, whilst my var. *rufescens* inclines to the distinctly red or reddish-ochreous forms.

Hoporina, Bdv., *croceago*, Fab.

This beautiful species is very constant in its tints and markings, a variety being most unusual among our British specimens, although a darker form occasionally occurs in some localities. A pale straw coloured form is also recorded from the Tyrol, Corsica, Andalusia &c. Fabricius' description of the type is as follows:—"*Noctua* cristata, alis deflexis ferrugineis strigis fuscis, costa albo punctata." "Alæ anticæ ferrugineæ strigis tribus obscuris. Costa punctis duobus baseos quatuorque in medio niveis. Posticæ albidæ puncto strigaque undata sanguineis" ('Mantissa,' p. 159).

α. var. *corsica*, Mab.—Of this variety M. P. Mabelle writes:—"This species (*croceago*) which never varies on the Continent, at least so far as can be judged from different authors and from what I have observed myself, has presented to me a remarkable variation which merits being described." M. Mabelle then describes it as follows:—"Varietas alis superioribus pallide flavescentibus fere subroseis ad margines nigro-pulverosis; lineis nigris nitide scriptis; pagina inferiore albescente cum pedibus vix flavo extrorsum tinctis." "The superior wings are of a whitish-yellow, slightly reddish and sprinkled with brown atoms. The markings are the same as in the varieties, with orange wings, but more strongly marked. The undersides are white &c. Otherwise the var. is like the individuals we get in France. I have met with a specimen each year" ('Ann. Soc. France,' 1867, p. 641). I have not seen a British specimen of this var., although I dare say such exist, for Humphrey and Westwood write:—"Varieties occur in the intensity of the ground colour of the fore wings, and in the depth and extent of their markings," and again "the fore wings are of an orange or yellowish red colour" ('British Moths,' p. 211).

β. var. *fulvago*, Hb.—This is a darker form than the type. Hübner writes:—"Resembles *oo* in size and shape, as well as in markings. The back of the thorax and the upper surface of the fore wings are pale tile colour; the central area of the wings suffused pale brown, and marked with divers brownish-red rings, wavy lines and

dots. The fringe is uniform tile colour. The hind wings are reddish. In the middle is a dark spot and a wavy line. The outer margin rather darker" ('Beiträge zur geschichte' &c., p. 12). The figure (Plate I., fig. F) to which this description refers, is of a dark red-brown colour. The following note from Mr. W. E. Nicholson, refers probably to this variety:—"I had a single specimen of this species from North Wales, which is of a dull brick-red colour. It seems to be a constant form in North Wales" (*in litt.*). I have heard of such dark varieties but have no specimen in my collection.

Xanthia, Och., Tr.

This beautiful genus is at once distinguished by its rich colours of yellow, orange, red and purple, and as may be expected, some of its species are very variable. Of the British species, *fulvago* (*cerago*) and *aurago* are by far the most variable, the remainder being comparatively constant. *Citrago* is, as may be readily noticed, not very closely allied to the other species. Perhaps no two species exhibit more than do *fulvago* and *aurago*, the genetic sequence in development of the palest yellow, orange-yellow, red and purplish. Some of the varieties of these two species are very beautiful. Guenée writes:—"The imagines of this group generally bear much resemblance to each other. One section (*fulvago* (*cerago*), *flavago* (*silago*), *aurago* and *aurantiago*) has the superior wings of a beautiful yellow, varying from citron to saffron, with the markings coloured in red. Another section (*gilvago*, *ocellaris* and *carneago*) presents the same designs on a fawn or reddish ground colour. In all, the inferior wings are of a more or less pure white. These species are extremely likely to vary, and it becomes therefore the more necessary to keep a long series, so as not to fall from insufficient data, into the opposite errors (1) the creation of species from varieties, and (2) the reunion of distinct species" ('Noctuelles,' vol. v., p. 391).

Xanthia, Tr., *citrago*, Linn.

This beautiful species is very constant in Britain. The ground colour is of two shades, yellow and orange-red. There is a slight variation in the depth of the central shade. The description by Linnæus is as follows:—"*Noctua* spirilinguis cristata, alis deflexis luteis: superioribus fasciis tribus ferrugineis obliquis" ('Systema Naturæ,' xth., 518). Taking the palest yellow form as the type, we have an orange form, and Eversmann describes a variety which appears to be very similar to, if not identical with, the type, both forms having the transverse strigæ well developed.

a. var. *aurantiago*, mihi.—The ground colour of the anterior wings of a distinct orange-red colour, instead of the yellow of the type; otherwise marked like the type. My reddest forms have come from Cannock Chase and Reading.

β. var. *subflava*, Ev.—This is described by Staudinger as:—"Al. ant. fascia basali limboque lato infusc." ('Catalog,' p. 117) and is given as coming from the "Ural and Petropolis."

Xanthia, Tr., *fulvago*, Linn. (*cerago*, Fab.).

This is a most beautiful species and the most variable in the genus. The ground colour extends from a pale lemon-yellow, often

almost white, to a deep orange tone, and the typical red markings are sometimes entirely absent, and at others, strongly developed with a distinct purplish tinge. There seems to be no very distinct continuation in the development of ground colour. The yellow is of two distinct shades with very slight trace of any intermediate form. The orange coloured specimens are very near *flavago* (*silago*) and bear a strong superficial resemblance to the species. In markings, however, there is every possible gradation, the only mark sometimes present being the fuscous shading in the lower part of the reniform stigma, the next markings developed appear to be several reddish spots &c., which make in their best developed form the central band between the central shade and subterminal lines. This red band frequently in the most strongly marked specimens becomes yellow. The specimens most absolutely devoid of red markings are comparatively rare in the South of Britain, but appear to be fairly abundant in some localities in the midland and northern counties. The Linnæan description of the type is as follows:—"*Noctua fulvago* spirilinguis cristata, alis pallidis: fasciis ferrugineis, palis abdomine alisque subtus fulvescentibus." "Alæ pallide glaucescentes: fascia una alterave ferruginea: postice fascia obsoleta utrinque punctata. Alæ inferiores, pallidæ. Subtus omnes pallide flavæ" ('Fauna Suecicæ,' p. 312). The *cerago* of Fabricius and Guenée also represent the type. Newman is the only one who describes the form in which the red markings have a purplish tinge, and Hübner's fig. 190 represents the form, intermediate between var. *flavescens* and the type, in which the red markings are indistinct and ill-developed. The following are the principal forms of the species:—

1.—Pale yellow, with lower part of reniform forming a dark spot = var. *flavescens*, Esp.
2.—Pale yellow, with indistinct red markings = var. *cerago*, Hb.
3.—Pale yellow, with distinct red markings = *fulvago*, Linn.
4.—Pale yellow, with purplish-red band = *cerago*, Newman = var. *suffusa*.
5.—Orange-yellow, with central spot = sub-var. *obsoleta*.
6.—Orange-yellow, with indistinct red markings = var. *imperfecta*.
7.—Orange-yellow, with distinct old markings = var. *aurantia*.
8.—Orange-yellow, with distinct red band = sub-var. *virgata*.

a. var. *flavescens*, Esp.—The pale yellow form of this species in which the markings is reduced to a dark spot filling in the lower part of the reniform, is not uncommon in several parts of Britain and the Continent, and appears to be well distributed with the type. Esper's description is:—"*Noctua* spirilinguis cristata alis superioribus luteis, macula in medio fusca, margine fulvo et serie punctorum nigrorum; inferioribus utrinque albis immaculatis" ('Die Schmet. in Abbildungen' &c., p. 322), whilst the figure to which this description applies is of "a pale yellow colour, with the lower part of reniform developed as a central blackish spot; the subterminal line represented by a row of dots" (*l.c.* pl. 122, fig. 2). The subterminal row of dots is frequently entirely absent in British specimens of this variety. Guenée writes of this form:—"All the reddish clouds have disappeared, and there are only faint traces in yellow of the ordinary transverse lines. The black

of the reniform stigma and the subterminal only remain and are very distinct; the fringe is yellow." He also adds:—"This variety is obtained when one rears a large number of *cerago*, but it is as rare as it is constant" ('Noctuelles,' vol. v., p. 393). Hübner's fig. 445 (*cerago*) represents this variety, as also does Haworth's *gilvago* ('Lep. Brit.,' p. 237) and that of Fabricius ('Mant.,' p. 161). Newman writes of this form:—"The variety *flavescens* of Esper, represented in the lower figure, is pale yellow, without any of the cloudy transverse markings, but having the central spot, which—from the absence of other markings—is rendered very conspicuous" ('British Moths,' p. 374). It is Haworth's *fulvago* var. *β*, which he describes as:—"Alis anticis omnino pallidioribus" ('Lepidoptera Britannica,' p. 237). My specimens have come from Morpeth, Ripon, Glasgow, Ulverston, Forres, Farnboro' (Kent), Leicester, Derby, Darlington, Reading &c.

β. var. *cerago*, Hb.—Hübner's fig. 190, represents a form of *fulvago*, intermediate between the var. *flavescens* and the type. It is not so obsoletely marked as in the former, nor so strongly marked as in the latter. Hübner's fig. may be described as:—"Anterior wings pale yellow, with pale, dull red markings. A small black dot occupies the lower part of the reniform. Hind wings white, without markings" ('Sammlung europ. Schmet.' &c., fig. 190). This is not at all an uncommon var. in Britain. I have it from Farnboro', Forres, Hartley Wintney &c. This intermediate form is figured in Humphrey and Westwood's 'British Moths,' Pl. 45, fig. 3.

γ. var. *suffusa*, mihi.—This is the *cerago* of Newman, who describes the ordinary red markings as:—"Sienna-brown, inclining to purple, all of which are strongly pronounced on the costal margin &c." This variety with such extreme dark markings is not at all common. I only have specimens from Morpeth, Hartley Wintney, Glasgow, Nottingham &c. Mr. Hope Alderson writes:—"I took a var of *Xanthia fulvago* in Sep. (1891), with the usual central band greatly suffused and spreading from the subterminal towards the base of the wing as far as the orbicular" (*in. litt*). It is Haworth's *fulvago* var. *γ* which he describes as:—"Alis fasciis confluentibus, saturatioribus" ('Lepidoptera Britannica,' p. 237).

δ. var. *obsoleta*, mihi.—This is a variety parallel to var. *flavescens*, but has the ground colour of an orange-yellow instead of pale yellow. I have specimens from Leicester &c.

ε. var. *imperfecta*, mihi.—This is a variety parallel to var. *cerago*, Hb., but having the ground colour of an orange-yellow colour. My specimens have come from Farnboro', Ripon, Hartley Wintney &c.

ζ. var. *aurantia*, mihi.—Parallel to the type, with distinct red markings, but with orange instead of pale yellow ground colour. My specimens have come from Farnboro', Morpeth, Willington, Nottingham and Forres.

η. var. *virgata*, mihi.—This form is parallel to var. *suffusa* with a distinct central red band between the central shade and subterminal line, but the ground colour of an orange tint. It is the *fulvago* of Haworth, who writes:—"Alis læte aureis nebulosis, fasciis duabus maculosis valde interruptis rufo-fuscis" &c. ('Lepidoptera Britannica,' pp. 236-237). My specimens have come from Pitcaple and Weymouth.

Xanthia, Tr., *flavago*, Fab. (*silago* Hb.).

This is a most constant species, considering the amount of variation in its two nearest allies (*fulvago* and *aurago*). The ground colour presents practically no variation. The red markings in the centre of the wing, consist sometimes of a number of red dots, at others, of a distinctly solid red band. The normal red parts of the wing vary from bright red to dark purplish. The type is thus described by Fabricius :—"*Noctua* cristata, alis deflexis flavissimis : punctis fasciaque lata fuscis." "Alæ anticæ flavissimæ punctis aliquot fuscis. Macula magna baseos ad marginem exteriorem fusca. Pone medium fascia lata, sinuata, fusca, in qua puncta tria costalia, flava. Pone hanc striga e punctis parvis fuscis. Alæ posticæ cinereæ" ('Mantissa,' p. 160). Guenée writes of this species :—"A little less common than *cerago*. One readily distinguishes the varieties of these species, even when most nearly alike, by the colour of the head and collar, which are in *silago* of a ferruginous-brown" ('Noctuelles,' vol. v., p. 394). The following are the only vars. of the species described :—

1.—With the central band complete and dark in colour = *flavago*, Fab.
2.—With the central band complete, red = var. *ochreago*, Bork.
3.—With the central band broken up, red = var. *togata*, Esp.

a. var. *ochreago*, Bork.—This differs from the type only in having a complete red central band instead of a dark purplish-fuscous band. Borkhausen writes :—"The ground colour of the fore wings has reddish markings. These consist of a spot near the outer margin, a central band and another spot near the base (on the costa). The central markings are red (rosy), extending into a band reaching from the costa to the inner margin" ('Naturgeschichte' &c., p. 671, No. 288). This would appear to be the *silago* of Hübner.

β. var. *togata*, Esp.—This is the form in which the central band is broken into transverse series of dots, more or less complete. Esper's description is :—"*Noctua* spirilinguis cristata, alis deflexis flavis, disco saturatiore, serie triplici macularum unaque punctorum marginalium rubescentium, inferioribus pallidis" ('Die Schmet. in Abbildungen' &c., p. 336).

Xanthia, Tr., *aurago*, Fab.

This is another most beautiful and most variable species. I am indebted entirely to the Reading collectors, especially to Mr. Holland, for my specimens and for notes on the species. The ground colour varies from the palest yellow, to deep purplish-red, through orange. The orange-red and purplish-red have both almost unicolorous forms, but the pale yellow is, so far as I know the species, always banded. Mr. Holland writes :—"*Aurago*, here—Reading—varies beautifully but gradually from the pale yellow—which is the commonest form—through orange to one uniform purplish colour. From a long series you might pick out at least five vars., looking distinct enough—represented *poorly*, but as well as I can now, by the four top specimens I am sending you, and the extreme purple var. just mentioned" (*in litt.* Oct.' 91). Strange to say, I had already divided the specimens I had by me as Mr. Holland suggested. This was as follows :—

1.—Pale yellow, with dark basal and outer bands = *aurago*, Fab.
2.—Pale orange, with basal and outer bands = var. *virgata*.
3.—Pale orange, almost unicolorous = var. *unicolor*.
4.—Deep orange-red, with basal and outer bands = var. *rutilago*, Fab.
5.—Deep purplish-red, almost unicolorous = var. *fucata*, Esp.

The type is thus described by Fabricius:—"*Noctua* cristata alis deflexis fuscescentibus: litura baseos fasciaque media late flavis." "Statura præcedentium (*croceago*). Alæ anticæ basi apiceque fuscæ litura flavescente. In medio fascia lata dentata flava. Posticæ cinereæ" ('Mantissa,' p. 159).

α. var. *virgata*, mihi.—This variety differs from the type only in having the central fascia of an orange colour instead of pale yellow. It appears to be as common as the type.

β. var. *unicolor*, mihi.—This has the dark basal and outer areas almost obsolete, the orange of the central fascia spreading over and occupying the whole of the wing space. This is not at all a common form, the unicolorous varieties usually being more or less purplish, and inclining to var. *fucata*.

γ. var. *rutilago*, Fab.—The form with the central area of a deep reddish-orange colour, is described by several authors under the name of *rutilago*. Guenée writes:—"The *rutilago* of Borkhausen must be considered as intermediate between the type and the var. *fucata*" ('Noctuelles,' vol. v., p. 394), whilst Hübner's *rutilago* ('Beitraege' &c., vol i., plate 2, fig. L) and his *aurago* ('Sammlung europ. Schmet.' &c., fig. 196) are orange-red with purplish basal and outer areas. It is the *fucata* of Staudinger's 'Catalog,' p. 117 where he writes:—"Magis unicolor, al. ant. fascia media aurantiaca."

δ. var. *fucata*, Esp.—This is the unicolorous purplish-red form of the species and is the exact opposite in development to var. *unicolor*: for whilst the latter is produced by the normal purplish-red of the basal and outer areas being suppressed and the central orange fascia spreading over the whole wing area, *fucata* is produced by the orange of the central area being suppressed and the purplish-red of the basal and outer fascia spreading over that area. Although this variety looks almost unicolorous, the central band is slightly more orange than the basal and outer fascia, but the difference is very slight. I have such varieties in my collection. In sending me a var. for examination Mr. Clarke of Reading wrote:—"This is the most extreme dark variety of *X. aurago* taken here" (*in litt.*). Guenée writes of this variety:—"The median space powdered with reddish and almost concolorous with the rest of the wing; the stigmata and transverse lines almost obsolete. It is found with the type and is no more rare than its type" ('Noctuelles,' vol. v., page 394). Of Esper's figure I made the following description:—"The anterior wings unicolorous reddish with the basal and elbowed lines paler" ('Die Schmet. in Abbildungen' &c., pl. 124, fig. 3).

ε. var. *lutea*, mihi.—A series of *aurago* sent for my inspection from Mr. Chittenden, and captured near Ashford, in Kent, contained two specimens presenting forms quite new to me. One specimen was unicolorous, clear yellow-orange, with the exception of fine faint wavy

reddish lines, almost obsolete, for the basal and elbowed lines, and a very small amount of darker orange shading on the outer edge of the wing beyond the subterminal. This form completes the series, for we now have (1) pale orange, without and with dark bands; (2) dark orange, without and with dark bands. I have never seen so perfectly yellow a specimen before. Var. *virgata* is the banded form belonging to this variety. The second was a modification of the Fabrician type, but had faint pinkish bands instead of the usual dark coloration.

Xanthia, Tr., *gilvago*. Esp.

This cannot in Britain be looked upon in any way in the light of a variable species. It would appear to be more variable however on the Continent, for Guenée writes:—"It varies very much, less, however, than its congener, *ocellaris*. This species is distinguished from *ocellaris* by the superior wings being less pointed at the apex which is neither hollowed out nor subfalcate; by the tint, more reddish, never grey; the nervures always concolorous, the lower wings tinged with yellow" &c. ('Noctuelles,' vol. v., p. 395). Guenée further adds:—"*Gilvago* presents a crowd of modifications, but never constant. Sometimes blackish clouds occupy all the median area, at other times, they are reduced to a number of isolated dots" &c. (*l.c.* p. 396). In Britain, the form with the central area very dark and band-like, is perhaps more common than the type in which this area is covered with dots. I have not as yet seen a British specimen of the form without some traces of this band = var. *palleago*, Hb. Esper's description of the type is as follows:—"Alis superioribus supra flavis, fasciis macularibus, serieque punctorum postica fuscis; subtus et inferioribus, utrinque albis" ('Die Schmet. in Abbildungen,' p. 672; pl. 176, fig. 2). The type therefore is intermediate between var. *palleago* and var. *suffusa*.

α. var. *palleago*, Hb.—Guenée very pointedly remarks:—"This bears the same relation to *gilvago* that var. *flavescens* does to *cerago* (*fulvago*)" ('Noctuelles,' vol. v., p. 395). Hübner's figure may be described as:—"Anterior wings, reddish-yellow inclining to orange, with two double dark abbreviated basal streaks, a faint elbowed line and dotted subterminal; the stigmata outlined in dark grey. Hind wings pale ochreous" ('Sammlung europ. Schmet.' &c., fig. 442). The area between the central shade and subterminal shows no special development as in the type and following var. Guenée writes of *palleago*:—"Of a pale reddish-yellow colour, without blackish clouds and only marked with faint lines a little darker; stigmata and fringes concolorous. The series of subterminal dots remains, as well as the grey spot which occupies the lower part of the reniform. These are the only distinct markings. The lower wings of a straw-yellow tint" ('Noctuelles,' vol. v. pp. 395-396). Staudinger writes of this form:—"Al. ant. unicolor. rufo-flavescentibus" ('Catalog,' p. 118). I have seen no British specimens of this pale variety.

β. var. *suffusa*, mihi.—The ochreous or slightly orange ground colour of the fore wings, is much suffused with a deep fuscous transverse band, extending from the subterminal line to the central shade, through which passes the pale elbowed line; the inner margin

darker, and also the basal area. My specimens have come from Cambridge, Rotherham and Reading.

Mellinia, Hb.

The species *circellaris* (*ferruginea*), is difficult to locate. I incline to the opinion that it belongs to *Orthosia*, rather than to *Xanthia*. Certainly, judged by superficial appearance, the difference between the species of *Orthosia* and *ferruginea*, is no greater than between our species of *Xanthia* and the latter. There are besides many superficial characters which point to the neighbourhood of this genus as a better location for it than *Xanthia*, and I think our old lepidopterists were more correct in placing it apart, rather than in *Orthosia* as does Staudinger, or in *Xanthia* as is done by Guenée.

Mellinia, Hb., *circellaris*, Hufn.

This common species varies somewhat in the depth of the ground colour. Some specimens are pale ochreous, others bright red, whilst some are very much suffused with fuscous. The former is the type, the second = var. *ferruginea*, Esp., whilst the last = var. *macilenta*, Hb. Hufnagel's description of the type is:—"*Phalæna circellaris*. Ground colour yellowish with a brown tint; with a small blackish-grey spot, and a circular one in the centre of the wings" &c. ('Berlinisches Magazin,' iii., 404). The ochreous form is also the *fuscago* of Esper, 'Die Schmet.' &c., iii., Pl. 75, fig. 5.

a. var. *ferruginea*, Hb.—This is the commonest form we have in Britain. The fore wings are of a reddish-ochreous colour. Esper's description is:—"Alis ferrugineis, fasciis nigricantibus nubeculosis," whilst the figure to which this refers has the "anterior wings dark reddish with fuscous, but rather indistinct, transverse markings" ('Die Schmet. in Abbil.,' p. 246, Pl. 47, fig. 6). The *undata* of Vieweg is also the red form. The *rubecula* of Esper, Pl. 157, fig. 4, appears to refer also to the same variety. Hübner's figure of *ferruginea* may be described as:—"Anterior wings reddish, with two dark basal, transverse streaks; the orbicular yellowish; a dark central shade from costa to base of reniform and continued on to inner margin; reniform pale; the angulated line pale; area beyond angulated line to outer margin greyish, through which passes the pale subterminal. Hind wings dark grey, base ochreous" ('Sammlung europäischer Schmet.,' fig. 181). This red form is very common.

β. var. *macilenta*, Hb.—Hübner's figure of this dark suffused form of *circellaris* may be described as follows:—"Anterior wings dark reddish ochreous, much suffused with blackish, nervures very dark, basal line dark, reniform and orbicular pale, outlined in dusky, central transverse shade between the stigmata very dark, the elbowed line blackish, the subterminal shaded with black interiorly, edged with pale exteriorly. Hind wings dark grey, base paler, distinct lunule" ('Sammlung europ. Schmet.,' fig. 688).

Cirrœdia, Gn., *xerampelina*, Hb.

This beautiful species varies somewhat in ground colour, the range extending from pale yellow, through orange to red. The former is Hübner's type, which may be described as:—"Anterior wings of

a very pale yellow colour, slightly shaded along the base of the costa. There is no orbicular, but a reddish line runs through the normal position of the orbicular from the costa to the inner margin; the elbowed line also red; the reniform outlined in dusky; the central area between the two red transverse lines and below the reniform, shaded with grey; nervures dusky on outer margin; fringe reddish. Hind wings white with a pink tinge at the base, and a faint pinkish line parallel to hind margin" ('Sammlung europ. Schmet.,' fig. 421). Our ordinary orange form is the *centrago* of Haworth, and the extreme red form is the *unicolor* of Staudinger. In Britain, the pale yellow type with its ill-developed central band is rare, but appears to occur occasionally in most localities. There is a great deal of variation in the intensity of the purplish-red central band. In the type it is comparatively absent, but in some specimens of var. *centrago* it is exceptionally dark. Some of the darkest I have seen were from Gloucestershire. A very strange pale specimen was sent for my inspection by the Rev. Joseph Greene. It had the left fore wing of the pale type, but the right fore wing had no trace of the lower part of the central band, the asymmetry being very noticeable. In the type, and var. *unicolor*, the reniform usually stands out rather conspicuously, but in var. *centrago* it becomes a part of the central band and is then almost unnoticeable. Of the variation in this species Mr. Gregson writes:—"During the last two weeks of August, I obtained a nice series near Douglas, in the Isle of Man; they varied from full rich yellow to rich ochreous-brown" ('Entom.,' vi., p. 518).

a. var. *centrago*, Haw.—This is the intermediate form and the common one in Britain, where we rarely get either the pale yellow type or the red form *unicolor*. Haworth's description is:—"*Noctua* alis aureis medio fascia unangulata margineque postico subfuscis" ('Lepidoptera Britannica,' p. 236). Our common form (var. *centrago*), differs not only in the ground colour, but also in the colour of the median band which is of a ferruginous-purple. It is this form which is described by Newman in his 'British Moths,' p. 377. Geyer's *xerampelina* fig. 858 of the 'Sammlung europ. Schmet.' is also the same form. I am indebted more especially to the Rev. G. A. Smallwood for my specimens of this and the following variety. Humphrey and Westwood give a very full description of our British form. They write:—"The fore wings are of a rich orange colour with several minute black lines on the costa; the characteristic portion of the wing is occupied by a red-brown bar, broadest towards the costa, where it becomes obsolete, terminating in a rounded lobe in the space ordinarily occurring between the stigmata, which are obsolete. The apical margin is also occupied by a bar of the same colour, which does not extend to the costa. The apex itself is acute, and the apical margin crenated, with the middle rather angulated; the hind wings are pale whitish, with slight reddish-yellow margins. This very rare species is widely dispersed, having been taken in the North of England, Norfolk, Dorsetshire &c." ('British Moths,' p. 210). There is, as I have previously remarked, considerable difference in the intensity of the central band. Some that I have seen, bred by the Rev. J. Greene from Gloucestershire being exceptionally dark.

β. var. *unicolor*, Stdgr.—Staudinger gave this name to the form described by Guenée as var. **A.** His description is:—"The whole of the wing of a clear carnation-red, with the before mentioned parts (sides of median space and outer margin) and often the median space much darker, the latter then absorbing the reniform stigma; the two median lines generally more distinct, and marked in pale yellow. The two sexes similar" ('Noctuelles,' vol. v., p. 402), whilst Staudinger's description is:—"Al. ant. fere unicolor. rufescentibus, flavo-bistrigatis" ('Catalog,' p. 116). In Britain, this variety is generally known as the Manx form, but it is recorded from Ripon ('Young Nat.,' viii., p. 223), and I have seen specimens from Derbyshire and Gloucestershire, whilst the Rev. G. A. Smallwood has given me a specimen captured in his locality (Burton-on-Trent). Of the Manx form, Mr. Birchall writes:—"I have received a fine series of *Cirrœdia xerampelina*, captured in the Isle of Man during the present month, by Mr. Warrington of Douglas. The specimens are all very richly coloured, and some of them present a remarkable variation from ordinary English examples, the golden-yellow of the fore wings being replaced by reddish-brown; two narrow lines of yellow only remain bordering the median band, the inner margin of which is not indented near the costa, but runs in a straight and uninterrupted line across the wing. In general aspect, the moth is more like *Leucania conigera* than *xerampelina*. Mr. Doubleday informs me that these specimens are identical with the form of *xerampelina* found in Central France, and that he is not aware that the variety has been previously taken in the British Islands. The appearance of the same variety, and that a very striking one, in localities so widely separated by distance and climatal conditions as Central France and the Isle of Man, is somewhat startling, and shows how little we really know of the causes governing the production of varieties and their preservation or extinction in different portions of what we may suppose was once a continuous territory. In the South of France, Mr. Doubleday informs me, *xerampelina* assumes another form being very small and dull-coloured" ('Entom.,' iv., p. 324). *Unicolor* is the var. *obscura* of Cockerell ('Entom.,' xxii., p. 55).

6. Family:—*Cosmidæ*, Gn.

This family, although closely allied to the preceding, has no very decided connection with the following (*Hadenidæ*), the affinities of which are decidedly with the *Apamidæ*. Some of the species included in the *Cosmidæ* have a superficial resemblance to certain genera in the *Orthosidæ*. We find in none of the species, with the exception of *Calymnia trapezina*, the extreme variation presented by certain species in the *Apamidæ*, *Noctuidæ* or *Orthosidæ*. In *trapezina* the variation is extreme, but otherwise, the members of this restricted family are, at any rate so far as we know them in Britain, remarkably constant, *Dicycla oo* perhaps showing more variation than the remaining species. As tree-frequenting species, "natural selection" has but little play in producing melanism or any of the forms of variation common in other families.

Dicycla, Gn., *oo*, Linn.

This pretty species varies in ground colour from a pale yellowish-

white to a yellow that is almost reddish in tint. There is also a tendency for reddish-grey fasciæ to be developed both in the basal area (between the two basal lines), and also between the subterminal line and central shade. In some extreme cases, this latter forms a complete band across the wing, extending even along the inner margin. The intermediate form, with the band developed between the subterminal and elbowed lines, is known as the *ferruginago* of Hübner, and the extreme banded form as the *renago* of Haworth. There is also a considerable amount of variation in the size of the stigmata, but it is very rarely that the reniform and orbicular are united. The type of this species is thus described by Linnæus:—"*Noctua oo.* Spirilinguis cristata, alis depressis cinerascentibus oo notatis" ('Systema Naturæ,' x. 507; 'Fauna Suecicæ,' p. 303). Guenée writes:—"*Oo* varies a little in the depth of the ground colour which is sometimes of a clear yellow as in fig. *e* of Engramelle, or fig. 3 of Duponchel. At other times, the basal space is entirely invaded by a greenish-grey, which often extends into the subterminal space, but these varieties do not constitute distinct races" ('Noctuelles,' vol. vi., p. 8). Guenée's *oo* is distinctly the type for he writes:—"Superior wings of a yellowish-white with a greenish-grey spot occupying most of the basal area &c." The different forms may be essentially classified as:—

1.—Pale yellow, without dark subterminal shade = *oo*, Linn.
2.—Reddish-yellow, without dark subterminal shade = var. *rufescens*.
3.—With a dark transverse shade, between elbowed and subterminal lines = var. *ferruginago*, Hb.
4.—With a dark transverse shade between subterminal line and central shade = var. *renago*, Haw.

α. var. *rufescens*, mihi.—Unlike the type this variety is not of a whitish-yellow tint, but has a warmer tone of yellow tending to orange or red. Otherwise it is marked like the type and has only the basal shade. It is without any development of the subterminal shade, except a small costal patch at the top of the subterminal line. The markings and transverse lines, too, instead of being of the greenish-grey (as Guenée terms it) hue of the type, are distinctly of a reddish tinge. This form appears to be as common in England as the paler type. Hübner's (Geyer) *oo*, fig. 867, is of this form.

β. var. *ferruginago*, Hb.—This variety has a dark shade developed between the subterminal and angulated lines, but not, as in the following variety, extending to the central shade. This band is well shown in Hübner's 'Sammlung europ. Schmet.,' fig. 195. It is also the *ferruginago* of Haworth whose diagnosis is:—"*Noctua* alis flavicantibus ferrugineo varie fasciatis, strigatis et subreticulatis, stigmatibus tribus flavis, postico cordiforme" ('Lepidoptera Britannica,' p. 238). It appears to me that Eversmann's *subflava* belongs here. He states that it is like *oo* and describes it as:—"Alæ anticæ ochraceæ, fascia lata baseos, striga media fasciaque lata terminali fuscis; posticæ lutescentes" ('Bull. Mosc.,' 1848, No. 3).

γ. var. *renago*, Haw.—This is the extreme form of the species. Here the subterminal band is continued on to the central shade and encloses the reniform, thus making, with the basal shade, the greater

part of the wing area of the darker coloration, and reducing the pale ground colour to the central area and the extreme outer margin. Haworth's diagnosis is:—"*Noctua* alis fusco ferrugineoque variis, stigmatibus tribus, basi et medio costæ, fasciaque marginali flavis." "Sequenti (*ferruginago*) simillima, at vix eadem, alis longe saturatioribus. Flavedo costæ secta est lineolâ ferrugineâ basi, tribusque aliis in medio. Fascia marginalis composita est ex maculis regularibus confertis, at distinctis. Stigma anticum rotundum, posticum cordiforme, tertium lineola crassa est. Alæ posticæ albæ" ('Lepidoptera Britannica,' p. 238). Of this variety Staudinger writes:—"Al. ant. fuscis, macul. margineque exteriore flavis" ('Catalog,' p. 114).

Cosmia, Och., *paleacea*, Esp.

This species has much of the superficial appearance of *Xanthia*. It varies but very little. There is a difference in the tint of ground colour, which varies from pale yellow almost to orange, and the transverse lines are better developed in some specimens than in others. The lower part of the reniform generally stands out conspicuously as a dark fuscous spot, otherwise there is but little variation. Esper's diagnosis of the type is:—"*Phalæna. Noct.* spirilinguis subcristata, alis flavescentibus, stria una alterave rufa, stigmatibus ordinariis pallidioribus, reniformi macula fusca fœta." The figures to which this description refers may be described as:—"♂. Pale yellow ground colour, distinct reddish transverse lines and outlines to stigmata, lower part of reniform blackish. ♀. Bright orange, no basal line, orbicular indistinct, lower part of reniform filled in with blackish, elbowed line reddish" ('Die Schmet. in Abbildungen' &c., p. 323; pl. 122, figs. 3, 4). Guenée describes two forms, the pale yellow or typical form and a darker orange-yellow form, the latter of which is the *angulago* of Haworth. The *fulvago* of Hübner is identical with Esper's type.

a. var. *angulago*, Haw.—This richer coloured variety is not only the *angulago* of Haworth, but also the var. **A** of Guenée, who writes:—"Anterior wings of a beautiful rich orange-yellow, with the markings of a dark ferruginous. The female is speckled, in places, with rosy-ferruginous, which destroys the contour of the stigmata" ('Noctuelles,' vol. vi., p. 7). Haworth's diagnosis is:—"*Noctua* alis aureis, striga unangulata ante, alteraque pone stigmata ordinaria subferrugineis" ('Lepidoptera Britannica,' p. 239). This form seems almost as common in Britain as the type.

Plastenis, Bois. (*Tethea*, Och.), *retusa*, Linn.

This is another species that varies little. Besides the typical olive-grey specimens, reddish examples occur. I have noticed no other form of variation worthy of mention. The type of this species is thus described:—"*Ph. Noct. retusa* spirilinguis subcristata, alis griseis retusis: strigis tribus pallidioribus." "Alæ superiores posticæ retusæ, colore cinereo-grisescente, minime nebulosæ, strigis tribus pallidioribus: prima ad basin; secundâ oblique transversalis, quam macula ovalis et reniformis excipit; tertia transversalis obliqua, quam linea transversalis flexuosa sequitur. Subtus alæ cinereæ puncto et arcu fuscis" ('Fauna Suecicæ,' pp. 321-322). The reddish tinted specimens mentioned above form the *gracilis* of Haworth.

a. var. *gracilis*, Haw.—Haworth himself when describing *retusa*

suggested that these were probably varietal forms. His description of *gracilis* is:—"*Noctua* alis emarginatis fuscis strigis duabus sesquialterâ, marginibusque stigmatum pallidioribus" ('Lepidoptera Britannica,' p. 251). Humphrey and Westwood write of it:—"*Noctua gracilis* is retained as a species by Curtis, Stephens and Wood, although Stephens, as well as Haworth, considers it as a probable variety of the preceding insect; it is, however, rather larger, measuring 13 lines in expanse; the wings of a brown colour, with the strigæ less distinct; the subapical one being entirely obsolete" ('British Moths,' p. 295).

Plastenis, Bois., *subtusa*, Fab.

This species offers a slight variation in the tint of the ground colour, but I have only once seen a decided variety, and, in that example, the ground colour is of a pale whitish-grey. There is, however, some difference in the tint of the olive-grey ground colour of the type, some specimens being much darker than others. Fabricius' description of the type is:—"*Noctua* cristata, alis incumbentibus fusco cinereis; strigis quatuor annulisque tribus flavescentibus." "Alæ anticæ obscure cinereæ striga parva baseos, altera ante medium, tunc annuli tres, anteriori striga secunda connexa, posteriori majori, reniformi, demum striga incurva et ultimo striga undata flavescentibus. Posticæ fuscæ" ('Mantissa,' pp. 152-153).

a. var. *pallida*, mihi.—Anterior wings of a pale whitish-grey, with scarcely a trace of the olive tint generally present, and no suggestion of fuscous. It must be a very rare form, as, out of a large number, I have seen only a single specimen. That came from Derbyshire.

Calymnia, Hb., *pyralina*, View.

This beautiful species has two distinct forms, one being considerably brighter in tint than the other. Otherwise it appears to vary but little. The red form is the more usual in Britain; the dull purplish-brown form being apparently very rare. The type is thus described by Vieweg:—"*Noctua pyralina* cristata alis deflexis: anticis brunneis fusco undatis, macula postica costali albida puncto gemino nigro adjacente" ('Tabellarisches Verzeichniss,' p. 87). He then gives a full description of the duller brown form of the species. The brighter and by far the more common form, is the *corusca* of Esper.

a. var. *corusca*, Esp.—Esper's diagnosis of this beautiful form is:—"Alis deflexis russo-fulvoque nebulosis, macula apicis lunari albida, punctis duobus nigris, strigisque obliquis nigrescentibus;" whilst the figure to which this description refers has the "anterior wings very bright red, with the basal, elbowed and subterminal lines whitish, edged with black internally" ('Die Schmet. in Abbildungen' &c., p. 424; pl. 135, figs. 4-5).

Calymnia, Hb., *diffinis*, Linn.

This species varies a little in the depth of the ground colour, some being more purplish-red than others, but there is no very distinct development in this direction. The transverse lines commence as white costal marks. Of these, the white costal mark of the abbreviated basal line is frequently absent, whilst that of the complete basal line varies considerably in its depth from the costa. Altogether this species varies but little. The Linnæan description of the type is:—

"*Ph. Noctua* spirilinguis cristata, alis ferrugineis margine exteriore maculis tribus albis, postice puncto nigro." "Alæ superiores ferrugineæ strigis aliquot obsoletis. Margo lateralis maculis 3 albis: anterioribus minoribus. Puncta 2, nigra, approximata, ad angulum alæ inferiorem. Subtus alæ pallidiores arcu ferrugineo obsoleto, absque puncto" ('Systema Naturæ,' xiith., p. 848). Although there is so very little difference in the varieties, three forms have been described: (1) a pale lilac-red = *confinis*, H.-S.; (2) a ferruginous-red = the type; (3) a dark purplish-red = *affinis*, Hb.

α. var. *confinis*, H.-S.—Staudinger says of this variety "multo pallidior" ('Catalog,' p. 115), whilst Guenée describes it as follows:—"It is intermediate to *affinis* and *diffinis*, of a lilac-grey, with nearly the same markings as *affinis*, but the white costal spots more enlarged and the elbowed and subterminal lines very close; the inferior wings and undersides paler." "Turkey" ('Noctuelles,' vol. vi., p. 11). Herrich-Schäffer's own diagnosis is:—"Rubenti grisea, maculis tribus costalibus maximis albis" ('Systematische Bearbeitung' &c., II., p. 224). He then states that it partakes of the character of both *diffinis* and *affinis* and compares it with these species.

β. var. *affinis*, Hb.—Hübner figures the bright purplish-red form of *diffinis* under the name of *affinis*. His figure has "the anterior wings of a bright purplish-red with a darker costa, and characteristic pale transverse lines distinctly white on the costa" ('Beiträge zur Geschichte" &c., Pl. I., fig. E). This is by far the commonest form occurring in Britain.

Calymnia, Hb., *affinis*, Linn.

This species is more variable than either *diffinis* or *pyralina*, and although the majority of our British specimens are red, a certain percentage are either grey or ochreous in colour. There is also a considerable tendency for the white costal marks at the origin of the transverse lines to become obsolete and thus give the specimens a more unicolorous appearance. The type is thus described by Linnæus:—"*Noctua* spirilinguis cristata, alis ferrugineis angulo inferiore puncto nigro gemino; inferioribus nigris." "Alæ superiores ferrugineæ striga una alterave pallidiore, quæ ad marginem exteriorem albicant. Puncta 2, nigra, approximata, ad angulum alæ inferiorum. Alæ inferiores nigricantes margine testaceo" ('Systema Naturæ,' xiith., p. 848). Of this species Humphrey and Westwood write:—"The fore wings are of a reddish-brown colour, the centre of the wing having a redder hue, but varying considerably in the depth of their tint, as well as in the intensity of their markings, which are very similar to those of *C. diffinis*, except that the white costal marks are replaced by slender, short flexuous pale lines. The characteristic portion of the wing is also marked with slight indications of the two ordinary stigmata. Close to the apex of the wing are two minute black dots. The hind wings are dark brown, with the base rather paler, and the cilia pale and dirty white" ('British Moths,' p. 267).

The different vars. of *affinis* may be thus classified:—

1.—Dark grey, with or without white costal streaks = var. *suffusa*.
2.—Ochreous (brownish), with or without white costal streaks = var. *ochrea*.
3.—Reddish, with or without white costal streaks = *affinis*, Linn.

a. var. *suffusa*, mihi.—The anterior wings differ from those of the type, in being of a dark grey coloration instead of the reddish or reddish-brown of the type. This dark grey variety has frequently a greenish tinge. Sub-var. *obsoleta-suffusa* has the ordinary white costal marks, which form the commencement of the transverse lines, obsolete.

β. var. *ochrea*, mihi.—Anterior wings of a pale ochreous-brown tint, with the stigmata generally very distinctly marked. Sub-var. *obsoleta-ochrea* has the white costal marks merged into the ground colour.

Calymnia, Hb., *trapezina*, Linn.

This is the most variable species in the family, the ground colour showing every possible phase in the genetic development of whitish-grey, ochreous, red and purplish-red. Some localities appear to be more prolific in varieties than others. Of the districts in which I have collected, my best vars. have come from the Deal sand-hills, but the finest I ever noticed was a series belonging to Mr. McRae, of Bournemouth, and taken in the New Forest. Of these, one grey specimen had the whole central area between the elbowed and basal lines filled in with black, making a band containing traces of the stigmata. I do not remember seeing such a variety before or since. There is also a considerable variation in the size of the various specimens. Some specimens have barely a trace of transverse lines etc., others have distinct fuscous transverse markings, sometimes indeed, shaded so strongly as to obscure the ground colour. The lower part of the reniform generally shows as a conspicuous blackish dot. The central shade also varies much and is sometimes strongly developed as a distinct fascia, whilst in others it is quite obsolete. The Linnæan description of the type is :—"*Noctua* spirilinguis lævis, alis depressis pallidis fascia latissima saturatiore puncto nigro margineque punctato." "Alarum fascia trapeziformis est cum puncto nigro in medio; margo posticus supra punctorum nigrorum serie notatus" ('Systema Naturæ,' x., p. 510). Of this species Humphrey and Westwood write :—"The fore wings are of a pale buff colour, varying to pale reddish-brown. The characteristic portion of the wing is large and more richly tinted than the remainder. It is bounded towards the base by a nearly straight slender brown line, edged with a pale buff line. This part of the wing bears slight rudiments of the stigmata; the anterior being indicated by a small dark dot, and the outer one by two placed transversely, and edged with pale margins. They are followed by a strongly curved pale slender striga, beyond which on the costa is a somewhat triangular greyish patch, bounded by a dusky line. This indicates the rudiment of the submarginal striga. Along the apical margin is a row of minute black dots. The hind wings are shining, and variable in colour. They go from brown to reddish, with a dusky margin" ('British Moths,' pp. 207-208). Newman writes :—"Their colour is various; pale grey, bright rust colour and dingy brown are the commoner colours, but there is almost every intermediate shade between them" ('British Moths,' p. 381).

The following is an attempt to form a rough classification of the varieties of this species :—

1.—Whitish or ochreous grey, with obsolete transverse lines = var. *pallida*.

1a.—Whitish or ochreous-grey, with distinct, transverse lines = *trapezina*, Linn.
1b.—Whitish or ochreous-grey, with red central band = subvar. *rufo-pallida*.
1c.—Whitish or ochreous-grey, with a black central band = sub-var. *nigro-virgata*.
2.—Bright ochreous (slightly reddish), with obsolete transverse lines, = sub-var. *obsoleta-ochrea*.
2a.—Bright ochreous (slightly reddish) with distinct transverse lines = var. *ochrea*.
3.—Bright red, with obsolete transverse lines = sub-var. *obsoleta-rufa*.
3a.—Bright red, with distinct transverse lines = var. *rufa*.
4.—Dark grey, with darker transverse lines = var. *grisea*.
5.—Black, with pale transverse lines = var. *nigra*.

α. var. *pallida*, mihi.—This variety differs from the type in having the complete basal and the angulated lines which form the boundaries of the trapezoid mark which gives the species its name, obsolete. The black reniform spot, specially mentioned in the diagnosis of Linnæus, is generally present in this pallid variety. Sub-var. *rufo-pallida*.—The basal and outer areas as in the last, but with the central area between the complete basal and the angulated lines, forming a reddish band. Sub-var. *nigro-virgata*, with the central (trapezoid) area filled in with black. I have only seen the specimen previously mentioned, taken by Mr. McRae in the New Forest.

β. var. *ochrea*, mihi.—The anterior wings of a deep yellow-ochreous, sometimes with a reddish tint. The transverse lines distinct as in the type. Sub-var. *obsoleta-ochrea*.—Like var. *ochrea* in ground colour, but with the transverse lines obsolete, the black spot in the lower part of the reniform, however, being generally distinct.

γ. var. *rufa*, mihi.—The anterior wings of a deep red, with the ordinary transverse lines and stigmata well-marked. They are sometimes much dusted with blackish scales. This variety has also a tendency to vary in its extreme forms to a purplish tint, but this is rather unusual. Sub-var. *obsoleta-rufa*. Like var. *rufa*, but with the transverse lines obsolete.

δ. var. *grisea*, mihi.—The anterior wings grey, much suffused with darker scales, and sometimes slightly reddish, the transverse lines are generally darker than the ground colour. I cannot help thinking that the *abluta* of Duponchel (*obelisca* by error), figured on Plate xxx., fig. 4, is this form of *trapezina*, but Staudinger refers it to *Cosmia abluta*, Hb., a species in another genus. As I do not know *abluta*, I only record my impression of Duponchel's figure.

ε. var. *nigra*, mihi.—A specimen was exhibited by Mr. Williams at the meeting of the Sth. London Ent. Society, Feb. 11th, 1892, with the ground colour entirely deep blackish-grey, with fainter transverse lines. I have never seen a similar form.

7. Family :—*Hadenidæ*, Gn.

This family has but little in common with the two families directly preceding it. Its affinities are very strongly with the *Apamidæ* and *Noctuidæ*, more especially the former. Among its

genera *Dianthœcia* and *Hadena* are the largest. *Dianthœcia* is perhaps one of the most important, and the variation of *D. carpophaga* and *D. nana* (*conspersa*) is very extensive and most interesting, and it also contains the material of one or two unsolved puzzles, notably the specific distinctness or otherwise of *D. capsophila*. *Hadena* is also a large genus and exhibits instances of fairly extreme variation in *H. protea*, *H. dentina*, *H. dissimilis* and *H. pisi*, although the remaining species of the genus are not at all excessive in their variability. A large number of species present melanic features, *e.g.*—*Dianthœcia nana* (*conspersa*), *D. cœsia*, *Cleoceris viminalis*, *Miselia oxyacanthæ*, *Aplecta occultà*, *A. nebulosa* &c., whilst the change in colour due to response to environment, noticeable particularly in *D. nana*, *Polia chi*, *Epunda lichenea* etc. is a remarkable illustration of the action of "natural selection," all these species developing some shade of green in their tint, apparently for protective purposes.

Eremobia, St., *ochroleuca*, Esp.

There appears to be very little variation in this species in Britain. The colour differs a little in intensity and the female is generally larger than the male. Guenée writes:—"Varies moderately, both in the ochreous tint and also in that of the markings, which vary from black to reddish and also in intensity" ('Noctuelles,' vol. vi., p. 16). Esper's description of the type is:—"Alis deflexis ochraceo-albicantique variis, fasciis tribus latis macularibus, fuscis, linea alba cinctis" ('Die Schmet. in Abbildungen' &c., p. 373). Esper's figure referring to this description is quite unrecognisable.

Dianthœcia, Bdv.

This interesting genus contains at least two very variable British species, *carpophaga* and *nana* (*conspersa*), the former varying from pale ochreous (almost white) to dark brown (and black, if *capsophila* be really only an extreme form of it), whilst the latter varies from pure white with black markings, to unicolorous blackish with an orange tinge. A considerable amount of doubt is expressed as to the specific distinctness of *carpophaga* and *capsophila*. Quite recently, Mr. C. G. Barrett has suggested that the latter is only a dark variety of the former. *Capsophila* has, I believe, only once been bred from ova and then it bred true, and no one ever gets a *capsophila* among the thousands of bred *carpophaga*. Where the species occur side by side on the coasts of Lancashire and Cumberland, there appears to be no doubt as to their distinctness, and although it must be allowed that there is no more structural difference between these than between many species and their varieties, yet they are more readily discriminated than many other well-known distinct, though allied species, and hence, it is advisable to keep them at present separate. The right of *compta* to be in the British fauna rests on the most slender evidence, and when it was introduced by Mr. Meek, who referred to Mr. Gregson as having captured one, the latter gentleman maintained that his specimen was a var. of *conspersa* and that *compta* did not exist in the Howth locality. The correspondence proved to the satisfaction of most British lepidopterists that *compta* was not a British species. The varieties of *conspersa* from the Shetland Isles and the coast of Devon illustrate well the influence of "natural selection" on a species, whilst

D. cæsia shows perhaps more than any other species, the difference between some of our insular varieties and the ordinary form obtained on the Continent. *D. luteago* var. *barrettii* (*ante*, vol. i., p. 135) should be referred to this genus and not to *Luperina*. Mr. W. F. de V. Kane in the 'Ent. Rec.,' vol. ii., p. 275, writes:—"I wholly dissent from Mr. Buckler in assigning this species a place in the genus *Luperina*. Mr. Tutt says *(in. litt.)*, that 'however necessary a *Dianthœcia* facies may be for protection etc., in the imago stage, the affinities will be best found in the larvæ.' It is, therefore, incontestable that the imago conforms to the *Dianthœcia* type; so much so, indeed, that the melanic var. of *D. nana* often passed for *D. barrettii*. The antennæ are of the *Dianthœcia* character, not that of *Luperina*; the emergence of the moth is that of a *Dianthœcia*; the pupa is distinctly *Dianthœcian* with the well-marked protuberance at the end of the wing-cases. Staudinger and Wocke rank *luteago* as a *Dianthœcia*. It feeds in the larval stage on *Silene*, which is the characteristic food of this genus. But Mr. Buckler and Mr. Dobrée say that the larva is similar in habits to that of *Luperina*. How? The head and first segment are exactly those of *Dianthœcia*. The shape is also similar to *D. capsophila*, and sometimes the larva of the latter is almost as pale as that of *D. barrettii* The only point alleged is its being an internal feeder. And the extraordinary thing is, that the greater portion of the species in *Luperina* are not internal feeders. Some of them eat the roots of plants, as *L. cespitis*, others eat the shoots and leaves, but hide only among the roots, *e.g.*, *L. testacea*, *L. nickerlii* and *L. virens*. *L. rubella* is the only one that is, I believe, an internal feeder, the rest eat grass, or various portions of low plants, just as *D. capsophila* does, to my knowledge, when the capsules are not to be had. In fact, when *capsophila* larva is nearly full-fed, it lives, like many Noctuæ, in the sand or earth, and eats capsules, leaves or stems of the *Silene* at night. I have bred *D. barrettii* as far as the larval stage, and the larva is a *Dianthœcia* larva, except that it is blanched like every internal feeder. It, however, also eats leaves and twigs above earth occasionally. Returning again to the imago, the shape and pattern is that of the *Hadenidæ*, none of the marked characters being wanting. The *Luperinas* are conspicuously devoid of these, and are rightly not so grouped. If we are to overlook this, and class a species from one characteristic of the larva only, we may as well remove *D. barrettii* to the *Sesiidæ* and place it next *musciformis*" ('Ent. Record,' ii., pp. 275-276); whilst Mr. Reid writes:—I consider *D. barrettii* a true *Dianthœcia*, the larvæ may have a superficial resemblance to those of the genus *Luperina*, but I am told by people who should know something about the matter, that they (the larvæ) are really *Dianthœcia*. The pupæ are true *Dianthœcia*, and the imagines are certainly in a more natural position among the *Dianthœciâ* than among the species of *Luperina*. The food plant should also be considered, but to my mind, the structural difference of the pupa is the best argument in favour of the insect being considered a species of *Dianthœcia*" ('Ent. Rec.,' ii., p. 276.) The close resemblance between *capsincola* and *cucubali*, with the exception of the violet tint in the latter, is rather remarkable. Guenée writes:—"The *Dianthœciæ*, are pretty Noctuelles, with markings as delicate as their colours are strongly marked. They fly quickly in the evening, over the flowers

on which the females deposit their eggs. They are aided in doing this by a very long ovipositor, the form of which varies in the different species, and which has helped me to discriminate allied species" ('Noctuelles,' vol. vi., p. 18).

Dianthœcia, Bdv., *irregularis*, Hufn.

This species only appears to offer a very slight variation in colour, some specimens being rather paler than others, especially on the outer margin. Hufnagel's diagnosis is as follows:—"Dull yellowish with white spots and brown zigzag transverse lines" ('Berlinisches Magazin', iii., 394). Borkhausen describes the same species under the name of *echii*, by which name it was first known in England. His description is:—"Ground colour of the fore wings whitish, spotted with light brown, with four darker nut-brown curved lines; the first on the base is very small and does not cross the wing completely, the second basal line is complete, the third is strongly angulated, whilst the subterminal line almost touches the angle made by the third line, and forms a Latin W in its centre. This line is bordered by a whitish one externally. The extreme outer area is very pale brownish. Between the complete basal and angulated lines stand the ordinary stigmata, the orbicular whitish, with the centre and outer ring pale dirty brown, the second is reniform with the centre filled in with darker brown. Under the orbicular, on the second line, stands a blackish-brown claviform stigma. The hind wings are light grey-brown, with a brownish transverse band, darker margin and lunule" ('Naturgeschichte &c.,' pp. 166-167).

a. var. *aberrans*, Ev.—This variety is thus described by Staudinger:—"Thorace alisque anterioribus subaldibis, his fascia media lata ochracea." "Siberia, west and north" ('Catalog,' p. 94). I am not aware that this variety occurs in England.

Dianthœcia capsophila and *D. carpophaga*.

D. capsophila is perhaps, so far as British specimens are concerned, one of the most constant species in the genus, although there is a slight tendency in some specimens, to be rather brown or grey than black, thus attempting to copy the darkest vars. of *carpophaga*. I look on this, however, as a case of parallel variation, necessarily occurring between two closely allied species, rather than anything throwing doubt on its specific distinctness. There is, also, a slight variation in the pale mottling, but nothing very striking. With regard to this insect being specifically identical with *carpophaga*, Mr. Birchall writes:—"There has been much discussion as to the claims of this insect to be considered a species distinct from *carpophaga*, some of the darker varieties of which, from Scotland, approach *capsophila* both in form and colour. The caterpillars of *carpophaga* and *capsophila*, like the perfect insects, differ principally in colour; *capsophila* in both cases being darker. The caterpillars of *capsincola* and *conspersa* are, however, equally difficult to separate; and these slight variations in the caterpillar state, seem to be characteristic of the *Dianthœciæ*, and alone are insufficient to enable us to discriminate the species. So we may suppose that the common origin of the various species of the genus, is indicated by these slight differences in the caterpillar state; but, for the purpose of classification, *carpophaga* and *capsophila* seem to be abundantly dis-

tinct, and must be so recorded." But, subsequently, in writing of *capsophila* to Mr. Newman, Mr. Birchall adds:—"This insect is the Irish representative of *D. carpophaga*, and in my opinion only a variety of that species, and reaches its extreme point of divergence from the English and Continental type in the Isle of Man. The difference between *capsophila* and *carpophaga* is wholly one of colour, and only exists in the perfect insect, the caterpillars and chrysalides presenting no difference. As we travel northward in Great Britain, there is a gradual deepening of the shade of colour from the clay-coloured, almost immaculate *carpophaga* of the southern counties, to the rich brown specimens obtained in Argyleshire. Amongst the Irish *capsophila* an occasional dark brown specimen occurs, but the colour of the majority is dark grey.* The Manx specimens are usually still darker, sometimes almost entirely black. The explanation seems to be that the species has reached Ireland by way of Scotland, and that the effect of insular conditions has been still further to increase the divergence from the original type of the mainland. As regards its natural history, the Isle of Man is certainly an outlying province of Ireland, in many respects "Hibernior Hibernicis." *Capsophila* occurs on the Irish coast from Belfast to Waterford, but I have not seen or heard of it on the western coast, or in the interior of Ireland. There have been records of its capture in North Wales, but I have not seen the specimens, and cannot say whether they ought to be referred to *carpophaga* or *capsophila*. This species was first discovered by Anderegg, in Switzerland. Guenée gives 'Alps of the Valais, neighbourhood of Digne,' and 'Spain,' as the Continental habitats; and he describes the Spanish form as "much darker than the Swiss, and almost black, with the transverse lines very white and slender, the wing-rays powdered with white, and the underside very dark." Mr. Newman adds:—"This seems to militate against the opinion expressed above by Mr. Birchall; and it is a remarkable fact that the most northern and most southern examples of the species are the darkest" ('British Moths,' pp. 386-387). Twenty years ago very little was known of variation, and I feel satisfied that *capsophila* is as well developed a species as many other so-called species in our lists. The knowledge that we now have of parallel variation, and the tendency of species to copy, in their varieties, the normal markings of allied species in the same genera, and at the same time, the similar facies developed in moths, most dissimilar in structure, when placed under similar circumstances or natural conditions, should check us from laying too much stress on purely superficial characters. It is remarkable that Duponchel figures a brown form as the type, in no way so dark as our specimens, whilst Guenée gives quite a satisfactory description of our typical form under his var. **A.** Mr. W. H. Blandford very recently brought the subject to the front ('Ent. Mo. Mag.,' vol. xxvi., p. 89), due to breeding imagines of both species from larvæ taken at Tenby. So good a lepidopterist as Mr. C. G. Barrett seems inclined to agree with him as to the specific identity of the two forms, but adds:—"The two forms are to be definitely distinguished." Most certainly they are; and it must be remembered

* I cannot see any difference whatever in the specimens in my cabinet which have come from Ireland and the Isle of Man. Grey specimens occur in both, and these come near *D. carpophaga* var. *fusca-pallida*.

that these specimens were bred from larvæ taken at large with those of *D. conspersa* and *D. capsincola*, and not bred from ova. It is well in formulating ideas from results obtained from larvæ taken at large, to remember Guenée's warning, and his remark that "the most distinct species have larvæ which can scarcely be distinguished, *e.g. albimacula*, *conspersa* and *capsincola*, especially when one finds them, as they frequently are to be found, feeding together on the same plant" &c. ('Noctuelles,' vol.vi., pp. 17-18). Mr. W.F. de V. Kane writes:—"I have collected *D. capsophila* in very considerable numbers from time to time, and also bred them from the N. S. E. and W. of Ireland, and have seen numbers of the Isle of Man specimens; and there is absolutely no approximation to *carpophaga* that would puzzle any but a tyro. *D. carpophaga*, however, is a variable species, and sometimes the darkest specimens look to an experienced eye like worn *carpophaga*, but it never, so far as I have seen it, acquires the true colour" ('Ent. Record' &c., ii., p. 273), whilst Mr. Murray writes:—"I hold the opinion of Mr. Kane as to *D. capsophila* and *D. carpophaga* being true species. I have caught and bred many hundreds, I may say thousands, of both, and have seen no *carpophaga* so near *capsophila*, as those from our own coast, yet there is not the slightest puzzle in picking these out, by anyone really knowing the species. I consider we have many species much more difficult to distinguish than these ('Ent. Record' &c., vol. iii., p. 8). Mr. Robson writes of *capsophila*:—"Very similar to the last species, *(carpophaga)*, but darker and not so much of an ochreous-brown in colour. Some have considered it to be merely an Irish form of *carpophaga*, and Mr. Birchall, who was in a position to speak with some authority, suggested, as previously mentioned, that it might have 'reached Ireland by way of Scotland, and that the effect of insular conditions has been still further to increase the divergence from the original type of the mainland.' From Ireland, he supposed it to have reached the Isle of Man, where the specimens taken are still darker. I have no personal experience of the matter, and can only speak from my limited acquaintance with the species in my own and other collections. The objection I see to the suggestion, is that, as already said, in *carpophaga*, the paler and darker shades preserve a relative proportion to each other whether the specimen be dark or light. In *capsophila*, on the contrary, the paler markings are distinctly brighter than they are even in examples of *carpophaga*, that are not nearly so dark as those of the other species. Besides this, *capsophila* was first taken, not in Ireland, but in Switzerland, and was figured by Duponchel some years before it was found in Ireland. It also occurs in Spain and elsewhere. The Spanish specimens are said to be nearly black with the markings white, in which respect, therefore, it still more forcibly contrasts with dark examples of *carpophaga*. The habits of this species in some respects resemble those of its congener" ('Young Naturalist,' vol. iv., p. 182). Much, therefore, as I am inclined to fall in with the hero worship we generally give to the opinions of Mr. C. G. Barrett, I am inclined to disagree with him about these species, and believe *capsophila* to be sufficiently well differentiated from *carpophaga* to be kept distinct in our collections.

Dianthœcia, Bdv., *carpophaga*, Bkh.

This species is perhaps the most variable in the genus. The

ground colour varies from white and very pale ochreous to deep brown, and the markings from complete obsolesence, except the outlines to the three stigmata, through every grade until we have the transverse lines dark fuscous, and the whole wing area bearing a very mottled appearance. The purest white ground colour I have ever seen in this species, is in a specimen given me by Mr. Austin of Folkestone, and I have seen similar ones in other collections. Mr. J. Henderson writes:—"I have a very white form from Box Hill and dark brown forms from Durham" (*in litt.*). Newman says:—"The colour of the fore wings varies, in some specimens pale ochreous-brown, often approaching to white, in others dark bistre-brown; in all, the discoidal spots are conspicuous and well defined; in one specimen in my possession there is a very obvious median darker band, and this contains the two discoidal spots; parallel with the hind margin is a zigzag pale line, adjoining which and pointing towards the base of the wing are two or three wedge-shaped dark brown spots: the hind wings are pale dingy brown at the base, and have a broad dark band on the hind margin; this is frequently preceded by a slender transverse line" ('British Moths,' p. 285). The type is thus described by Borkhausen:—"The ground colour is a mixture of umber- and grey-brown, which is sometimes darker and sometimes lighter. The four transverse lines are somewhat yellowish and bordered with brown, the abbreviated basal line indistinct, the others normal. Between the 2nd and 3rd lines are the stigmata, which are yellowish-grey in colour, outlined with brown and with the centres slightly brownish. The reniform has, in its centre, a small yellowish streak. Under the orbicular is the claviform which is always of a darker brown than the ground colour. The zigzag subterminal is the palest of the transverse lines, and on it, there are a few black cuneiform marks. On the hind margin is a row of lunular spots. Hind wings light grey-brown with darker hind margin" ('Naturgeschichte' &c., iv., p. 422). Of this species Mr. Robson writes:—"Ground colour ochreous, but not so pale as in the last species (*irregularis*); the hind margin, a blotch near the anal angle, and the margins of the stigmata are the palest portions of the wing. It is a very variable insect, southern specimens being much paler than those taken in the north, but the distinction between the ground colour and the markings appears to be equally preserved in most cases, the dark markings being proportionately darker when the ground colour is darker. Some of the specimens taken in the south are pale ochreous, almost without markings. This variety was called *ochracea* by Haworth." "The female of this species has not nearly so extended an ovipositor as some of the genus." He also writes:—"*Carpophaga* is tolerably well distributed in England. It occurs in Scotland, but not in Ireland. Newman says, 'the name occurs in the Irish list.' I do not know anything of this, but possibly the next species was the insect so named" ('Young Naturalist,' vol. iv., p. 182). The type appears to be by far the most common form, especially in the more northern localities. I have it from Ripon, Darlington, Hartlepool, Liverpool, Rotherham and the Suffolk coast, whilst from Kent I have two specimens only of this form.

The following is an attempt to classify the varieties of this species:

1.—White, markings nearly obsolete = var. *pallida*.
1a.—White, with ochreous mottling = sub-var. *ochrea-pallida*.
1b.—White, with fuscous mottling = sub-var. *fusca-pallida*.
2.—Pale yellow-ochreous, markings almost obsolete = var. *ochracea*, Haw.
2a.—Pale yellow-ochreous, central band darker = sub-var. *virgata-ochracea*.
2b.—Pale yellow-ochreous, mottled with darker ochreous = var. *lepida*, Esp.
3.—Dark ochreous (almost brown), markings nearly obsolete = var. *brunnea*.
3a.—Dark ochreous, with central band darker = sub-var. *virgata-brunnea*.
3b.—Dark ochreous, mottled with darker = *carpophaga*, Bork.

a. var. *pallida*, mihi.—The ground colour white, with scarcely, if any, tinge of ochreous. The outlines to the stigmata faintly marked, otherwise there are no darker markings. This form is rare, and generally occurs in our southern counties, but is sometimes found further north. Mr. Dixon of Hartlepool writes:—"I took a specimen of *carpophaga* here, nearly white in colour. It has no markings at all, except the margins of the stigmata. It is very much lighter than the palest specimen of the variety *ochracea* in Mr. Robson's cabinet. It has rather a shiny appearance, but is in very good condition" ('Young Naturalist,' vol. iv., p. 90). The variety is figured in Newman's 'British Moths,' p. 385, fig. 1. The sub-var. *ochrea-pallida* has the outlines of the stigmata and the transverse lines strongly tinted with ochreous, although the ground colour remains white, while sub-var. *fusca-pallida* has the ground colour white, with the typical markings of this species pricked out in dark fuscous, thus making even in this pale form, an attempt to copy its congener, *capsophila*. My specimen of *fusca-pallida* came from Folkestone, those of *ochrea-pallida* from Folkestone, Brighton and the Essex coast.

β. var. *ochracea*, Haw.—This variety is generally supposed to consist only of those obsolete specimens, which vary in a similar manner to var. *pallida*, but, as will be seen from the description, the variety includes all those which have, not only the outlines of the stigmata, but also faint transverse lines, and yet are without darker mottling. Haworth's description is:—"*Noctua* alis ochraceis strigis quatuor stigmatibusque ordinariis pallidis, unoque stigmate nigricante." "Corpus alæque ochraceæ. Stigmata ordinaria albicantia, stigmate tertio claviformi plus minus nigricante. Strigæ ut in præcedentibus quatuor; una imperfecta basi, duæ ante, tertia arcuata pone stigmata, omnes moniliformes et nigro plus minus marginatæ; quarta striga undata juxta marginem posticum est et ad apicem sæpe dilatata in maculam pallidiorem, in ipso margine striga tenuis ex punctis lunato-trigonis nigris, ciliis luteis. Posticæ alæ ex albido-fulvicantes nitidæ, fimbria fusca, ciliis luteis" ('Lepidoptera Britannica,' p. 199). Of *ochracea*, Humphrey and Westwood, who treat it as a distinct species, write:—"The fore wings are of a very pale clayish-buff colour, varied with darker markings; towards the base are several dusky oblique lines, separating the following space, which is paler than the base, and ter-

minated by three deep scalloped lines indicating the second striga; the middle of the wing is darker and bears the three stigmata, the two ordinary ones being pale with the centres rather darker and the edges black, and the supplemental one formed of a brownish oblique patch edged with a blackish line. Beyond the stigma is a much-curved row of small blackish arched lines succeeded by a subapical brownish shade, in which the fourth striga undulates, the middle of which is not so strongly angulated as usual, but is marked with several arrow-headed dark marks; the hind wings are marked with a slightly paler wave beyond the middle. Rare; found near London, Brighton, and in Norfolk. It occurs in the winged state at the end of June. It was accidently omitted in Mr. Doubleday's list of Noctuidæ published in the 'Entomologist' for October 1842" ('British Moths,' p. 165). My specimens of this variety have come from Brighton, Reading and the Suffolk coast. The sub-var. *virgata-ochracea* is figured in Newman's 'British Moths,' p. 385, fig. 3. It has the basal and outer areas pale ochreous, the space between the complete basal and elbowed lines dark ochreous, forming a transverse band. The orbicular and reniform stigmata are pale. I have only one specimen which came from Shoreham (Sussex).

γ. var. *lepida*, Esp.—This is a parallel variety to the type, but, instead of the dark ochreous ground being mottled with still darker brown, this has a pale ochreous ground colour, mottled with darker ochreous. Esper's figure may be described as:—"Anterior wings pale ochreous with very distinct markings; a blackish claviform, whitish orbicular and reniform, and whitish between the broken black parts of the subterminal; several small black transverse streaks on the costa and inner margin" ('Die Schmet. in Abbildungen,' pl. 152, fig. 2). My specimens have come from Grantham and the Essex and Kent coasts.

δ. var. *brunnea*, mihi.—This variety, like var. *pallida* and *ochracea*, has almost obsolete markings. The ground colour of the anterior wings dark ochreous, sometimes almost or quite brown. My specimens of this form have come from Ripon and Darlington. Sub-var. *virgata-brunnea* is another rare form. I have one specimen from Ripon and a second from Hartlepool. It is brown in colour like var. *brunnea*, but the central area is much darker. It forms therefore a parallel form to *virgata-ochracea*, and is figured in Newman's 'British Moths,' p. 385, fig. 5.

Dianthœcia, Bdv., *capsophila*, Dup. (sub-species?).

The type of *capsophila* is thus described by Godart and Duponchel:—"This species is very near to *carpophaga*, of which we should not be astonished if it were only a local variety. It differs from it really only by its darker tint and by the clear transverse lines of the fore wings, which are very much more white than yellow. Otherwise there is absolutely the same design in the two species. The species (or variety, whichever it may be), has been found in Valais by M. Anderegg" ('Histoire Naturelle' &c., p. 100). The figure of *capsophila* to which this description refers, appears to me rather a variety of the species as we know it, than our typical British *capsophila*, to which it bears a close resemblance, although failing almost as much as many forms

of *carpophaga* in touching the colour of British specimens. It is of "an ochreous-brown tint, with numerous (10) short black costal streaks; the lower part of the complete basal line, the lower part of the elbowed line, the outlines of both stigmata, the whole of the subterminal, and the extreme edge of the outer margin white. The subterminal with a complete row of small cuneiform spots upon it. Hind wings dark grey, with a pale base" (*l.c.* iv., pl. 58, fig. 8). Guenée says of this species:—"Larger than *carpophaga*, from which it differs chiefly in its blackish colour, whiter lines, slightly less distinct markings; in a way it seems to be intermediate between that species and *capsincola*" ('Noctuelles,' vol. vi., p. 20). Of the general variation, the same author writes:—"*Capsophila* varies like *carpophaga*, and it is only with practice that one becomes able to distinguish it from the dark varieties of the latter species" (*l.c.* p. 21). Our British specimens are occasionally typical and tinted with brown, but the great mass of our Manx and Irish specimens are of the dark form called by Guenée var. **A**. Of some of the early captures in the Isle of Man, Mr. Gregson writes:—"It may interest some of your readers to know that I took *Dianthœcia capsophila* freely during my stay: they varied considerably in colour, and were finer than any I have ever taken at, or seen from, the Hill of Howth, near Dublin or in Cumberland" ('Entomologist,' iii., p. 104).

a. (?). var. *capsohphoba*, Rbr.—The *capsophoba* of Rambur appears to be only a brown *capsophila* with a white subcostal nervure, and the basal line, outlines of reniform and orbicular, edging of elbowed and subterminal lines all whitish (*vide* 'Cat. Sys. de l' Andalousie,' Pl. 9, fig. 2).

β. var. *suffusa*, mihi.—This is Guenée's var. **A** of which he writes:—"Always darker and almost black, with the lines very white and generally finer, the nervures more powdered with white, and the undersides darker." "Spain" ('Noctuelles,' vol. vi., pp. 20-21). This would apply to most of our specimens which are generally black or dark grey, rarely brown.

Dianthœcia, Bdv. *capsincola*, Hb.

For a common species, this exhibits but very little general variation. In colour, some specimens are browner than others, whilst there is occasionally some tendency for the orbicular and reniform to join at their bases, as is normal in the allied species *cucubali*. Guenée writes:—"It varies very little. Of all the *Dianthœciæ* the female of this species has the longest ovipositor" ('Noctuelles,' vol. vi., p. 21). Of the type figure of this species I made the following description:—"Ground colour dark grey, with black edges to the pale transverse lines; the claviform black, and a black quadrate spot between the stigmata; the central band containing these black spots well marked; the transverse lines and outlines of stigmata pale grey, a row of black cuneiform spots on the pale subterminal" ('Beiträge zur Geschichte' &c., Pl. 3, fig. P 3). Mr. Robson writes of *capsincola*:—"Rather colder brown than the others, and very similarly marked; larger than the preceding *(capsophila)*, and generally larger than the succeeding species *(cucubali)*. It cannot be mistaken for any other except *cucubali*, and the purple shade in the latter makes it easy to distinguish them.

The female has a very long ovipositor. A very extraordinary variety of this species is figured in Newman's 'British Moths,' but it is not described. This may be the form named *D. behenis* by Freyer, and which is said to have occurred at Salisbury" ('Young Naturalist,' vol. iv., pp. 182-183). *Behenis* is most certainly a variety of *cucubali*, although Staudinger was uncertain whether to refer it to *capsincola* or *cucubali*. The strange variety figured in Newman's 'British Moths,' p. 387, fig. 2, appears to be slightly crippled. I have never noticed a variety of the species.

Dianthœcia, Bdv., *cucubali*, Fuessl.

This beautiful species presents scarcely any variation, at least in our British specimens. Fuessly thus describes the type:—"The fore wings dark brown with a light reddish or purplish tint, the pale lines forming a network. Round the orbicular, two yellow parallel lines run from the costa to the middle of the wing, whilst two others run round the reniform, and being turned towards the base, meet the others, forming a triangle, the apex of which is slightly rounded. The spaces contained by these two pairs of lines are continued into the wing, and are at last cut off by a somewhat curved, reddish-lilac coloured line. The subterminal, fine, yellow and zigzag, on which is a row of cuneiform spots" ('Neues Magazin' &c., ii., 2, p. 218). I have seen no variety of this species.

a. var. *behenis*, Frr.—This is undoubtedly a var. of *cucubali*. It has the natural violet tint of that species, the stigmata contiguous &c., but the costa is slightly pale. Staudinger was uncertain, for he writes:—"Al. ant. costa alba; an sequ. (*cucubali*) ab. ?" ('Catalog,' p. 94). Freyer says of it:—"I should take this moth for *N. cucubali*, for in size, form, colour and markings, it is scarcely to be distinguished from it, but it differs in having a distinct whitish-yellow line on the costa of the fore wings which extends from the tip right over the reniform and is lost in the pale subterminal line. This light costal border is not found either in *cucubali* or *capsincola*, and this induces me to give a special name to this Noctua. The fore wings, moreover, are somewhat lighter and rounded off, otherwise it agrees with *cucubali*; but the peach-coloured bands are wanting, and the ground colour resembles rather that of *capsincola*, and it is somewhat similar on the underside. Dr. Nickerl found this Noctua in the neighbourhood of Salzburg" ('Neuere Beiträge' &c., p. 142). This variety in no way resembles the variety of *D. capsincola* figured in Newman's 'British Moths,' p. 387, fig. 2, as it has simply a pale costal area, and in no way can the pale colour be said to spread into the central area of the wing as in Newman's figure.

Dianthœcia, Bdv., *albimacula*, Bkh.

This species was for a long time rare in Britain, until the Folkestone collectors found it in considerable abundance. It offers but little variation, and that chiefly in the quantity of white markings in the anterior wings. The orbicular appears to be always outlined in white, as also does the inner edge of the reniform, the outer edge of the latter is also sometimes similarly outlined, whilst both these stigmata are occasionally joined by a white line. There is, however, very considerable variation in the size and shape of the white spot under the

stigmata, which is sometimes almost linear, at others forming a comparatively large white quadrate spot. The ground colour is sometimes redder than at others, the redder form being the *concinna* of Hübner. The type is thus described by Borkhausen:—"The ground colour of the fore wings is a dark grey-black, which sometimes becomes black-brown, sometimes brownish-grey; the ordinary lines run transversely through the wings; base white with black markings. In the middle of the wing, towards the costa, is a large white spot in which are the two ordinary stigmata with blackish rings surrounding them. The hind margin is spotted with black; the fringes are white and black. The hind wings are blackish with paler bases" ('Naturgeschichte' &c., iv., 149). Of *albimacula* Mr. Robson writes:—"Olive-brown with the lines black, edged with white. The lines beyond the middle have the white edges on the outside, those nearer the base have the white on the inside. The stigmata are very distinct, white, with an olive shade in the centre, but not so large as in most of the other species. I have never seen any specimens of this insect that have been taken as imagines in this country, and those reared in captivity have all been rather smaller than Continental types. Continental examples also, so far as my experience goes, are much paler in colour, having more of the olive brown, which is of a paler shade; the white stigmata are larger, and the black marks smaller and fewer in number, although this may not always be the case" ('Young Naturalist,' vol. iv., p. 183).

a. var. *concinna*, Hb.—"The anterior wings of a dark dull red colour, with the upper part of the base white with an incomplete black basal line; the complete basal line white edged with black; the stigmata outlined in white with a white costal patch above both stigmata, and another white patch just below them; the elbowed and subterminal lines white. Hind wings dark grey, base paler, dark nervures, lunule and transverse line" ('Sammlung europ. Schmet.,' fig. 51).

Dianthœcia, Bdv., *conspersa*, Esp. (*nana*, Rott.).

This is a most interesting species and although its varieties are practically unknown on the Continent, some of them have been known for a very considerable time in England. For some years, a beautiful variety captured on our west coast was confounded with *Dianthœcia* (*Luperina*) *barrettii*; but it was not until our professional collectors brought us the wonderful varieties from the Shetland Isles that we had any real knowledge of how great was the variation in this species. Some of these Shetland examples resemble much the west coast specimens, but others are very different. Of some of these Shetland forms Herr Hoffmann writes:—"The darkest of this peculiar Shetland form would scarcely be taken for *nana* if the lighter specimens did not form connecting links with the type. I saw three males which may be compared with the normal form in the following manner:—Ground colour of a lighter or darker leaden-grey with a greenish-yellow tint. In the lightest specimens the white spots and markings of the normal type are distinct, there are also traces of white colouring on the head and thorax. In the 2nd specimen the white colouring is wanting entirely on the wings, but white traces on the head and thorax are visible. In the 3rd and darkest there are no white markings at all, it is simply lead-grey

with a slight greenish-yellow tint, reniform and orbicular surrounded with black, also the two transverse lines. Mr. McArthur writes:—'The *nana* are all dark. The ordinary form does not occur, though some specimens are lighter than those I sent.' The figures in the 'Entomologist,' 1880, Plate iv., figs. 12-13 represent light forms. Their colour, compared with those I have, is too yellowish. This var. appears peculiar because a simple dark shading is not prevalent. Even the darkest specimen does not show the brown-black colour of the normal type which contrasts so deeply with the white. The dark parts appear much lighter, paler lead-grey, and the white is tinted with greenish yellow, the colours evidently meeting each other to produce more uniformity" ('Stett. ent. Zeit.,' 1884, pp. 363-364). Of these *Dianthœcia conspersa* from the Shetland Isles, Mr. J. Jenner Weir writes:—"All the specimens are very much darker than the ordinary colour of the species, and some are almost black and quite devoid of markings, resembling very much in their dull leaden hue, *D. cæsia*" ('Entomologist,' vol. xiii., p. 290). Mr. Gregson writes:—"From twelve young *conspersa* larvæ from Hoy, I have bred ten fine perfect specimens, not one of which could be recognised as *conspersa* at first sight. They have neither the dark nor light colours and markings of *conspersa*; they are all more ochreous-brown and yellow, some with rather lighter markings; two are bright ochreous-yellow, without any light markings, in fact, they are in pairs, so that placed five and five, no difference could be observed or choice made between them" ('Young Naturalist,' vol. vi., p. 263). Of *Dianthœcia conspersa* from Unst, Mr. Weir writes:—"These are all of the true Shetlandic coloration, but lighter; some with the markings nearly obliterated, and of a dark leaden-brown colour" ('Entom.,' vol. xvii., p. 3). Of the variation in Welsh specimens of this species, Mr. Gregson writes:—"In July 1885, I took a few *Dianthœcia conspersa* larvæ near Llangollen, and from these larvæ I bred five good specimens, every one of which is so different from the type which I have taken at Penmaenbach (North Wales), Isle of Man, Cumberland, Westmoreland and North Lancashire, and also from the wonderful ochreous variety of it which I bred from Mr. Curzon's larvæ from Hoy (see 'Young Naturalist,' 1885-6), and which I then called 'var. *ochrea*,' that I have determined to describe these as *Dianthœcia conspersa*, var. *albimaculoidæ*. Ground colour cold deep brown, thorax dark grey, shoulder marks (first striga) only just indicated, many wavy black markings on the disc, and seven or eight black marks on the costa, and along the hind-margin, the broad arrow-heads are black, the first stigma, like that of *albimacula*, is round, white, with a dark centre, the exact colour of the ground of *albimacula*, as is also the filling in between the black wavy lines, the second stigma is lost just as in *albimacula*, and the usual white marks in typical *conspersa* are merged into brown in var. *albimaculoidæ*. I may say that I received some *D. conspersa* larvæ in 1886 from Mr. Curzon, when he was in Shetland (on Mainland); these produced six specimens, five perfect and one injured, identical with my Welsh variety, *albimaculoidæ*. The specimens of *D. conspersa* var. *obliterœ*, first taken by Weaver, in Perthshire, and which were mistaken by Newman (see 'Zoologist') for *barrettii*, are rich, full ochreous-brown without any

markings; but fig. 15, Pl. 39, called *Miselia compta*, in Westwood and Humphrey's 'British Moths,' is certainly a variety of *conspersa* with rather more white upon it than var. *albimaculoidæ*, but the description of *compta* on page 187 of the same work is certainly a description of *compta* where it is said "the wings being regularly fasciated with white," but it applies to *conspersa* where it is said "it feeds on *Lychnis dioica*, as *compta* feeds on *Dianthus*" ('Young Nat.,' vol. viii., p. 178). I do not know whether Mr. Gregson's variety here referred to as var. *albimaculoidæ* is identical with my var. *suffusa*, which is very devoid of white markings, but the ground-colour of the latter is black or blackish-grey not brown. I quite agree with Mr. Gregson that Humphrey and Westwood's *compta* is *conspersa* and I believe the statement "regularly fasciated with white" to be simply a loose description of the figure, although such a description applies of course, strictly, to true *compta*. Of this species, Mr. Robson writes:—"The stigmata white; the reniform clouded with darker; the inner margin mottled with white, and a blotch of the same colour near the tip; the remainder of the wing clouded and marbled with darker marks of at least two shades, which vary from brown, in examples from the South of England, to black in those from the North. Specimens recently brought from the Shetland Isles are nearly all black, only being a little lighter in shade, where those from other localities are white. *Conspersa* is perhaps the scarcest of the four generally-distributed species, and it is rarely very abundant even where it does occur. In Ireland it has been very seldom taken. It has a habit, not usual with others of the genus, of resting on palings, and I have been told of a fence near Croydon some two miles long, on which the collector is likely to meet with thirty or forty specimens every day, while the species is on the wing. On my collecting-ground I have only taken seven specimens in nearly thirty years, and one of these was at rest on some palings. For purposes of comparison, I may say that during the same period I must have taken at least a couple of thousand *carpophaga* on the wing, and I never saw but one on the palings" ('Young Naturalist,' vol. iv., p. 184).

The following is an attempt to classify the different varieties of this species:—

1.—Black, much mottled with white, central white fascia unbroken = var. *fasciata*.
2.—Black, much mottled with white, central white fascia broken = *conspersa*, Esp. = *nana*, Rott.
3.—Black or blackish-grey, very little white mottling = var. *suffusa*.
4.—Black, tinted with ochreous, white restricted to reniform area = var. *intermedia*.
5.—Blackish, much mottled with ochreous = var. *ochrea*, Gregs.
6.—Dull unicolorous ochreous-black = var. *obliteræ*, Robson.

I am entirely unable to distinguish between the var. *ochrea* and *obscuræ* of Gregson, in both of which the usually white parts of the wing appear to be ochreous (*vide* 'Entomologist's Record,' vol. ii., p. 306). It is very doubtful whether Hufnagel's description * of *nana* does not

* This is one of the few original descriptions I have been unable to test personally. I am indebted to Mr. Kirby of the British Museum for this.

refer to *Hadena dentina*. It certainly applies much more fittingly to that species than to the one under consideration. It is :—"Anterior wings whitish-grey shading into dark grey, with a whitish-grey dentate spot in the middle of the fore wings. Of the third size. On tree trunks; common." This description can hardly belong to *conspersa*, and I therefore take Rottemburg's *nana* as the type * description. There appears to be no doubt that Rottemburg's description applies to our *conspersa*. He writes:—"*Ph. nana*. Ground colour of fore wings dark black-brown. The extreme base is white, with some black spots. In the middle of the fore wings is a white round spot, and a similar reniform spot, both surrounded by a black line. The reniform is somewhat grey in the middle. With the lower edge of the reniform another rather large dentate snow-white spot is in contact. The outer border marked alternately with black and white. On the lower and inner margin of the fore-wings stands another rather large white spot, enclosing a few black dots. Hind wings dark grey, rather paler towards the base, border whitish, a very small whitish spot at the anal angle. Head and thorax spotted above with dark grey and white; abdomen concolorous with h.-w. Size of *Phal. triplasia*." Esper's *conspersa* also represents the type of the species. His description is:—"*Noctua* spirilinguis cristata, alis superioribus nigris albo maculatis punctatis striatisque stigmatibus ordinariis albis; orbicular, magnitudine reniformi fere æquali, in apice et angulo ani macula alba" ('Die Schmet. in Abbild.' &c., p. 294).

α. var. *fasciata*, mihi.—An occasional variety occurs in which this species copies its ally, *compta*, and has a complete white band. Of this variety Mr. Gregson writes:—"I once took a wasted variety of *D. conspersa* at Penmaenbach in Wales. It has been said to be a *compta* repeatedly. I believe that all so-called British *compta* are only varieties of *conspersa*. Mr. Meek and others called my Penmaenbach var. of *conspersa,—compta*" ('Entomologist,' vol. vi., p. 518; vol. vii., p. 17). I have occasionally seen similar examples.

β. var. *suffusa*, mihi.—This form appears to replace the type in North English, Scotch (mainland) and some Irish localities. The ground colour is as black or blacker than in the type, but the normally white, basal, outer marginal and inner marginal areas are essentially of the darker ground colour, the white being reduced to a minimum, and existing principally, though to a much less degree than in the type, around the reniform area. My specimens have come from Ballycastle, Sligo, Pitcaple, Beverley and Clevedon; besides which, I have seen specimens from Hartlepool. Mr. Bond writes:—"The Irish specimens are much richer and darker in colour than any English specimens I have seen" ('Entomologist,' vol. iv., pp. 121-122), whilst Mrs. Battersby writes:—"I have been fortunate in capturing *D. conspersa* this season, Mr. Birchall says it is the darkest specimen he ever saw" (*l.c.*, p. 136). Subvar. *grisea-suffusa*.—The intense black of var. *suffusa*

* Of course, by the law of priority, if we are satisfied that *nana*, Hufn. = *dentina*, Esp., it should replace it. There is no doubt that *nana*, Rott. = *conspersa*, Esp., but if *nana* be used for *dentina* it cannot be used very well for *conspersa* also. For myself, I would throw out *nana* altogether, except that it is in general use all over the world for the species under consideration, and this seems a sufficiently good reason for retaining it.

changed to blackish-grey; the white markings reduced as in *suffusa*. I have seen specimens from Durham.

γ. var. *intermedia*, mihi.—Whilst as deficient in white markings as var. *suffusa*, only having them around the reniform, the ground colour of this form has a distinctly ochreous tint and is not of a deeper black than the type, as is that of var. *suffusa*. I have seen specimens only from Shetland. This may be Gregson's var. *albimaculoidæ* referred to just previously, but I must acknowledge that Mr. Gregson's note puzzles me entirely.

δ. var. *ochrea*, Gregson.—Gregson says of this:—"All the white obscured with ochre, the whole insect of an ochreous tint" ('Ent. Record' &c., ii., p. 306). This would appear to be the variety bred by Mr. Fenn and figured in Newman's "British Moths,' p. 389, fig. 2. Of the "protective coloration" of this form Dr. W. S. Riding writes:—"I bred a variety of *D. conspersa* last year from larvæ obtained in Cornwall. The white is entirely replaced by buff, with a slight greenish tinge (the latter especially noticeable on emergence) in two of the specimens bred, and in four others there is transition in all degrees from the type of the variety, but with a predominance of the buff. The hills in the district are metamorphic, varying in colour from slate-grey to blackish, and they are covered with lichen, especially the yellow lichen. Query—Is this a protective variation? It seems possible if not probable, as the larvæ were taken near the coast, from *Silene inflata* and *S. maritima*" ('Entom. Record' &c., vol, ii., p. 275). This variety was noticed as far back as 1870 by Mr. Moore, who was informed by Mr. Newman that it was *D. barrettii*, although both the Rev. Mr. Hellins and Mr. Moore correctly supposed it to be a var. of *conspersa*, the specimens of the latter gentleman having, as he says, "a strong tinge of yellowish-olive, with a distinct flush of bluish-purple in some of the darker parts, almost approaching iridescence" ('Entomologist,' vol. v., p. 30). Mr. Howard Vaughan then correctly referred the specimens again to *conspersa* (*l. c.* p. 77), and several other notes referring to these specimens occur in the same volume. My examples have come from Cornwall (Dr. Riding) and Shetland. It is strange that in those from Cornwall, the orbicular is usually ochreous, whilst in those from Shetland it is whitish.

ε. var. *obliterœ*, Robson.—Mr. Robson describes this variety as:—"The entire wing suffused with the darker colour," certainly a rather comprehensive description. The ground colour of these unicolorous Shetland specimens is of a distinct ochreous-black tint, but with no distinct demarcation of ochreous markings as in var. *ochrea*. As yet I have only seen specimens from Shetland.

Dianthœcia, Bdv., *cæsia*, Bkh.

Probably there is no species in the British fauna which illustrates the melanic tendency of our insects when compared with ordinary typical Continental specimens, better than this. *Cæsia* varies much on the Continent of Europe, some specimens being a mixture of bright orange and bluish, whilst others are almost unicolorous blue. The former is Borkhausen's type, and the form one generally gets from Continental collectors, the latter is represented by Hübner's fig. 60, which is almost entirely unicolorous bluish-grey. Our British specimens, on the other

hand, lose the orange and blue tints almost entirely, and become changed to an almost unicolorous dark slaty or bluish-grey colour. Mr. Robson writes of *cæsia*:—"This species is very easily distinguished from all others of the genus, being rather bluish-grey in colour. It is larger than *compta*; the central fascia is similar in shape, but much obscured with bluish-grey, and in British examples exceedingly so. The difference indeed, between British and Continental specimens is so well marked, that Mr. Gregson, one of the first captors of the insect here, proposed to call our form of it by the name of *manani*, after Manan, the first king of the Isle of Man. Had this suggestion been adopted, the differences between the two would have been more prominently brought forward, and no one would have been likely to purchase the foreign form as a British example. It was first taken in 1866, in the Isle of Man. The following year Mr. Birchall bred it from larvæ found feeding on *Silene maritima*, on the south coast of Ireland. Since that time it has been taken with some regularity, and may now be found in most of our collections" ('Young Naturalist,' vol. iv., p. 184). The type is thus described by Borkhausen:—"The colour of the fore wings is a very indistinct but agreeable mixture of grey and light bluish, in which large and small blackish and orange spots are mixed up. In most specimens no markings are seen owing to this mixing. In the clearer ones, however, are seen 3 angular (curved) lines, the same as in *flavicincta*, these being somewhat lighter than the ground colour, but bordered with darker" ('Naturgeschichte' &c., iv., p. 279).

a. var. *manani*, Gregs.—As previously stated Mr. Gregson captured the first British specimens of this species in 1866. He writes:—"With the assistance of Mr. Doubleday, I make out a *Dianthœcia* I captured in the Isle of Man, to be a singularly permanent variety of *D. cœsia* (*N. dichroma*, Esp.). It is a very fine bluish lead-coloured insect, almost devoid of distinct markings, except a few yellowish spots or patches. It is suffused and rough-looking as a friezed coat, and as it is such a decided and permanent variety I propose to call it var. *manani*, after Manan, first king of Man" ('Entomologist,' vol. iii., p. 104). On the same page Mr. Parry records, under the name of *Mamestra auredo*, the capture of the same variety. Writing of this form Mr. Gregson afterwards added:—"My first brood is of a dark blue lead-colour, with a few yellow patches, without perceptible strigæ or stigmata, the later specimens being more like typical *cæsia*. To say the first brood, or *manani* form were *cæsia* required a thorough knowledge of Continental moths, which I had not, and therefore deferred to Mr. Doubleday's judgment; but anyone having seen typical Continental *cæsia* could tell at a glance that the later specimens, when fine, were *cæsia*, as they are not blue, but suffused whitish, with a darker central fascia, the stigmata well defined, and a row of dots outside the fascia &c. It is only because I took and bred more than twenty specimens in May, with little, if any, variation amongst them, and also quite as many of the typical form later in the season, that I ventured to give the permanent variety a name; and, however much I may regret having done so for Mr. Parry's sake, I must tell him it was named long before he visited the Isle of Man in June" ('Entom.,' vol. iii., pp. 128-129). Of the Irish form, which agrees with var.

manani, Mr. Birchall writes:—"*Dianthœcia cœsia* has been bred by my friend Warren Wright, of Dublin, from larvæ taken on the South coast of Ireland, feeding on *Silene maritima*. The specimen which he has kindly sent to me for examination does not differ from those taken in the Isle of Man" ('Entomologist's Monthly Magazine,' vol. iv., p. 91). This would appear to be the var. *doubledayi* of Millière published in the 'Nat. Sic.,' 1886.

Hecatera, Gn., *chrysozona*, Bkh.

This species appears to vary but little, in fact, in a long series of some 40 specimens I only notice that there is a slight sexual demorphism, the females being slightly darker than the males, and the band in both sexes is, in some specimens, rather less distinct than in others. Borkhausen describes the type as follows:—"The forewings have a silver-grey ground colour mixed with minute black scales, and three whitish transverse lines in the ordinary position. The space between the 2nd and 3rd is grey-brown and forms a broad band, which, on account of the strong curve of the 3rd line, becomes much narrower on the inner margin. On both sides, this band is bordered by a black, strongly indented line, the pointed teeth of which encroach into the white streaks. In the band, stand the ordinary stigmata, grey in colour, and a dark dentate median shade almost linear. Everywhere are mixed orange coloured spots and streaks. Near the hind margin is an orange row of dots, and on each dot is seen a small black wedge-shaped spot with its point turned inwards. The hind margin is round with whitish-grey fringes. Hind wings dark grey with paler base" ('Naturgeschichte' &c., iv., p. 264). Hübner's *dysodea* (fig. 47) is rather darker grey and the orange becomes almost red. It is called *ornata* by Villers (280), and *ranunculina* by Haworth (p. 183). Dr. Staudinger names one variety from Greece.

a. var. *innocens*, Stdgr.—Staudinger's diagnosis of this variety is:—"Multo dilutior, fere albicans" ('Catalog,' p. 92). I have never seen an almost white specimen of this species, although I should not be at all surprised if an occasional specimen resembling this local Grecian form were captured in Britain.

Hecatera, Gn., *serena*, Fab.

This widely distributed species, constant as it is in Britain, with its white ground colour and dark central band, would appear to be variable enough on the Continent, if we judge by Staudinger's 'Catalog,' p. 92. In Britain, an occasional specimen (generally of the female sex) occurs, in which the basal area and extreme outer margin are dark grey instead of white, but as far as my experience goes, such variation is not at all common. Occasionally the males have the band less strongly developed, reminding one of Guenée's statement "the median space is more or less obscure" ('Noctuelles,' vi., p. 29). The type is described by Fabricius as:—"*Noctua* cristata alis deflexis albidis: fascia lata fusca utrinque flavo maculata." "Parva. Corpus albidum atomis fuscis. Alæ anticæ basi albæ punctis aliquot nigris, in medio fuscæ, qui color utrinque striga undata flavescente terminatur maculis ordinariis albidis, apice albæ striga nigra fuscaque. Costa albo nigroque punctata" ('Mantissa,' p. 171). This typical form with the basal area

spotted with black and the outer margin fuscous, would appear to be the darkest of our British specimens. Our pale ones would be referred to the *leuconota* of Eversmann.

a. var. *leuconota*, Ev.—Staudinger gives the following diagnosis of this variety:—"Thorace alisque ant. albidis, his fascia lata media obscura" ('Catalog,' p. 92); whilst Guenée writes of it:—"Of a clearer white, without the terminal lunule and without any trace of the subterminal line, in the place of which, there is only a very small dot between the lower part of the first and second. No traces of yellow on the transverse lines, of which the external *filet* is almost entirely wanting. Two black dots at the base replace the abbreviated basal line. Inferior wings, having the white terminal band prolonged through almost its entire length" ('Noctuelles,' vol. vi., p. 30). The localities given by Staudinger and Guenée are Russian, and Guenée adds "where it replaces *serena*." Eversmann's original description is:—"Corpus album; alæ anticæ cretaceæ spatio medio nigro, ut in specie genuina; posticæ albæ, externe nigricantes, maculis albidis anguli analis." To which he adds:—"Forma genuina apud nos invenitur, var. *leuconota* antem non raro volat in provincia Casanensi, in promontoriis Uralensibus, circa Orenburgum et ad Volgam inferiorem, circa Sareptam" ('Fauna Volg. Ural.', 235).

β. var. *obscura*, Stdgr.—Guenée's var. B is named *obscura* by Staudinger, who describes it as:—"Obscurior, magis unicolor" ('Catalog,' p. 92). Guenée's more complete description is:—"The ground colour darker, more ashy, with the median space only a little deeper in colour, and in which the ordinary stigmata are more vaguely marked and not encircled with black. The subterminal better marked, almost continuous, although spotted and not arranged as an M. Fringes dark" ('Noctuelles,' vol. vi., p. 30). Guenée gives "Central France," and Staudinger "the Alps," as localities. We occasionally get such specimens in Britain, but I have received quite typical specimens from Continental collectors under this varietal name. I have a female with the basal area and outer margin very dark. It was captured in Westcombe Park.

γ. (?) var. *corsica*, Rmbr.—Staudinger queries this as a var. of *serena*, and writes:—"Dilutior magis unicolor" and then adds "or a var. of *chrysozona*." Guenée adds:—"This species is very rare and has not been captured since it was taken by Mr. Rambur. Having only seen one specimen that he took, and that in bad condition, I am unable to give a description, nor, which I regret more, can I say in what it positively differs from a female, sent from Madrid, by Mr. Graells, and which is, if not a species, a very strongly marked variety" ('Noctuelles,' vol. vi., p. 28).

Polia, Tr., *chi*, Linn.

This species is very variable in Britain, developing, at least, two very distinct races, independently of the melanic form which has recently been discovered by Mr. Porritt near Huddersfield. The ground colour of the fore wings varies from an almost pure white (sometimes with a faint bluish tinge) through a dark cold whitish-grey to black. The var. *olivacea*, with a greenish tinge, is fairly well distributed in our northern English localities, but can nowhere be called

common, although Mr. Maddison states that as many as 25 per cent. of the *chi* he takes in Durham are var. *olivacea*. The form with dark grey fore wings in both sexes (var. *suffusa*) is most interesting, and in the Bradford district, entirely replaces the type. The Linnæan description is:—"*P. Noctua* spirilinguis cristata, alis deflexis canis: superioribus *x* nigro-notatis" ('Systema Naturæ,' xth., p. 514). The hind wings of this species exhibit a fair amount of sexual dimorphism, those of the females being darker than those of the males. In the fore wings, there is a tendency in the typical form to follow the same line of variation, and this, apparently, led Mr. Mansbridge in the 'Ent. Record' &c., vol. ii., p. 200, into supposing the females to be var. *suffusa*. The *x*-like mark varies much, and reminds one of certain forms of *Luperina testacea* and some species of *Miana* and *Apamea*. There is also considerable variation in the row of wedge-shaped spots on the subterminal which, in its extreme development, forms a transverse wavy line. The central shade is rarely well-developed, although frequently distinct. The spots on the hind wings of the males (on the outer margin) remind one somewhat of similarly developed spots on the hind margin of the posterior wings of certain species of the Bomycid genus *Spilosoma*. Guenée says of this species:—"It varies very little and only in the shade of grey. Mr. Stephens has given under the name of *olivacea* a variety which is of an olive-green colour, but I have not seen it and am not certain that it really belongs to *P. chi*" ('Noctuelles,' vol., vi., p. 35). Mr. C. G. Barrett writes:—"At Kendal, *Polia chi* was to be found commonly sitting on stone walls, and in many instances, so posted against ledges and inequalities, as to be fairly well concealed, or, at any rate, only noticeable by those who looked for them; but on the slopes of the Pennine hills, between Oldham and Huddersfield, where the original grey or whitish colour of the stone walls has become totally changed by the constant action of smoke from the cotton mills of the large towns, and the woollen mills of the villages, this moth becomes so conspicuous that it may be seen fifty yards away, and is indeed more noticeable than the wall itself. Here, one would suppose, would be a grand opportunity for the development of the variety *olivacea* and other dark forms, but no such alteration has taken place. I searched for hours for such varieties, and found only one, although the moth actually varied much in the dark markings on a *white* ground. One specimen I found on the blackened trunk of a tree, but their preference for walls was astonishing, hardly one was to be found on the isolated rocks or rocky hill sides" ('Entomologist's Monthly Mag.,' vol. xxii., p. 111). The change since then must have been very rapid, as the Huddersfield district now produces quite melanic forms. It is quite possible that dark varieties occurred then, but were too well concealed for Mr. Barrett to find them.

a. var. *olivacea*, St.—This beautiful variety has, when fresh and in fine condition, the anterior wings of a delicate greenish-grey, the hind wings exhibiting the same sexual demorphism as the type. The original description of Stephens is:—"Viridi-olivacea, alis anticis strigis 4-denticulatis albis liturisque nigris, ciliis cinereo-albis olivaceo maculatis, posticis fuscis, strigâ pallidâ." "Olive-green, ant. wings with 4 denticulated white strigæ, the first abbreviated at the base; the second, before the middle, angulated towards the costa; the

third beyond the middle, very much curved and becoming parallel with the second towards the inner margin; the fourth is composed of irregularly lunate spots and is parellel with the hinder margin; some of these spots have wedge-shaped black marks on their inner edges, and the two middle strigæ are united by a black streak between the stigmata which are faintly bordered with black and white on the inner margin. Cilia ashy-white, with olivaceous spots: post. wings fuscous with a pale waved central striga. Taken at Cramond Rest, Edinburgh" ('Illus. Haust.,' iii., p. 325). Staudinger says of it:—"Al. ant. olivaceo-grisescent." ('Catalog,' p. 97); while Newman writes:—"There is a beautiful local variety, in which the ground colour of the fore wings is a delicate olive-green, interrupted by four transverse series of pure white spots, the first very short and close to the base; the second nearly direct, but zigzag, is situated before the middle of the wing; the third very much bent, and situated beyond the middle of the wing; and the fourth is oblique and parallel with the hind margin. The discoidal spots are rather obscure" ('British Moths,' p. 394). Newman also figures the variety on the same page. Humphrey and Westwood write:—"*Polia olivacea*, described by Mr. Stephens in the appendix to the 3rd volume of his 'Illustrations' as measuring $1\frac{1}{3}$ inch in the expanse of the fore wings, and of a green-olive colour, with four denticulated white strigæ and black markings, the stigmata faintly bordered with black and white, with olivaceous spots; taken at Cramond, near Edinburgh, by Mr. Little, has subsequently been considered as a variety of *P. chi*" ('British Moths,' p. 192). Of var. *olivacea*, Mr. Robson writes:—"Thirty years ago, I took var. *olivacea* here (Hartlepool) in some numbers, along with the type, but it seems to have disappeared, for I have seen neither for quite twenty years. *Olivacea* is comparatively common about Newcastle-on-Tyne, whence I obtained all the specimens I have had of recent years. It passes the winter in the egg state. The eggs are of the usual Noctua form, like a tiny limpet shell, and deposited so that one overlaps the other. It is an easy species to rear, and a bred *olivacea* is something very different to the faded specimens captured, being much darker and not so green. The first I ever bred appeared to be something I did not know, and thoughts of a new species came into my head, but quickly proved vain. In the west of the county of Durham—perhaps I should say the south-west—the type occurs commonly but I have no knowledge of *olivacea* occurring there. If the species occurs in the north-west I should expect it to be *olivacea* rather than the type" ('Entom. Rec.' &c., vol. ii., p. 84). To which Mr. Maddison adds:—"Referring to Mr. Robson's note ('Ent. Record,' vol. ii., p. 84) the type and the var. both occur here. I take them at rest on grey stone walls, tree trunks, and palings, the var. forming about 25 per cent. of the specimens taken. I have also one or two intermediate forms" ('Entom. Record' &c., vol. ii., p. 107). Mr. Elliot, writing of this species at Jedburgh, says:—"*Polia chi* is very common, and the variety *olivacea* frequently occurs, some of a pale green, varying to a dark smoky shade, the abdomen being almost black" ('Entom. Mo. Mag.,' vol. xviii., p. 258). For my finest specimens of *olivacea* (both sexes), I am indebted to Mr. Finlay of Meldon Park, who takes the variety regularly in his district. Mr.

Gregson writes:—"I have several of this form (*olivacea*); one, given to me by Mr. Allis, is of the darkest green I have seen, the body being dark brown, and one, obtained near Lees, near Oldham, is dark brownish-olive, with the markings very light. The latter is a most striking instance of change of colour" ('Entomologist,' vol. iv., p. 54).

β. var. *suffusa*, Robson.—This form has the fore wings of a cold dark-grey in both sexes, and has been described by Mr. Robson, who writes:—"In the Cleveland district of Yorkshire, the type form of *P. chi* is very common and may be taken in any number at rest on the stone walls that form boundaries on the moors. In West Yorkshire, another form occurs, distinct enough to have a varietal name. Instead of the pure white of the type, it has the ground colour much suffused with grey. It is scarcely so dark as captured *olivacea*, and is entirely without the greenish hue of that variety. *Suffusa* would be an appropriate name for it. I know little of the species from other places. The few Scotch specimens I have seen, all have the pure white ground of the type" ('Entomologist's Record' &c., vol. ii., p. 84). Mr. Robson also writes:—"Mr. L. S. Brady of Sunderland has sent for my examination a specimen of *Polia chi*, the larva of which he obtained, along with those of several species of *Tæniocampa*, by beating in 1883, at Arthog, in North Wales. The moth did not emerge in August or September, as usual, but came out in the spring of 1889 with the specimens of *Tæniocampa*. The specimen sent me is of a darker grey variety, which, I believe, has no varietal name yet, but which I have always known as the Yorkshire form" ('Young Naturalist,' vol. xi., p. 234). I have always known this variety as the Bradford form, due, I suppose, to the Yorkshire collectors in that neighbourhood having been the first to notice it. There is, of course, a tendency for the ground colour of typical females to be darker than the typical males, but in var. *suffusa*, the ground colour of the males also undergoes a darkening process.

γ. var. *nigrescens*, mihi.—At the meeting of the Ent. Soc. of London, on February 10th, 1892, Mr. Porritt exhibited almost melanic specimens of *Polia chi* of which he writes:—"The melanic specimens of *P. chi* which I exhibited at the meeting of the Entom. Soc. of London on the 10th inst., differ from the ordinary type in having the usual pale markings replaced by slaty-red colour in the forewings of the males, and by dark olive-lead colour in the females. The hind wings are paler in the male, but as dark or even darker than the forewings in the female" (*in litt.*). This form was first noticed by Mr. Porritt who wrote:—"An almost melanic form of *P. chi* in both sexes has been captured here (Huddersfield) both this and last season" ('Entom. Record' &c., vol. iii., p. 7), although there is a reference to black forms having occurred in the Leeds district by Mr. Mansbridge in the 'Entom. Record' &c., vol. ii., p. 200.

Polia, Tr., *xanthomista*, Hb.

A local form of this variable species is found in the Isle of Man and Cornwall. There appears to be a very great range of variation in this species on the Continent, and a tendency to develop local races through the action of "natural selection" in different localites is observed. In certain parts of Switzerland, var. *nivescens* only occurs, in

others, the dark type is common, whilst in others, specimens with a greenish tint and richly speckled with orange are common. Guenée writes of it:—"This species is as common, but less distributed than *flavicincta*. It varies infinitely, and I have had a large number of specimens sent me for determination, which have puzzled their possessors. However, the constant well-marked and uniform design, and the inferior wings, always white in the males, without a median line, with a well-marked lunule and a strongly accentuated series of terminal lunules, whilst those of the female are grey almost black, together with the short abdomen of the latter sex, ought to prevent all confusion" ('Noctuelles,' vol. vi., p. 37). Mr. Sydney Webb, who now has Mr. Gregson's series of this insect, writes:—"This may (in Britain) be called an "invariable" species, excepting that there is a central dark cloud, that sometimes assumes almost the character of a fascia. Gregson calls this form var. *statices*." Mr. Webb adds:—"I also send you a prettily marked ♀ with very pale ground colour, in which the transverse markings are rather crowded together in the middle of the wing, also another specimen in which the yellow markings are largely in excess, making a great contrast with the dark central fascia" (*in. litt.* 27, 2, '92). The announcement of this species as British, was made by Mr. Doubleday as follows:—"A day or two since, my friend, Mr. Greening of Warrington, sent me a NOCTUA to name which he bred from a larva found by himself in the Isle of Man. It is *Polia nigrocincta* of Ochsenheimer, a species new to Britain. It is not uncommon in Hungary, the South of France &c., and is easily distinguished from *P. flavicincta* by the following characters:—The superior wings are bluish-grey, thickly irrorated with black, interspersed with minute orange dots; and a narrow black band occupies the centre of the wing, extending from the costa to the inner margin. The inferior wings are white in the male, without any median line, and nearly black in the female. It is variable in size and in the intensity of the markings. I possess a fine series from France and Germany" ('Entom.,' vol. iii., p. 349). Mr. Carrington figures, what is, compared with our ordinary British form, a variety of *Polia nigrocincta*, which from the bright orange suffusion would appear to be the type. He writes:—"We are indebted to Mr. Clarence E. Fry, for permission to figure this beautiful variety. It is one of some forty specimens of *Polia nigrocincta*, bred by Mr. E. G. Meek, from larvæ collected in 1877 by Mr. Pankhurst in the Isle of Man, while he was jointly employed by Mr. Fry and Mr. Meek to collect Lepidoptera in that Island. The larvæ were transferred to London. No particular variety was observed amongst the larvæ, which were fed on sea-pink (*Armeria maritima*) and sea-plantain (*Plantago maritima*). The imagines of this species seldom vary either in colour or markings. Nor do the other British species in the genus *Polia*, with the exception of the north-eastern form of *Polia chi*, called *olivacea*. The variety under notice is so unlike the original type as to be difficult to identify. The woodcut gives a general idea of the appearance. Instead of the usual bright black and white of the superior wings, they are suffused with bright orange colour, with here and there a small patch of grey. The stigmata are strongly marked. The orbicular being filled in with bright sandy-red. The usual black markings are very pale in colour; in

fact, dark grey. The anterior wings are slightly suffused with black round the outer edge" ('Entom.', vol. xii., p. 161). Mr. Carrington could not have known much of the species to say "the imagines seldom vary," unless he judged only from British specimens. His remark, too, about *P. chi* and *P. flavicincta* not varying is also incorrect. Of the species in Cornwall, Dr. Riding writes:—"Whilst at Morthoe, I was fortunate enough to take 3 males and 4 females of *Polia nigrocincta* in fine condition. This is, I believe, the first time the insect has been taken in England, with the exception of the solitary specimen captured at Padstow in 1862, although imagines and larvæ, the latter especially, have been found pretty freely in the Isle of Man. The specimens I have seen from that locality have a less distinct black band" ('Entomologist,' vol. xvi., p. 248). Hübner's type may be thus described:—"Anterior wings pale grey, with the two basal lines yellowish; the orbicular and reniform both outlined in yellow; the angulated and subterminal lines being also of the same colour. The hind wings white with blackish outer margin, a dusky line parallel to the margin and a distinct lunule" ('Sammlung europ. Schmet.,' fig. 647). This form, strongly speckled and mottled with yellow is, therefore, the type; whilst the less strongly yellow-speckled form is the *nigrocincta* of Treitschke. Standinger also mentions a white form irrorated with black and yellow scales which he calls *nivescens*. Of the type Standinger writes:—"Forma (aberratio) obscurior, al. ant. valde flavo-conspersis" ('Catalog,' p. 96). Guenée treats Hübner's type as a variety and writes:—"The general tint becomes browner and more unicolorous (equal)." What this means, I must confess I do not know, for Hübner's figure is in no way brown. The rest of Guenée's description is correct enough. He writes:—"The tint is no longer bluish, and numerous bright orange-yellow scales follow all the lines and outline the stigmata along their inner borders. The females have a more generally yellow tint, and the yellow scales brighter and more numerous." He then adds:—"Independently of this variety, *nigrocincta* presents a crowd of others but without any constancy" ('Noctuelles,' vol. vi., p. 37).

a. var. *nigrocincta*, Tr.—Standinger says of this:—"Forma frequentior, dilutior" ('Catalog,' p. 97). Guenée writes of this variety (which he considered the type):—"The colour of the type of this species consists in the males of a clear ashy or bluish, having only rarely yellow spots slightly visible. The type has also the median space, distinctly blackish, and the ordinary stigmata marked in clear grey. The females are, however, more difficult to separate into races" ('Noctuelles,' vol. vi., p. 37). Treitschke's description is:—"Alis anticis cinerascentibus, medio nigrocinctis, strigaque postica albis," to which he adds:—"An *albicincta* from Borkhausen appears to be nothing else than a pale *nigrocincta*, without a strong mixture of yellow and black scales. All specimens, however, differ in their colouring, and there is some sexual difference. The male is much smaller and scarcely the size of *cæsia* whilst the female is almost as large as *flavicincta*. The male is whitish-grey, the female ashy-grey." "The grey forewings are divided by the transverse lines into three parts. The first is at the base and is always more or less tinged with yellow, the incomplete basal line is edged with yellow. The second division

is broader with a blackish fascia crossing it, and contains the orbicular and reniform which are paler but filled in with blackish, also the small claviform. The angulated line separates the second and third divisions; the latter contains the pale subterminal on which is placed five cuneiform spots. The hind wings of the males are whitish, with a brownish stripe before the white fringe. Those of the females are grey" ('Die Schmet. von Europa,' vol. v., pp. 32–33). The greater part of our British specimens are of this ashy-grey tint with a central band and a minimum of yellow scales. Such would, therefore, belong to var. *nigrocincta*. The same form with more orange scales becomes var. *statices*, Gregson. How Staudinger makes this variety "paler" than the type, I am at a loss to understand. Hübner's figure, as I have before stated, is of a very "pale grey" tint, mottled with yellow, whilst *nigrocincta* is "ashy-grey," mottled with black.

β. var. *nivescens*, Stdgr.—Staudinger says of this variety :—"Multo pallidior, al. ant. albicant. nigro flavoque irroratis" ('Catalog,' p. 97), the locality which he gives being "Helvetia."

γ. var. *statices*, Gregs.—It is very doubtful whether, among our British specimens of this species, occasional individuals do not occur which belong to the type, and to each of the named varieties, but, at the same time, our British specimens generally, have a racial appearance, as do so many other of our species, and hence the form has been named *statices* by Mr. Gregson. He writes :—"On the Continent this species varies very much, some specimens being difficult to separate from *P. flavicincta*, whilst others want the yellowish tones which enrich that species; but I have not yet seen or heard of a single specimen of our dark form occurring anywhere except in the Isle of Man, and I think that, as the Manx specimens are all of one type, it would be advisable to call them var. *statices*" ('Entom. Mo. Mag.,' vol. vi., p. 65). The great and only character of var. *statices*, the type of which has kindly been submitted to me by Mr. Sydney Webb, would appear to be a strong development of the dark central shade, which almost assumes a banded form, otherwise the coloration, especially the development of yellow, is quite typical. But these special characters are exactly those of Treitschke's *nigrocincta*, but whilst *nigrocincta* has scarcely any yellow markings, *statices* is nearly as well coloured as the type in this respect.

Polia, Tr., *flavicincta*, Fab.

This species, like the rest of the genus, varies in the direction of forming local races, and among our British specimens we have two very distinct forms :—(1) Pale greyish, mottled with yellow = the type, which appears generally distributed. (2) A much darker and more localised form, strongly powdered with black scales, which is much more restricted, but is the ordinary form taken in the Huddersfield district. There is another dubious variety from Sicily called *calvescens* which will be described in detail. I believe the variety is genuine enough, for I have a most striking specimen, apparently identical with it, which was given to me by Mr. Mason of Clevedon, where it was captured. The type of the species is thus described by Fabricius :—"*N.* cristata, alis dentatis deflexis fusco

cinereoque variis fulvo punctatis." "Caput cinereum basi parum fulvum. Thorax cinereus atomis fuscis fulvisque. Alæ anticæ fusco cinereoque variegatæ punctis sparsis fulvis. Costa albo punctata. Posticæ cinereæ supra striga, subtus puncto strigaque fuscis" ('Mantissa,' p. 178). Our British specimens vary from a pale ochreous-white with most of the dark markings contracted into a restricted space under the stigmata, through a pale grey with dark grey and distinct ochreous markings, to a blackish-grey sometimes strongly suffused with orange, at other times with the orange almost obsolete.

α. var. *meridionalis*, Bdv.—Guenée describes this dark variety in full. He writes:—"The blackish atoms are so numerous that they give to the wing a deep ashy ground colour in the male, and a greyish-black in the female. The orange colour is also more intense, and the patches of this colour on the subterminal line are covered here and there with indistinct black spots, which lose their cuneiform shape. The inferior wings are notably darker, well marked with blackish, the lunule is well defined and almost touches the median line above, whilst on its lower edge where it is yet better marked, it is as far removed from it as in the type" ('Noctuelles,' vol. vi. pp. 39-40). Millière writes of this variety:—"This Pyrenean race is of a very deep grey in all four wings, this colour passing frequently into black in certain specimens, which, then, almost lose the ordinary lines and orange spots" ('Iconog. et Des.' &c., vol. ii.). This form only occurs in one British locality to my knowledge, *viz.*, at Huddersfield, whence I have received it from Mr. Porritt. Mr. Hodges also takes it in Guernsey. In recording this form he writes:—"I secured a very fine series of *P. flavicincta*, at rest on the rough stone walls near St. Sampson's. These specimens are much more richly mottled and generally darker, with more orange markings, than any I have seen in England" ('Ent. Record,' i., p. 249). Guenée says:—"This variety is to *flavicincta*, what *xanthomista* is to *nigrocincta*" ('Noctuelles,' vol. vi., p. 140). Surely this is an error. As *meridionalis* is the dark var. of *flavicincta*, so *nigrocincta* is the dark form of *xanthomista*. Boisduval's original description is "valde obscurior" ('Gen. et. Ind. Meth.,' p. 127).

β. var. *calvescens*, Bdv.—This var. is paler than the type and Guenée thus writes of it:—"I must own that I dare no longer consider this *Polia* as distinct, since I have better studied it. It differs essentially from the type, only in that the bottom line on the inferior wings is less wavy, and owing to that is nearer the lunule, this line is also much fainter. The inferior wings are generally, of an almost unicolorous grey above, with the markings obsolete. They appear to me a little more rounded. The superior wings have the fringes less intersected and crenulate than in the type, the markings are less distinct, especially the subterminal. As to colour, it does not differ from that of *flavicincta* in the two females of M. Boisduval, and the yellow has only disappeared in that, which he has, I believe, described as a male, owing to the specimen being worn." "Sicily" ('Noctuelles,' vol. vi., p. 40). Dr. Staudinger gives it as a var. of *flavicincta* with a mark of doubt, and adds "or a var. of *rufocincta*" ('Catalog,' p. 96). For myself, I believe it to be, as I have

previously stated, identical with a beautiful pale variety I have with the ground colour ochreous-grey, the subterminal almost obsolete, and the darker markings almost restricted to that part of the inner margin under the stigmata. The yellow blends with the ground colour and hardly exists in the form of dots. Altogether, it is a most beautiful pale form. Millière writes of var. *calvescens*:—"I believe that *P. calvescens*, Bdv. is only a sub-var. of the type. In the Dept. of the Rhone, in low-lying places, varieties of this *Polia* may be obtained by breeding, of a greyish, almost white coloration, with ochreous spots, which are determined with difficulty and which are probably this sub-variety" ('Iconog. et Descrip.' &c., ii.). Boisduval's original description is:—"Statura *pumicosæ*, at magis *flavicinctæ* affinis. Alæ maris cinerascenti-albidæ, atomis nigricantibus confertim adsperso-nebulosæ; alæ feminæ luteo-pulverulentæ, fere ut apud *flavicinctam*. Alæ posticæ fuscæ, lunula media limboque obscurioribus" ('Gen. et Ind. Meth.,' p. 127).

Dasypolia, Gn., *templi*, Thnb.

This interesting species has had an endless number of positions assigned to it. By Guenée, it was placed next to *Polia* in the *Hadenidæ*; by Newman, it was removed to the neighbourhood of *Hydræcia* in the *Apamidæ*; by Staudinger, to the *Xylinidæ*;* in fact most authors appear to have had different ideas on the matter. To me, this boreal species appears to be an old form, not altogether dissimilar to *Polia*, but with a different superficial appearance owing to its habits and the peculiar localities it haunts. Its larval habits are, however, very unlike those of that genus. It appears to vary somewhat in the ground colour, the ordinary tint being of a dull ochreous-grey. Probably fresh specimens are dull greenish as mentioned by Thunberg, as there appears a slight trace of such a tint on some of my specimens. The type is thus described:—"*Noctua templi* cristata alis deflexis obscure virescentibus strigis undatis maculisque ordinariis flavescentibus" ('Diss. Ent. sist. Ins. Suec.,' Pt. iv., p. 56). Some of our palest specimens are entirely ochreous, whilst some are of a deep ashy grey. In some specimens, too, the transverse lines are much more distinctly marked than in others. Of the specimens from the Shetland Isles, Mr. Jenner Weir writes:—"Only three specimens were captured; two of them are very much lighter than the usual colour of the species" ('Entomologist,' vol. xiii., p. 290), whilst the following year he adds:—"As remarked in my paper, last year, out of the specimens taken two were very light in colour. The insect has been again captured this year, and the light variety has again been found, but a variety has also appeared very much darker and browner than the usual type, and with two darker bands through the centre of the upper wings" ('Entomologist,' vol. xiv., p. 280); whilst of the same species from Unst, Mr. Weir writes:—"All the specimens are smaller than those taken in Mainland"

* Many years ago Treitschke wrote: "I have before stated that *templi* was placed here (*i.e.* amongst *Polia*) by Ochsenheimer, but there is something foreign about this insect and it might be placed as well near *cassinea* and *nubeculosa*, of which, however, its life-history, at present unknown, might afford the best clue" ('Die Schmet. von Europa,' vol. v., pt. 2., p. 24.) Its life-history has not, however, shown any affinities with these species although it was removed to their immediate neighbourhood by Staudinger, perhaps, owing to Treitschke's suggestion.

('Entom.,' vol. xvii., p. 3). Treitschke's diagnosis of the species is :—"*Polia* alis anticis fusco cinereis, fascia media obscuriore, stigmatibus strigaque externa flavicantibus." To this he adds :—"Sweden is the fatherland of this species and not Austria as remarked by Hübner. It is considered a great rarity in Germany. It is about the size of *polymita*, head and back very thickly clothed with scales, brown-grey, the abdomen more yellowish. The antennæ of the male are more strongly pectinated than is usual in the latter species. The fore wings, head and thorax are uniform in colour; the basal line is double; the orbicular and reniform are small and yellowish-white; the angulated line turns inwards under the reniform, but turns outwards again near the inner margin; the subterminal consists of a strongly lunulated line. The fringes are grey. The hind wings are yellowish-grey, with darker transverse line and lunule" ('Die Schmet. von Europa,' pt. 2, pp. 23-24). It is not always that the basal and angulated transverse lines are sufficiently pale and well-developed to give the central area a banded appearance, but I have such specimens in my cabinet.

α. var. *ochracea*, mihi.—The whole of the fore wings of a pale and clear ochreous colour with slightly darker edgings to the pale transverse lines and stigmata, the subterminal line continuous and not broken up into spots by the dark nervures as it is in the darker type. My most ochreous specimen came from Leicester, whilst Mr. Weir (as before mentioned) reports the form from the Shetlands.

β. var. *suffusa*, mihi.—Of a very dark grey with the typical ochreous transverse lines almost obsolete, but the darker edgings to these lines showing up still darker than the ground colour, the only ochreous in the fore wings being a tiny orbicular and a few obsolete dots following the subterminal. The hind wings grey with two darker transverse lines. My darkest specimens came from Barnsley.

Cleoceris, Bdv., *viminalis*, Fab.

This is one of the most interesting species in the British fauna, so far as its tendency to melanism is concerned. In certain parts of Yorkshire, Derbyshire and the more northerly counties of England, quite black forms occur, which are very different from the greyish-white specimens from Kent, or the glossy silvery-grey specimens from the Shetland Isles. Of *Cleoceris viminalis* from Hoy, Mr. Gregson writes :—"Large; bright silvery ground colour, with well-pronounced markings" ('Young Nat.,' vol. vi., p. 274). Though I have bred a large number of specimens from larvæ taken in Kent, I never obtained a black one, although, a type specimen, with the basal half dark (blackish), and the outer half grey, occasionally occurs. A beautiful intermediate form, with a tendency to a melanic ground colour with silvery-grey markings occurs at Darlington, and some pale specimens have the costal area strongly red. The type is perhaps the rarest form in Britain. It is described by Fabricius as :—"*Noctua viminalis*, cristata, alis incumbentibus (deflexis) basi fuscis: strigis undatis fulvis apice cinereis" ('Gen. Insec.' &c., p. 284). Borkhausen, under the name of *saliceti*, also describes the type. He writes :—"The basal half of the fore wings is dark brown, the other half pale grey, as in *B. coryli*" ('Natur-

geschichte' &c., p. 630). Staudinger places this species between *Cirrœdia* and *Anchocelis*, a position which seems to me, most unnatural. In the general variation of *viminalis*, I would call attention to the peculiar development of the ⊢ - like mark. This is not formed in the ordinary way, by the union of the claviform with the elbowed line, but by a stigma-like development arising on the elbowed line and extending backwards to the central shade. The following is an attempt to classify the different varieties : —

1.—Bright silvery-grey, with red costa = var. *stricta*, Esp.
2.—Bright silvery-grey = var. *scripta*, Hb.
3.—Base brownish, outer half grey = *viminalis*, Fab.
4.—Ground colour suffused, markings distinct = var. *intermedia*.
5.—Black, with distinct markings = var. *obscura*, Stdgr.
6.—Unicolorous black = var. *unicolor*.

a. var. *stricta*, Esp.—This is the grey form with the reddish costa. Esper describes it as :—" *Ph. Bombyx* spirilinguis alis deflexis cinereis, strigis duabus transversis, e lineolis interruptis nigris, maculisque disci rufis " ('Die Schmet.' &c. contd., p. 38). Esper has two figures of this. One is represented with closed wings, the other with them expanded. The colour is ashy-grey with the costa reddish, the subterminal and elbowed lines dusky, basal lines blackish, central shade reddish on side nearest orbicular, the reniform also reddish and a red costal patch at top of subterminal. This is rather a common form in the South of England.

β. var. *scripta*, Hb.—Hübner's figure of this, our most common South of England form may be thus described :—" Ground colour silvery bluish-grey, with all the transverse lines double, but the elbowed line indistinct, a brownish area around both stigmata, the orbicular of the ground colour, the reniform yellowish. Hind wings grey with a bluish tint " ('Sammlung europ. Schmet.,' fig. 50).

γ. var. *intermedia*, mihi.—There is a very distinct intermediate form of this species, with the ground colour suffused with blackish scales, and yet with the basal area, the space from the costa through the reniform to the inner margin, and the outer marginal area, glossy silvery-grey ; not whitish-grey as in most of the Kent specimens, but the grey of a decidedly darker tint. The best specimens I have seen of this intermediate form have come from Darlington, Mr. Milburn having kindly sent me a long series.

δ. var. *obscura*, Stdgr.—Staudinger simply describes it as " multo obscurior," but refers this variety to Haworth's *scripta* var. *β*. Of this, Haworth writes :—" Alæ longe saturatiores quam in *a* ; posticæ fuscæ, vel fuscescentes strigâ marginali magis interruptâ, ciliis cinereis " ('Lepidoptera Britannica,' p. 213). Newman writes :—" In many specimens I have received from the North of England, the darker colour is diffused over the whole wings as represented in the lower figure " ('British Moths,' p. 99).

ε. var. *unicolor*, mihi.—This is an extreme form of Staudinger's var. *obscura*, in which the whole of the wing is strongly black, absorbing the transverse lines and stigmata which are of the same coloration. I have a long series of this var. from Derbyshire, Yorkshire &c. It appears to be a purely British variety so far as is at present known.

Epunda, Dup., *lichenea*, Hb.

This is a most beautiful species with two well distributed and distinct races. The first is of a deep olive-green with red markings = the type; the second is of a pale greenish-grey, with scarcely any trace of red markings = *viridicincta*, Frr. Strange to say, at two places on the South coast of England, this species is common, but all those specimens which come from Plymouth are quite typical, whilst those coming from Portland are uniformly var. *viridicincta*. Specimens which were taken by Mr. A. J. Hodges in Guernsey were typical, whilst specimens, captured by Mr. Baxter at St. Anne's-on-Sea, were of the *viridicincta* form. Under *flavicincta* we have the record of a pale Sicilian var. (*calvescens*), and the pale var. *viridicincta* is also recorded from the same locality. There is no doubt that this variation is another illustration of the action of "natural selection," the different environment in each instance being due to geological causes. Hübner's type may be thus described:—"♂. The ground colour dark green, suffused with red; two basal reddish-ochreous lines; the stigmata outlined in red; a dusky angulated line beyond the reniform, followed by pink lunules and a whitish subterminal line; outer margin green. Hind wings white, with a dark shade and dark line parallel to hind margin, dusky lunule. ♀. Markings and colour as in ♂, but more distinct, hind wings greyer" ('Sammlung europ. Schmet.' &c., figs. 562-563). *Epunda lichenea* is recorded by Mr. Christy from Argyllshire in September ('Entomologist', vol. xxiv., p. 246), but I have no idea what form he captured there. In the 'Proc. Sth. Lond. Ent. Soc.,' 1888-89, p. 136, Mr. South says:—"Of this species I exhibit two series, one of which is from Plymouth, and the other from Portland, both places on our S.W. coast. The specimens in the Plymouth series are fairly typical of the species, whilst the series from Portland is composed of small pale greenish-grey specimens, with but little, if any, of the pink or reddish tinge which characterises the type, and all the stigmata are conspicuous. Further, the secondaries are much paler in both sexes."

a. var. *viridicincta*, Frr.—Guenée gives a graphic description of this variety as it occurs with us at Portland. He writes:—"Generally paler. The prevalent colour of the superior wings is whitish-grey, and the markings, which are partly effaced, are pale olive-green. The median space is darker and in part occupied by green, which surrounds the two grey stigmata; the fringe is yellowish. The inferior wings are whiter, with the transverse line and lunule equally faint. The female is rather darker than the male." "Sicily" ('Noctuelles,' vol. vi., p. 49). Guenée then adds:—"I am unable to see in this supposed species, anything but a variety of our *lichenea*. From their descriptions, German authors appear to know this last species only imperfectly, and this explains why they have considered it distinct, and why they have compared *viridicincta* with *dysodea*, with which it has only a very distant connection in colour" (*l. c.*, p. 49). Freyer himself says:—"Treitschke writes:—'It is a pity that you had a worn specimen for figuring in which the green scales which caused the name, remained little visible'" ('Neuere Beiträge' &c., p. 176). Of Freyer's figure I wrote:—"This is the pale greenish-white or greenish-grey form of *lichenea*, with the abbreviated and complete basal lines, the elbowed

line and central shade darker grey in colour. The central area, between the complete basal line and elbowed line, greener and having a slightly banded appearance" (*l. c.*, Pl. 21, fig. 2). Staudinger simply says:—"pallidior."

Epunda, Dup., *lutulenta*, Bkh.

The capture of a beautiful series of this species at Sligo, in Ireland, by Mr. Percy Russ, led at once to a great deal of writing about the varieties of this species. One of the professional collectors, Mr. Salvage, then spent a summer in Ireland, and brought home with him a very extensive and variable series. The type agrees very well with our South of England form, in which the brownish-black ground colour is decidedly dusted with grey. Borkhausen writes of the type:—"It is the size of *N. exclamationis*. The ground colour of the fore wings dull brown-black, slightly glossy, and tinted with reddish-ochreous, which, however, is only seen in fresh specimens. There are 3 indistinct, somewhat darker-bordered transverse lines. Close to the hind margin is a lighter angulated line which forms a Latin W in the middle." "The fore wings are blackish-brown, glossy, with an obsolete dot in the middle. Hind wings whitish, shaded with brown-black on the costa." "In some vars. the transverse lines are scarcely to be seen, there being indeed, only a faint trace of them" ('Naturgeschichte' &c., p. 576). In Britain, we appear to get five distinct forms:—1. Unicolorous ashy-grey. 2. Unicolorous brown-black. 3. Ashy grey, with black central band. 4. Glossy black, with blacker lines. 5. Glossy black, with white lines. The first is undoubtedly the *consimilis* of Stephens; the second, the type = *lutulenta*, Bkh.; the third, var. *sedi*, Gn.; the fourth = the *lüneburgensis* of Freyer; whilst the fifth has been erroneously referred to *lüneburgensis* by Dr. Staudinger, and also by several recent writers in our English magazines. Besides these, there are some minor varieties, which will be dealt with in the descriptions following. I will only add here that Staudinger's summary of *lüneburgensis*:—"Nigricans, fasciis distinctis albis" ('Catalog,' p. 95), is entirely erroneous as far as the typical description and figure of Freyer are concerned, and seems to have been due to an error, based on the examination of Herrich-Schäffer's figures, where the glossy traces of the transverse lines are coloured paler, and thus misled Staudinger into calling them "white." Of course there is the possibility of white-lined forms occurring on the Continent, such as we now know occur in the Orkneys, and Dr. Staudinger may have seen such, but by no stretch of the imagination could such specimens be made to agree with the *lüneburgensis* of Freyer. This error on the part of Staudinger, led to Mr. W. F. de V. Kane adopting his description, both, apparently, overlooking the fact that Freyer's *lüneburgensis* is the type of the variety and not Herrich-Schäffer's figures, in which, as I have stated, I see nothing but an attempt to figure the pale gloss by which the transverse lines are indicated. Although Mr. Kane's note is, therefore, not based altogether on correct data, it shows sufficient research to be quoted at length. He writes:—"Several variations of this insect are described by Guenée and Herrich-Schäffer, none of which seem to me to correspond to the dark brown form taken in Scotland, in Galway by Mr. More; and in Sligo by Mr. Russ. This passes, I find, under the

name of *lüneburgensis*, but I think erroneously. If I am correct, it should be described and named as a distinct variety, being constant in coloration, and not confined to either sex or locality. *E. lutulenta*, W.V. is given (by Guenée) as follows:—'Of a dark sooty grey, with pencillings scarcely visible, and only the reniform stigma and subterminal line somewhat better marked, and joined to shadings of somewhat warm brown. The female darker, with hind wings of an uniform dusky colour.' This I take to be pretty much the English normal type of *Epunda lutulenta*. Guenée describes three varieties as follows:—'*Consimilis*, St., female var.—Of paler grey, but with pencillings as slightly marked.' '*Lutulenta*, Hüb., female var.—Of a grey mouse-colour, with the two median lines very slenderly, but distinctly, marked in black, the sublateral being more strongly marked.* Hind wings white to the centre, with a median line scarcely visible above, but on under side, a well-marked sinus opposite the cellule. South France.' '*Sedi*, male and female (Bdv. *in litt.*).—Of ash coloured grey with deeper median band; all the transverse lines well marked and double, bordered with warm brown. The stigmata a little clearer, but the lower portion of the reniform shaded with blackish. The hind wings of the female of a lighter hue than in the type, with traces of a median line. Central and South France.' Guenée states that he has never seen var. *lüneburgensis*, but, judging from the figures of Herrich-Schäffer, considers it to approximate closely to our form,' *i.e.* I presume, to that of *E. lutulenta*, W.V. On reference to the illustrations in question, it will be seen that the two female (?) insects are represented as being of different shades of brown, with all the lines drawn broadly in a paler tint, as also the outline of the stigmata. Hind wings of both darkly shaded. In fact, the darker specimen reminds one strongly of *Luperina cespitis* in general colour and manner of pencilling. The female (?) var. of H.-Schäffer, neither in depth of colour, marking, nor in being confined to one sex (?) seems to correspond to the Scotch and Irish insects to which I refer. Staudinger's short description of the two varieties tallies with the above, and more forcibly illustrates the dissimilarity I allege to exist:—'Ab et var. *lüneburgensis* (Frr., H.-S., Gn.). Nigricans, fasciis distinct. albis.' 'Ab. et var. *sedi* (Gn.), *lutulenta* (Dup. iii., 18, 1). Omnino cinerascens, fasciis distinct. nigris.' In the Doubleday European collection there is a dark ashy grey variety, with blackish and light grey delineation, marked "*lüneburgensis*;" and in the cabinet of Mr. Tugwell of Greenwich, there are two Scotch specimens, one of which is a dark ash coloured grey, with sepia brown lines and markings distinctly traced, and not very narrow, bordered with paler shading. Orbicular distinct, of pale area on darker ground. Reniform only partly traceable. The above description I wrote down when examining the specimen, and it will be seen to correspond pretty nearly with Guenée's *sedi*. The other is a dark brown form, which occurs in the west of Ireland also, and is exactly identical. It may be roughly described as having the exact coloration of *E. nigra*, *i.e.* a deep sepia brown-black, with (as in *E. nigra*) pencillings indicated, not in colour, but in the glossy texture

* Instead of "the sublateral being more strongly marked," Guenée says, "the subterminal less marked."

of the wing. I have seen both male and female of this variety, the hind wings of the latter being dusky. In fact, the insect seems only distinguishable from *E. nigra* by the antennæ of the male, and the dentation of the sublateral line on the fore wings of both sexes" ('Entomologist,' vol. xvii., pp. 14-15). Of this paper I would say, (1) That Mr. Kane has adopted a rough translation of Guenée's description (which is here and there incorrect) for *lutulenta*, W.V., which is a 'Catalogue' name, and of which there is no description in the 'Vienna Catalogue,' and that he should, I think, have adopted the original type description of Borkhausen. (2) That Mr. Kane in following Staudinger's diagnosis of var. *lüneburgensis* has fallen into the latter author's error of overlooking Freyer's original description, although, strange to say, Staudinger incorrectly calls his white-lined var.—*lüneburgensis*, Frr. I quite agree with Mr. Kane that var. *sedi*, has no right to be named *lüneburgensis*, but it is clear that the glossy black Irish var. is that variety, and it appears equally certain that var. *lüneburgensis* has no "distinct white fasciæ," which view he seems to have adopted through Staudinger. Mr. Dobrée then explained that the usual Continental form is rather paler than any we get in England, but there is no doubt that our Kent form and the ordinary Continental type are practically identical. He wrote:—"My amusement consists in collecting specimens of our insular Noctuæ from different parts of Europe, and I think that I can assist Mr. Kane. The typical *Epunda lutulenta* of Continental authors is a relatively light-coloured insect (*vide* the figures of H.-S., 83 and 405, and of Hübner, 159; and also specimens in my collection), which we seldom see. Their *lüneburgensis* (*vide* H.-S., 429 and 430) is our *lutulenta* proper in its various shades of depth of colour, and I doubt whether any of these is sufficiently dark to justify its being set up as a distinct variety, for I have seen Kent specimens as dark as those from Morayshire. *Sedi* is no doubt the ashy grey variety passing here as *lüneburgensis* (but why ?). I certainly have received *sedi* from Germany under the name of *lüneburgensis*, but I have set that down as done in deference to our English acceptance of the word; and this is probably the case with Mr. Doubleday's specimen. Herrich-Schäffer gives a figure, No. 428, which is a fair representation of *sedi*, and probably intended as such; but unfortunately, in the text below, the number is quite omitted" ('Entomologist,' vol. xviii., 106-107). At the same time I am afraid, Mr. Dobrée was not at that period, quite conversant with the black forms obtained by Mr. Percy Russ at Sligo, or he would not have inlcuded them, when he said:—"I doubt whether any of these is sufficiently dark to justify its being set up as a distinct variety." The inclusion of the black Sligo form as var. *lüneburgensis*, is, however, certainly warranted by Freyer's description, which is an excellent one of our very darkest Scotch and Irish forms. Of these Sligo forms, Mr. Russ writes:—"The varieties *lüneburgensis* and *sedi* both occur in this district. By *lüneburgensis*, I mean the dark form almost as black as *Epunda nigra*, but with the central bar clearly visible in certain lights; and by *sedi* the ashy-grey form with very distinct darker central bar. Neither of them have any superficial resemblance to what I believe to be the ordinary English *Epunda lutulenta*, which I take to be a dull smoky brown, nearly unicolorous, insect, by no means so handsome as either of the varieties named. In one of my

specimens of *lüneburgensis*, a male, there is a distinct wavy dark central line across the upper side of the under wings; and in another, a female *sedi*, the same wavy line occurs, but is pale on the dark ground, or exactly reversed. If, possible, it is my intention this autumn to obtain eggs from both varieties, and see if they are constant. I should also be glad to obtain, in exchange for some of mine, eggs of the English *Epunda lutulenta* to compare the larvæ " ('Entomologist,' vol. xvii., p. 143). The fact that var. *lüneburgensis*, H.-S. (not Freyer), was in reality closely allied to, if not identical with our ordinary English specimens, was long ago incidentally noted by that accurate observer Dr. F. Buchanan White. Fifteen years ago he wrote :—" On looking at my series of this species, I find one specimen (received from Dr. Trail, and taken near Aberdeen) which agrees exactly with H.-S. 428, **lüneburgensis*. Another example from Forres (Mr. Norman) is like H.-S. 405, *lutulenta*, but rather smaller, and not markedly different from my English examples " ('Entom. Mo. Mag.,' vol. xiii., p. 164). Mr. Carrington, quite correctly, included the very dark Scotch variety of *lutulenta* under the name *lüneburgensis*, when he writes :—" A fine series of this handsome variety, was taken by J. W. Greaseley, on behalf of Mr. N. Cooke, in Inverness-shire ('Ent. Mo. Mag.,' xiii., 141). I had the pleasure of seeing several beautiful examples, exceedingly unlike *lutulenta*. I have also seen specimens from Aberdeen and Berwickshire, the latter very bright in colour " ('Entomologist,' x., p. 33).

a. var. *consimilis*, St.—This is a British form described by Stephens as var. *β* of his *Charœas fusca*. He writes :—" ♀. With the anterior wings nearly of an uniform pale cinereous, the stigmata and fasciæ being only visible in certain lights " ('Illus. Haust.,' ii., 110). Guenée writes :—" These are those females which have the wings of a clearer grey, but in which the markings are no better developed " ('Noctuelles,' vol. vi., p. 46). I have only one specimen which can refer to this variety. This was captured near Strood in Kent, twenty years ago.

β. var. *lüneburgensis*, Frr.—This variety is thus described by Freyer :—" *Lüneburgensis* was named by Councillor Heyer and communicated to me. It has the greatest similarity to my *N. tripuncta*, plate 501, only it is smaller and without the white spots in the reniform. M. Heyer writes :—'For some years the larvæ of this species have not been obtainable by reason of the new railway being carried through the heath where I discovered them.' The fore wings black-brown; the third band (angulated line) somewhat lighter. Stigmata the same colour as the bands. The claviform is not visible; fringes brown. Body ash-grey above and below; thorax covered with whitish-grey hairs; hind wings milk-white " ('Neuere Beiträge' etc., p. 72); whilst of the figure to which this description refers, I wrote :—" Anterior wings glossy black, with a very slight purplish tinge, the basal, elbowed and subterminal lines darker, an angulated, narrow, central shade very dark and quite black. Hind wings white, with dark nervures and a row of dots on the nervures " (*l.c.* pl. 526, fig. 2). Mr. Kane relies on the fact that the Irish variety is not *lüneburgensis*, be-

* This has just previously been referred to by Mr. Dobrée as " a fair representation of *sedi*." Dr. White's note was written some years before that of Mr. Dobrée.

cause he considers *lüneburgensis* is not of the colour of *Epunda nigra*, whilst the Irish var. is of the same colour, and says of the dark Irish form :—"It has the exact coloration of *E. nigra*." Now Freyer says of *tripuncta* :—"Colour dark black-brown, like *æthiops*." But Freyer's *æthiops* = *nigra*, Haw., and then Freyer adds :—"*Lüneburgensis* is exactly similar to *tripuncta*, but without the white spots in the reniform." Therefore it follows that *lüneburgensis* is like *æthiops* = *nigra*, which Mr. Kane points out is the case with the dark Irish forms. I think there can be no possible doubt that the dark form we get is identical with *lüneburgensis*, Frr. Freyer's figure, too, throws out the black transverse lines of the dark Irish form most strongly, thus showing how utterly misleading is Staudinger's summarised description. Herrich-Schäffer, evidently, was not conversant with *lüneburgensis*, for, as Mr. Dobrée and Dr. Buchanan White long since pointed out, one of his figures (428) resembles the var. *sedi*, the other (405) is more like typical *lutulenta*. My own description of this beautiful variety, made from a very extensive series kindly supplied by Mr. Percy Russ of Sligo, is as follows :—"The anterior wings of the ♂ deep brownish-black ; the subterminal, elbowed and basal lines more intensely black ; the claviform also intensely black ; the central shade very dark and outlined by two exceedingly black wavy lines ; the orbicular and reniform outlined in black, but indistinct owing to the dark ground colour ; a paler gloss follows the angulated line in one or two specimens (? Staudinger's "albis"). The hind wings are white, the nervures dark, and the outer marginal line black, whilst a row of dark spots on the nervures sometimes tend to banded form. Occasionally a ♂ of this variety has greyish hind wings but not so dark as in the ♀'s, and a transverse line in the place of the row of dots. The ♀'s of this variety are excessively dark, the fore wings marked as in the ♂'s, the hind wings blackish, only grey at the base, a transverse line generally present instead of the dots on the nervures ; fringes paler than the hind wings." I also add :—"The variation in the fringes of the hind wings of the Irish specimens of this var. and var. *sedi* is most remarkable. Some have the outside of the fringe darker than the inner part, some the outer part paler than the inner, some are streaked with black and white, others entirely white, and others entirely grey." I have received this variety from Morpeth, and Mr. Hodgkinson records it from Dutton (Lancs.) in the 'Entom.,' xiv., p. 68. Staudinger's diagnosis of *lüneburgensis* does not, in my opinion, apply to Freyer's form, but applies to var. *albidilinea*.

γ. var. *tripuncta*, Frr.—This variety only differs from the above, in having whitish spots in the reniform (*vide* descr. of *lüneburgensis* above). Freyer writes :—"The fore wings are dark black-brown like *æthiops* and *pancratii*. The hind wings are plain white with no dark anterior shading near the fringes ;" whilst his figure may be described as "unicolorous blackish, with the basal and elbowed lines, and the outlines of the stigmata black, but almost lost in the dark ground colour ; the subterminal black and distinct. The hind wings shaded with black, base paler" ('Neuere Beiträge' &c., p. 32, fig. 501). This is only a sub-var. of our darkest vars. with traces of whitish in the reniform stigma. I once saw some tending in this direction, which had been captured by Mr. Russ.

δ. var. *sedi*, Gn.—This beautiful variety is thus described by

Guenée :—" Of an ashy-grey colour with the median space darker ; all the lines conspicuous, double, and edged with brown. The two ordinary stigmata a little paler ; the lower part of the reniform filled in with blackish. The inferior wings of the ♀, grey, much paler than in the type with traces of a median line. Southern and Central France " (' Noctuelles,' vol. vi., p. 46). This is a very beautiful variety and taken in both sexes by Mr. Russ of Sligo. Of a magnificent series captured by that gentleman, I made the following notes :—" Anterior wings of the ♂'s deep slaty-grey, with a beautiful hoary tinge ; a dark band across the centre of the wings, which is broader at the costa and narrower towards the inner margin ; a wavy line on either side of this band and forming its margins, slightly paler than the ground colour, the stigmata (reniform and orb.) slightly paler than the band (*i.e.* they are of the ground colour), the claviform more intense black ; a black wavy transverse line between the central band and the outer margin ; the extreme spaces between the nervures slightly darker ; the fringes smoky black. The hind wings white, with a narrow black marginal line, dark nervures, and black spots on the nervures ; fringes white. The anterior wings of the ♀'s are banded like those of the males, but the ground colour is darker and the hind wings are dark black grey with the base paler. The transverse row of dots almost developed into an irregular line, fringes dark grey." Guenée says that he has " bred this pretty variety from the same larvæ as typical *lutulenta*, near Châteaudun " (' Noct.,' vi., p. 46). It would appear that this variety is also captured in Scotland, with the dark var. *lüneburgensis*, for Mr. N. Cooke writes :—" On the 17th Sept. I received from near Loch Laggan, Co. Inverness, three specimens (two ♂ and one ♀) of a moth I thought I never saw before, which had been taken at sugar on the night of the 15th September ; so I sent a neighbour of mine, Mr. W. Greaseley of Wallasey, to work it up. He succeeded in taking four more of the moths, obtained eggs from two females, noticed a plant much eaten in the locality where the moths were taken, and a deal of frass, like that of NOCTUÆ larvæ, underneath the plants ; consequently he brought the seeds to try to grow the plant for the larvæ to feed on in spring." " The moths are much smaller than the *lutulenta* we take here (Liscard). Mr. N. Greening of Warrington, says that Mr. J. Cooper brought the same variety from Loch Rannoch about 25 years ago." " It is an interesting variety and itself varies from light grey to nearly black " (' Ent. Mo. Mag.,' vol. xiii., p. 142).

ϵ. var. *albidilinea*, mihi.—This variety has been erroneously considered as *lüneburgensis*, Freyer, and under this name Staudinger writes of it :—" Nigricans, fasciis distinctis albis " (' Catalog,' p. 95). In Britain, it appears only to have occurred so far in the Orkney Islands. Mr. J. Jenner Weir first noticed it and wrote of it under the name of *lüneburgensis* :—" This is a very interesting capture ; several specimens taken agree well with the description given by Staudinger in his ' Catalogue of European Lepidoptera,' No. 1341, p. 95. He writes as follows :—' Nigricans, fasciis distinctis albis.' The habitat given is South-western Germany ; ? Pyrenees " (' Entomologist,' xv., p. 4). It was afterwards noticed by Mr. Gregson, who writes of the specimens from Hoy :—" *Epunda lutulenta* var. *lüneburgensis*. Ground colour almost black, with light silvery edging to central striga. Never saw any so fine before " (' Young Naturalist,' vol. vi.,

p. 274). I suppose that Staudinger made an independent description from such specimens in his possession, which were known to him as *lüneburgensis*, and that he added Freyer's name as the nomenclator to his (Dr. S.) description. It is almost the only explanation of Freyer's name being applied to this description.

Epunda, Dup., *nigra*, Haw.

There is practically no variation in this species except that presented by the sexes, the hind wings of the females being much darker than those of the males, although the hind wings of the former have sometimes paler bases than at others. I note also, that the coloured part of the reniform is sometimes pale yellow, at others deep orange, and that this difference of colour is not sexual. Haworth's description is :—"*Noctua* alis anticis nigris fascia lata saturatiore, stigmatibus ordinariis fere obliteratis, postico albicante, posticis albis" ('Lepidoptera Britannica,' p. 192).

Valeria, Germ., *oleagina*, Fab.

The right of this species to be considered British rests on very slender evidence. Newman writes :—"I believe there is no ground for doubting the capture of this beautiful moth in Wales. Several specimens occur in the older British collections which, from time to time, come under the hammer, and they are always set in the customary English fashion, and with English pins. At that early period, the setting-boards which are so commonly used by beginners, and which flatten out the partially folded character of the hind wings, had not been invented. Few of our English entomologists adopt the old fashion of setting insects with card braces beneath the wings, but Mr. Doubleday is one of them, and his specimens are always distinguishable by the perfectly natural elegance of the shape. The specimen of this moth in the collection under my care is from the late Mr. Haworth's cabinet" ('British Moths,' pp. 401-402). In the 'Entomologist,' vol. xvii., p. 129, the Rev. Joseph Greene writes what is called 'The story of *Valeria oleagina*,' and says :—"In the year 1856, I sent to 'The Zoologist' (vol. xiv., p. 5073) a short article entitled 'Adaptation of the colouring of Moths to autumnal tints.' At the close of it, I asked whether any one could inform me in whose collection were to be found authentic specimens of the above insect. My object in doing so was to obtain some particulars as to when, where, and by whom it was discovered. From that day to this my question has remained unanswered. A few months ago I obtained some curious fragments of the 'Entomological Transactions.' One of the papers is headed thus :—'Review of the Rise and Progress of the Science of Entomology in Great Britain; chronologically digested,' by A. H. Haworth, Esq., F.L.S., F.H.S. and P.E.S. In this, Mr. Haworth says :—'Plate 37 finely represents, as a new species, the rare *Bombyx oleagina* of Fab. and of 'Lep. Brit.,' and *Noctua oleagina* of Hüb., 'Schmet., cum icone.' I have seen Mr. Plastead's specimen, here mentioned, several years since, that gentlemen having dug the pupa in Battersea fields, along with *Noctua persicariæ*. I have also seen another which was caught in Scotland twenty years ago; and my friend, Mr. Donovan, F.L.S., found one in Wales.' And so here at last after so many years, I find an answer to my question! Can any

of your readers inform me whether the three specimens above referred to are still in existence? There can be no reasonable doubt, I should imagine, as to their being genuine British specimens. It seems very strange, considering the number and indefatigable zeal of collectors since that period, that no other example, so far as I am aware, has since been taken. It is the more remarkable, when we consider the widely separated localities in which the above were taken, *viz.*, Battersea, Scotland, and Wales!" In a footnote, Mr. A. E. Fitch says:—"Donovan ('British Insects,' vol. xiii., pl. 439), states that he took his specimens on the wing, by a low hedge, near Fishguard, Pembrokeshire, in July, 1800. Newman ('British Moths,' p. 401) mentions that the specimen in the Entomological Club collection is from the late Mr. Haworth's cabinet. The collection is under the care of B. T. Lowne, and still contains the insect in question." The type is thus described by Fabricius:—"*Bombyx* alis deflexis viridibus fusco subundatis: maculis duabus albis, anteriore pupillata, posteriore majore." "Antennæ pectinatæ, ferrugineæ vachi alba. Maculæ duæ distinctæ alæ anticæ, antica pupilla ferruginea, postica majori. Posticæ albidæ margine fusco" ('Mantissa,' p. 117). Humphrey and Westwood write:—"The moth is of great rarity (in Britain), but is very widely dispersed, having been taken near London, in Richmond Park, near Bristol, in South Wales and in Scotland" ('British Moths,' p. 186).

Miselia, St., *oxyacanthæ*, Linn.

We have three forms of this species in Britain, one of which var. *capucina* is very distinct. The ground colour varies from a pale reddish-grey mottled with bright green, to a deep reddish-brown without any trace of the latter colour. The subterminal area varies very much, in some specimens it is of a pale pinkish-white, in others, the pale colour is obsolete and absolutely lost in the ground colour. It is very susceptible to exposure, and readily bleaches. I have a specimen from which the colour has almost entirely disappeared, presumably from this cause. It is one of those species, too, which exhibits the transition from green to red, as the darker red specimens are almost, or frequently absolutely, without the beautiful green colour which characterises the paler and more variegated forms. The Linnæan description mentions this green colour as "cærulescente," so that it may occasionally become blue, and if so, it offers a parallel instance to *Actebia præcox* var. *præceps*, but I have never seen any such specimens. This description is:—"*Noctua* spirilinguis cristata, alis deflexis bimaculatis, margine tenuiore cærulescente" ('Systema Naturæ,' xth., 516). Linnæus further adds:—"Alæ superiores griseæ macula unica; majore, ovali, lutescente; postice margo latior cinerascens; ad marginem tenuiorem juxta anum litura linearis alba fere longitudinalis" ('Fauna Suecicæ,' p. 319). With reference to the term "cærulescente" and the interchange of the red and green coloration, it may be interesting to notice a remark of Guenée. He writes:—"Two old authors present to us, in this species, anomalies which have not since been observed. The first is Rösel, who figures in bright rose colour all the markings which are usually olive-green; the other is Sepp, who figures the ordinary stigmata, larger and of a clear brown with green only on the inner and outer margins" ('Noctuelles,' vol. vi., p. 55). Mr. Gregson writes:—"I have one rayed variety, and a series of dark, almost uni-

colorous specimens, the latter having been obtained from the South of England" ('Entomologist,' vol. iv., p. 54). The forms which we have are:—

1.—Pale reddish-grey, narrow stripe of green on inner and outer margins = var. *pallida*.
2.—Reddish-brown, with bright green inner and outer margins = *oxyacanthæ*, Linn.
3.—Unicolorous reddish-brown, green obsolete = var. *capucina*, Mill.

a. var. *pallida*, mihi.—The anterior wings of a pale reddish-grey, the inner margin with a minimum of pale green; the central area rather darker, the subterminal area sometimes especially pale, the stigmata and transverse lines very distinct. It is not at all an uncommon form, and is the palest we get in Britain. My palest forms have come from Newbury and Sligo, where they occur with the typical form.

β. var. *capucina*, Mill.—Staudinger simply says:—"Al. ant. brunneis" ('Catalog,' p. 98), and gives as the only locality "Anglia." Guenée does not mention this variety which may probably be restricted to Britain. The anterior wings are of an unicolorous reddish-brown, the stigmata rather indistinct, the normal green absent, the pale subterminal area obliterated and filled up with the darker ground colour, the transverse lines indistinct, the white lunular spot on the inner margin towards the anal angle being the only pale spot that is fairly distinct. Newman writes:—"In a variety of frequent occurrence which I have represented in the lower figure, the fore wings are of a nearly uniform dark brown colour, the white mark being thus rendered very conspicuous: this is called the 'dark crescent' by Haworth" ('British Moths,' p. 402). It is the *oxyacanthæ*, var. *β* of Haworth who writes:—"*Bombyx* alis anticis fusco brunneis absque viridi, strigâ punctorum minutorum pallidiorum marginali" ('Lepidoptera Britannica,' p. 202). Millière writes:—"This constant variety appears commonly in England, from whence I have received many specimens, especially from Mr. Doubleday, who reared them from larvæ. In this variety the testaceous grey of the type is replaced by deep carmelite brown. The green scales have entirely disappeared except fine and slight traces on the ordinary median lines, but the pale mark formed by the lower part of the elbowed line stands out conspicuously in clear white. The basal line remains in black, but the brown subterminal spots are absorbed as also are the black terminal streaks. A fine pale line marks the outline of the wing. No author, up to the present, has mentioned this remarkable and constant variety" ('Iconog.' &c., iii., p. 165; Pl. 116, fig. 6). Millière had evidently overlooked Haworth's notice of the variety. It is also figured in Newman's 'British Moths,' p. 402, fig. 2. My specimens have come from Newbury, Barnsley, Ripon, Twickenham and Farnboro' (Kent). Specimens occasionally occur which are as unicolorous as *capucina*, except that there is a trace of the green, which is characteristic of the type, on the inner margin.

Miselia, St., *bimaculosa*, Linn.

This species probably, does not now occur in Britain, although a few specimens existed in the old collections of three-quarters of a century ago; and Guenée gives England as one of its localities. The

Linnæan description of the type is as follows:—"*Noctua* cristata alis albido cinerascentibus: anticis subnebulosis, posticis nigro bimaculatis" ('Systema Naturæ,' xiith, 856). It is essentially a south and central European species occurring in "Germany (except the north); Hungary; Russia (south and central); Gaul (south and central); Italy (north) and England (south)," according to Dr. Staudinger ('Catalog,' p. 98). Humphrey and Westwood write of this species:—"This fine species measures two inches in the expanse of the fore wings, which are of a pale buff-coloured grey, minutely speckled; the fore margin, with about ten dark oblique dashes, an oblong, oval chestnut-coloured patch towards the base, resting upon a dentate striga, preceding the stigmata, which are large and pale coloured, a very large supplemental one being placed behind the anterior one; beyond the stigmata, is a curved and crenated striga of a brown colour, edged with pale tint, and followed by a few dark dots on the veins, and a waved interrupted submarginal striga. The hind wings are also pale, with two large dark patches, one in the middle and one near the anal angle. I believe this insect still remains unique in the British Museum, the specimen having been taken near Bristol. Boisduval gives August as the time of its appearance in the perfect state. The caterpillar, as figured by Hübner, is grey, with longitudinal dusky and whitish lines, each segment with two oval patches, each bearing a spiracle; the hind part of the body with two conical protuberances: it feeds on elm" ('British Moths,' p. 186; Pl. xxxix., fig. 10). It is also figured by Curtis ('British Ent.,' pl. 177) and Wood ('Ind. Ent.,' pl. xiii., fig. 291).

Dichonia, Hb. (*Agriopis*, Bdv.), *aprilina*, Linn.

Guenée says:—"There has been extreme confusion between this species and *Diphthera* (*Moma*) *orion*, owing to the fact that the Linnæan description applies to both. Authors have been about equally divided in opinion, but the insect which still remains in the Linnæan cabinet dispels all doubt. Sepp's figures are veritable masterpieces in drawing and colouring" ('Noctuelles,' vol. vi., p. 59). I only know of one variety, that in which the central space between the complete basal and the subterminal lines forms a black band, broken only on the costa and a small space between the orbicular and claviform. There is considerable variation in the amount of black and in the depth of the green, but so-called white and yellow varieties of this species appear generally to be due to exposure or to the action of ammonia or cyanide of potassium. The Linnæan description is:—"*Noctua* spirilinguis cristata, alis deflexis: superioribus virentibus, fascia maculisque atris: postice punctis trigonis" ('Systema Naturæ,' xth., 514). Newman says:—"The fore wings are pale green, ornamented with black and white markings, and black markings often forming something like a median band; the discoidal spots are distinct, and always white, with green centres, bounded with black" ('British Moths,' pp. 402-403).

a. var. *virgata*, mihi.—I first became acquainted with this beautiful variety through the kindness of Dr. Chapman, who gave me a Hereford specimen. Since then I have seen specimens captured by Mr. Mason of Clevedon, and Mr. Hodges informs me of specimens

that have been sent to him by collectors from Durham. The space between the subterminal and basal line has the black coloration, generally restricted to a central fascia, spread over it so as form a central band. Such varieties are very striking and beautiful. A specimen, approaching this form, is figured in Newman's 'British Moths,' p. 402, fig. 2. Mr. Mason writes of a specimen bred in 1891:—"I have bred an unusually fine form of *Agriopis aprilina*, from pupæ collected the first week in September at the base of an oak. It is the finest and darkest of seven or eight very large specimens from the same tree. It has the central area between the elbowed and basal transverse lines filled in with black, making a decided central band" ('Ent. Rec.,' &c., vol ii., p. 273). It must be borne in mind that typical specimens generally exhibit a blackish central fascia. This is not what is referred to here as a central band, but a much more highly developed character.

Brotolomia, Ld. (*Phlogophora*, Och.), *meticulosa*, Linn.

In this common species, we get very little variation, the colour sometimes varies towards a greenish tinge sometimes towards reddish. The characteristic central triangular blotch, however, varies somewhat, the outer lines forming the blotch being sometimes separated some distance on the inner margin (at apex of blotch) and sometimes joining on the margin. The inner line which bounds this blotch is the basal line, but the outer line is only at its lower extremity joined by the angulated line, which is ill-developed but perfectly distinct in its upper part. A small blackish lunular mark on the outside of the subterminal near the apex is, in some specimens, much better developed than in others. The Linnæan description of the type is:—"*Noctua* spirilinguis cristata, alis erosis pallidis: superioribus basi incarnata triangulo fusco" ('Systema Naturæ,' xth., p. 513). Strange to say the rosy or redder form which is much the rarer, I believe, with us, is taken as the type by both Linnæus and Haworth, whilst Guenée treats the red form as his var. A. Haworth writes:—"*Noctua* alis erosodentatis, roseo-albidis, fascia triangulari medio purpurascente" ('Lepidop. Britannica,' p. 244). Guenée writes of this form:—"Ground colour reddish, the olive-green replaced by brownish-red" ('Noctuelles,' vi., p. 65). I have two or three very red specimens from Deal.

a. var. *pallida*, mihi.—The ordinary British form of the species, as described in Newman's 'British Moths,' p. 403, is tinged slightly with olive-green and without the strong reddish ground colour of the type. Guenée treats this as the type.

Trigonophora, Hb., *flammea*, Esp.

The naming of this species exhibits one of Staudinger's peculiarities. He alters *ypsilon*, Bkh. to *fissipuncta*, Haw., in the genus *Dyschorista*, because there is another NOCTUA named *ypsilon* in the genus *Agrotis*. He alters *empyrea*, Hb. back to *flammea*, Esp., although he allows another species, *Meliana flammea*, to exist under the same specific name, *vide* 'Catalog,' pp. 104 and 108. Esper's Pl. 53, fig. 3. is an excellent drawing of our species. His diagnosis is:—"Alis subdentatis rufis, macula disci flava repanda adjacente linea

lata nigra" ('Die Schmet.' &c., p. 269). In the general variation of this species there is little to record, but I would call attention to the peculiar way in which the strangely-marked reniform has its lower border frequently continued along the median nervure towards the base. There is also frequently a trace of the oblique pale mark, so characteristic in the centre of the wing of certain species of the genus *Hadena, e.g., atriplicis,* which suggests its affinity to certain moths in that mixed-up genus. As a matter of fact, Staudinger only separates this species from *atriplicis* by the latest addition to our imported species, *Prodenia littoralis.* It is interesting to note the peculiar way in which the ⊢-like mark, generally incomplete, is formed in this species. In the species of *Apamea* &c. where it occurs, it is a development of the claviform. In *Cleoceris viminalis* it starts on the elbowed line and reaches back to the central shade. In this species both marks are developed and unite to form the complete ⊢-like mark. I would only add that the *empyrea* of Hübner is a very differently coloured insect to ours which = the *flammea* of Esper. His figure 63 is of a pale ochreous-brown, with the basal and central areas, as far as the elbowed line, except a narrow edge on the inner margin, blackish; outline of orbicular and whole of reniform, ochreous; a blue mark under the reniform and some blue scales along the inner margin. Whether varieties of this species occur, I do not know; I have never seen one.

Euplexia, St., *lucipara,* Linn.

This is another invariable species, of which I have never seen the semblance of a variety, and Guenée says:—"I see scarcely any difference between European and exotic specimens" ('Noctuelles,' vol. vi., p. 69). The central triangular patch, much less often than in *P. meticulosa,* has its sides meet on the inner margin, the two lines generally reaching the margin at some distance apart. I have only one specimen out of a long series which absolutely does so. The space beyond the outer line which bounds the dark central patch, is sometimes a little lighter, sometimes darker, but there is no constancy. The reniform, too, varies slightly, sometimes being entirely pale, sometimes with a dark central shade. The Linnæan description of the type is as follows:—"*Noctua* spirilinguis cristata: alis purpurascentibus: fascia nigra macula postica flava" ('Systema Naturæ,' xth., p. 518).

Aplecta, Gn.

Guenée says of the species in this genus:—"They are remarkable for the size of the stigmata and for the generally oblong form of their wings. The greater number of them have the abdomen crested, but this character, generally a very good generic one, is useless in this genus, for the most closely allied species are alternately with or without. They have the ordinary manners of the *Hadenidæ* and present few varieties" ('Noctuelles,' vol. vi., p. 74). The genus would not have presented many varieties to us a few years ago, but we now know its species to be fairly variable. One of the most interesting particulars is, that purely melanic specimens occur in two species, *nebulosa* and *occulta,* out of our five British ones in the genus, whilst *prasina* certainly attempts to follow in a similar direction. The development of a glaucous coloration in *advena* and *tincta* is very remarkable, and in

certain specimens of these species, there is frequently a tendency for the darker red colour of the wing to increase at the expense of the normally paler parts.

Aplecta, Gn., *prasina*, Fab.

There is a considerable difference in the green tint even of freshly emerged examples. Some have the green almost white, whilst others have it of a very deep shade. In some cases, too, the whole wing, except the costal commencements of the transverse lines, is entirely green, whilst in others the basal lines, central shade, stigmata and other markings are dark, restricting the green area very much. I have one dark reddish-brown specimen without any green coloration. Subjected to ammonia or cyanide of potassium, the green becomes yellow, and Guenée states that "*mixta*, Haworth, is only an old example in which the green has faded to yellow" ('Noctuelles,' vi., p. 75). The pale spot outside the reniform at the top of the angulated line is very characteristic, but in those specimens in which the ground colour tends to whitish-green, it becomes much less conspicuous. The type is thus described by Fabricius:—"*Noctua* cristata alis deflexis fusco viridique variis: lituris duabus albis, thoracis crista duplici." "Alæ fuscæ nigro parum undatæ viridique variæ. Liturae duæ magnæ, altera ad basin, altera pone medium. Posticæ fuscæ ciliis albis, subtus puncto strigaque undata nigris" ('Mantissa,' p. 169).

α. var. *pallida*, mihi.—The anterior wings of a pale whitish-green with only the upper parts of the basal and subterminal lines developed as costal streaks, and with the costal end of the central shade developed between the stigmata. The characteristic pale patch outside the reniform is absorbed in the paler ground colour. This is the extreme pale form. Pale coloured specimens also occur in which the transverse lines and central shade are fairly complete.

β. var. *suffusa*, mihi.—Anterior wings reddish-brown, with a black area around and including the stigmata; a pale patch outside the reniform as in the type, the transverse lines complete and black, outlined with pale greyish. I have only one specimen, and never saw another of this dark form.

γ. var. *jaspidea*, Bork.—Borkhausen writes of this:—"*Noctua*. Green mixed with dark grey, with whitish lines" ('Naturgeschichte' &c., p. 440). Guenée says:—"It differs from the type only by the absence of the white blotch outside the elbowed line, and by its darker stigmata. The black streaks on the stigmata are also more marked. It is bred from the same larvæ and does not appear to merit being specially named any more than *egregia*, Esp." ('Noctuelles,' vi., p. 75).

δ. Guenée also describes another variety which he calls var. A. Of this he writes:—"The orbicular round and not obliquely oval; the claviform very distinct; the inner border broadly white, above all, in the median space; the pale spot which follows the reniform very white, the subterminal line very deeply indented. North America." Guenée then adds:—"These characters appear insufficient to me to form a species, and besides, I do not know that they are constant. However, it is possible that it has a different larva" ('Noctuelles,' vi., p. 76).

Aplecta, Gn., *occulta*, Linn.

There are two very distinct forms of this species, one much mottled with grey, the type; the other, more or less melanic, with the ground colour black. This latter is the *implicata* of Lefebvre, and perhaps no more striking error occurs in Staudinger's 'Catalog,' than when he writes of this:—"Minor, dilutior" (p. 89). Certainly Lefebvre's figure is small but it is dark enough in colour. The type is described by Linnæus as:—"*Noctua* spirilinguis cristata, alis deflexis fusco nebulosis, striga inferioribusque brevioribus margine albis." "Fascia linearis repanda alba, supra superiores ubi inferiores terminantur margine postico utrinque albo: alæ inferiores multo breviores sunt" ('Systema Naturæ,' xth., 514). Of *Aplecta occulta* at Rannoch, Mr. Wheeler writes:—"One specimen was captured almost as light as two southern types in my cabinet, taken near Ipswich" ('Ent. Mo. Mag.,' vol. xiii., p. 141); whilst of the same species from Unst, Mr. Weir writes:—"These are somewhat intermediate in colour between northern and southern specimens" ('Entom.', vol. xvii., p. 3). Of those obtained in the Shetland Isles, the same gentleman writes:—"It is singular that the specimens of this insect are quite as light in colour as the usual southern type, none being dark like those taken in Scotland" ('Entomologist,' vol. xiii., p. 290), whilst of this species near Reading Mr. Holland writes:—"A single specimen of a beautiful dark grey colour, was taken at sugar, a few miles away, seven or eight years ago" ('Ent. Mo. Mag.,' xxi., p. 158).

a. var. *implicata*, Lef.—Under this name two different varieties seem to have been described; the first is the black northern form described and figured by Lefebvre in the 'Ann. Soc. France,' 1836, fig. 4 and p. 394, and also described by Duponchel and Zetterstedt; the second is a paler form, referred erroneously to *implicata*, Lef. by Guenée, and apparently copied from Guenée by Staudinger, who perpetuates the error. Zetterstedt's description is a quotation of Lefebvre's, and admirably describes our black form. He writes:—"*Hadena implicata.* 'Alis anticis nigricantibus, strigis duabus albidis dentatis, maculis ordinariis nigro circumcinctis, orbiculari albida, reniformi cinerea; posticis fuliginosis, fimbria, alba.' Lefebvre, ♀. (Long. $1\frac{5}{8}$ poll.) Lefeb. in 'Ann. de la Soc. Ent. de Fr.' 1836, 3, p. 394; Pl. 10, fig. 4, ♀. Hab. in Groenlandia; D. Lefebvre *l.c.*; in terris arcticis a me frustra quæsita. Affinis videtur sequenti (*extricata*)" ('Insecta Lapponica,' p. 940). Staudinger does not appear to have known the black form of this species, neither does Guenée, for the latter gives quite a new description to which he applies Lefebvre's name, whilst the former quotes Zetterstedt's *extricata* as synonymous with Lefebvre's *implicata*, which represents, as I have stated, the black form. It is strange that Guenée and Staudinger should both describe as *implicata* a form paler than the type. It is, indeed, difficult to find out in what respect Guenée considers his *implicata* differs from the type. This is the var. *æthiops* of Robson, who describes it as:—"Black, lines and margins of stigmata greyer." The original type figure of this dark variety is black with a greenish hue, with black transverse lines and outlines to stigmata. Duponchel describes *implicata* at length. He writes:—"The fore wings are black and traversed by the ordinary basal and angulated lines in the centre. These

are pale and nearer together at the inner margin than on the costa. Between these are the two ordinary stigmata surrounded with black, the orbicular whitish, the reniform obscure grey and scarcely noticeable. The claviform is grey bordered with black, whilst at the base of the wing and touching the costa is another grey patch. There are some black cuneiform spots near the hind margin" ('Histoire Naturelle' &c., xiii., p. 592). Guenée treats this as a distinct species and writes:—"It is distinguished from *occulta* by its size, its more unicolorous appearance, being paler, more purplish, less clouded" &c. In fact, Guenée gives in some particulars, an exactly opposite description to Lefebvre's typical figure. Newman says of this variety:—"The northern specimens are remarkable for their dark colour, some of them being almost black" ('British Moths,' p. 407). Newman also figures this variety on p. 406, fig. 2. Mr. Robson writes of a specimen in Mr. Gregson's collection:—"One dark specimen taken by Mr. Carrington in Perthshire, is without the white lines on the wing on the right side. NOCTUÆ with odd wings must be very rare, this is the only instance I remember" ('Young Naturalist,' vol. viii., pp. 122-123). Of a specimen in his collection, Mr. Sydney Webb writes:—"One of my Scotch specimens has odd wings, arising from a black cloud slanting obliquely across the wing from the pale patch at the base to the renal stigma; from the farther end of this cloud, at the inner margin, the dark subterminal proceeds as usual to near the apex, so that the only pale portions visible on the wing, are the basal patch, an obscure orbicular and ordinary reniform stigmata; posterior to the last of which are three pale dashes which fade away where the second line should be; hind margin, as usual, slightly paler" (*in litt.* 7.4.'92). I do not know whether the var. *passeta*, Mieg. 'Le Nat.,' 1886, which was named from a Scotch specimen, is this form, as I cannot refer to the original description, but it is very probable. Herr A. Hoffman, in writing of the Shetland examples says:—"They resemble the light southerly forms. The black form of the Scotch mountains, which occurs also in our own mountains (Upper Hartz &c.), has not been taken" ('Ent. Zeit. Stett.,' 1884, p. 363).

β. var. *extricata*, Zett.—This appears to be an intermediate form between the paler mottled grey type and the black var. *implicata*. It is only distinguished from the latter by certain minor characters by Zetterstedt, such as "the transverse lines being whitish and double, the costal markings white" &c. Zetterstedt writes:—"*H. extricata*: alis anticis nigricantibus cinereo fuscoque variis, strigis duabus geminis dentatis, macula ordinaria interiori ovata, striolisque, basalibus ad costam, albis; posticis fuliginosis, fimbria alba. ♂. (Long. al. exp. $2\frac{1}{8}$ poll.)." "Hab. in Lapponia. D. Schönherr, e cujus museo mecum ad describendum communicata (Lappon. borealis?)". "Magna, pulchra et distincta. Similis quodammodo et affinis *H. implicatæ*, Lefeb. ♀, sed vix ejus mas. Differt ab illa: alis anticis nonnihil longioribus et angustioribus, strigis albis geminis, seu singula per striolam mediam tenuissima longitudinaliter divisa (nec ut in *implicata* simplici), exteriori angulato-dentata, nec simpliciter arcuato-dentata, ut et tandem strigulis costalibus ad basin albis. Maculæ ordinariæ, exterior reniformis cinerea, interior vero obliqua ovata ad costam adscendens. Ipsa costa punctis strigiformibus tribus albis

utrinque nigrocinctis, distantibus. Alæ posticæ obscure fuscæ, omnino immaculatæ, fimbria alba" ('Insecta Lapponica,' p. 940).

Aplecta, Gn., *nebulosa*, Hufn.

Without showing a very great amount of ordinary variation, this species presents a range of colour development extending from pure white to the most intense black. These melanic specimens, only five of which are at present known, have been bred by Messrs. Collins and Acton of Warrington, during the last two seasons, 1890-1891, and probably these present at once, the most recent and most intense development of the many melanic varieties for which the British Isles are remarkable. The almost pure white form of this species is rare, and of the ordinary mottled ones we have two distinct forms; one, generally found in Yorkshire and the Midland counties, is of a dark grey ground colour; the other, of a whitish-grey mottled slightly with ochreous. Hufnagel's wretched description of the type is:—"Fore wings whitish-grey with spots and stigmata edged with brown or brownish-grey with whitish-grey spots" ('Berlinisches Magazin,' iii., 418). This description in a general way, applies perhaps to our typical form but such descriptions as these are most unsatisfactory. The type is certainly the *plebeia* of Hübner (fig. 78), whilst *bimaculosa*, Esp. (p. 403) appears to be the darker Yorkshire form. *Grandis*, Haw. (p. 185) is typical, but *trimaculosa*, Esp. is not this species, as placed doubtfully by Staudinger ('Catalog,' p. 89), but *advena* (*vide* description Esp. p. 400). In Newman's 'British Moths,' p. 407, fig. 3 represents a peculiar banded form, the central shade being unusually well-developed and black, and the orbicular particularly white, with white basal patches on the costa and on the side of the thorax; whilst fig. 4 presents a very strange form, with a series of white lunular spots on the outer margin of the anterior wings, outside the subterminal, which, as well as the angulated line, is represented by a single black wavy line, as also are the basal lines, whilst the stigmata are obsolete. These figures were made from specimens in Mr. Bond's cabinet and are altogether abnormal.

The forms we get may be classified as follows:—

1.—White, with almost obsolete markings = var. *pallida*.
2.—Pale grey, with darker grey and slightly ochreous markings = *nebulosa*, Hufn.
3.—Dark grey, with blackish markings = var. *bimaculosa*, Esp.
4.—Black = var. *robsoni*, Collins.

α. var. *pallida*, mihi.—This beautiful white form, the exact opposite to var. *robsoni*, was first made known to me by the Glasgow collectors. All the basal lines are obsolete except the costal dots, the orbicular also obsolete except a central dot, the reniform except a faint outline; the angulated line is not traceable, but the subterminal is characterised by a few black dots following the pale wavy line. My specimens have come from Glasgow, Cork and Chattenden.

β. var. *bimaculosa*, Esp.—The anterior wings are grey much mottled with dark scales, the transverse lines are distinct but generally dusky, whilst the stigmata are slightly paler, the row of cuneiform spots show every transition from a wavy line to almost complete absence. The characteristic >- like mark at the anal angle also varies in intensity. Although generally known as the Yorkshire form, this

var. is in no way restricted to that county in Britain. I have it from Rotherham, Warrington, Sheffield, Reading etc. Esper's diagnosis of the variety is :—"Alis deflexis cinereis, crenatis, superioribus, stigmatibus albis, striga marginali dentata fusca, maculis duabus nigris" ('Die Schmet in Abbildungen' &c., p. 403). Esper's figures, *l.c.* pl. 132, figs. 1-2, are very bad indeed. Mr. Holland writes :—"Specimens of *A. nebulosa* taken here (Reading) differ in colour remarkably from those from the New Forest. The latter are white with distinct markings and very large, but ours are generally smaller and always much suffused with grey, approaching, in this respect, to Yorkshire specimens" ('Ent. Mo. Mag.,' vol. xxi., pp. 158-159). Mr. Robson writes :—"Mr. Gregson has some very dark examples of this insect that he tells me were taken at Sheffield. I had not seen the form before" ('Young Nat.,' vol. viii., p. 123).

γ. var. *robsoni*, Collins.—Probably this is one of the finest melanic forms that Britain produces. The fore wings of this variety are of an entirely glossy black, with only the slightest possible traces (produced by a more glossy appearance) of the reniform stigma and subterminal line. The only trace of the original colour is presented by three minute whitish costal dots near the apex. I have seen the five specimens which are all at present known. One of these is now in my cabinet, thanks to the kindness of Mr. Acton of Warrington, who, with Mr. Collins of the same town, has bred the specimens. This form appears to have been developed through var. *bimaculosa*, Esp., for a specimen sent to me by Mr. Acton, bred with var. *robsoni*, was a very dark one of that form. The first notice of var. *robsoni* is from the pen of Mr. Collins, and is as follows :—"I bred a black variety of *A. nebulosa* from a solitary larva, picked up in the Delamere district, in the spring. Mr. C. G. Barrett says that this form is quite new to him" ('Ent. Record' &c., i., p. 241); whilst we further read :—"At the meeting of the Lanc. and Cheshire Ent. Soc., Oct. 12th, 1891, Mr. Collins read a paper entitled 'A few remarks on *Aplecta nebulosa*,' stating that five melanic specimens had been bred from larvæ taken at Delamere, for which he proposed the varietal name of *robsoni*, in honour of the well-known entomologist Mr. J. E. Robson of Hartlepool. Mr. Collins exhibited the five specimens, with others bred at the same time" ('Ent. Record' &c., ii., p. 264).

Aplecta, Gn., *tincta*, Brahm.

This beautiful species presents some slight difference in the brightness of the ground colour, and also in the tint and extent of the red costal shade. Occasionally, too, there is a tendency to form a central fascia, but this is not generally very noticeable. The W-like mark in the subterminal is generally ill-developed, although occasionally distinct. Brahm's description of the type is as follows :—"The fore wings are silvery-grey and shining with paler transverse lines, and a zigzag line near the hind margin. The first line stands near the base and consists actually, like the others, of two reddish-grey lines, between which the ground colour appears somewhat lighter. The second stands not far from the orbicular, and the third just beyond the reniform. On the second, rests the claviform stigma, which is bordered with grey-black and tinged with purple. The discoidals

stand in a faintly mixed purple shade, which starts from the hind margin. Their outlines, as well as the angulated line on its lower border, have the same tint though somewhat deeper. The subterminal line has two scarcely perceptible teeth, and is accompanied towards the inside at three places with brown spots. On the hind margin stand three white dots, not far from the tip, and a row of brown, somewhat rounded off, triangles are close to the fringe. The hind wings are bright ash-grey" ('Insekten Kal.' &c., ii., p. 394). This species is the *argentina* of Haworth (p. 186); whilst the *hepatica* of Hübner (fig. 77) represents the bluest form of the species we get.

a. var. *suffusa*, mihi.—The only variety I ever saw of this species was sent for my inspection by Mr. Hope Alderson, who bred it from a larva taken at Farnboro' (Kent). It has the whole area between the basal and angulated lines deeply suffused with dark purplish, the suffusion extending below the stigmata almost to the inner margin. The description I made of this specimen was as follows:—"Anterior wings of the normal silvery bluish-grey ground colour, with a double abbreviated, followed by a complete double basal line. The orbicular large and pale, and on its inner edge is a dark purplish-brown wedge-shaped mark. The reniform and claviform normal, but a deep purple-brown blotch fills in the space between the orbicular and reniform, whilst another large purple-brown patch under the orbicular and reniform and in contact with them, reaches back to the claviform and fills up the central area of the wing. The subterminal line forms an exceedingly dark lunule about half-way down its length, and another at the anal angle in which is a purple-brown spot. The hind margin has a series of dark triangular patches, the outer edge of the nervures also dark. Hind wings normal."

Aplecta, Gn., *advena*, Fab.

This is another interesting species and very close allied to *tincta*. It generally develops a glaucous tinge, without, however, the bright bluish tint of the latter species. Sometimes this pale colour spreads over almost the whole of the anterior wings, sometimes it is entirely absent and the wing is uniformly dull reddish-grey. The lower part of the outer edge of the reniform is occasionally white; the orbicular varies from entire absence, through a pale ring to a dark-centred ocellated stigma; the claviform is sometimes obsolete, sometimes clearly outlined, whilst the subterminal varies from complete absence to a well-developed row of dots. The Fabrician description of the type is as follows:—"*Noctua* cristata alis deflexis dentatis cinereo fuscoque variis, thoracis crista bifida." "Magna cinereo fuscoque varia, postice striga abbreviata nigra. In medio maculæ ordinariæ. Posticæ fuscæ. Thoracis crista elevata, bifida quasi caniculata" ('Mantissa,' p. 183). We get three very distinct forms in Britain:—

1.—Pale reddish-grey, tinged with glaucous = var. *nitens*, Haw.
2.—Dark reddish-grey along costa, pale between elbowed and subterminal lines = *advena*, Fab.
3.—Unicolorous dark reddish-grey = var. *unicolor*.

a. var. *nitens*, Haw.—Haworth gives an excellent description of our palest form of this species. Strange to say, my best example of this form is like Haworth's, much below the average size, but small size

does not by any means always accompany this form. The wing is tinged all over with silvery glaucous, in a very small way copying its ally, *tincta*. The pale reddish-grey is better developed around the stigmata than elsewhere, and the subterminal is generally distinct. Haworth's description is:—"*Noctua* alis brunneo argenteoque variis, striga postica ex punctis angulatis confluentibus, antennis setaceis nudis." "Exemplarium unicum maris solum vidi. Præcedenti nimis affinis (*advena*, Haw.) at minor, antennis setaceis, nudis nec hirto-pectinatis, stigmateque claviformi majore. Alæ anticæ magis brunneæ et posticé magis argenteæ, stigmate reniformi inferne semicincto margine albissimo. Cætera fere ut in priore (*advena*), at strigâ posticâ extus magis albâ" (Lepidoptera Britannica,' p. 188). This is an excellent description of a variety in my cabinet and fits it so exactly that it might have been the specimen described. Humphrey and Westwood write:—"*Noctua nitens*, Haworth, has been regarded as a variety of the preceding species, than which, however, it is smaller, measuring $1\frac{5}{8}$" in the expanse of the fore wings, which are of a redder-brown colour, with the extremity more silvery; the supplemental stigma larger, the apical striga more distinct, and formed of angulated, confluent spots; the antennæ are setaceous and naked and not furnished with bristly pectinations" ('British Moths,' p. 189).

β. var. *unicolor*, mihi.—In this variety the pale glaucous colour extremely developed in var. *nitens*, and fairly well-marked in the type, is entirely absent. The anterior wings are unicolorous dark reddish, slightly grey, with the stigmata and transverse lines almost obsolete, and of the typical subterminal line, only the mark near the anal angle is noticeable. Humphrey and Westwood write:—"Occasionally, as in our figure 1, the wings are almost entirely concolorous, with only a slight white edging to the stigmata, and a reddish patch behind the anterior, and another beyond the posterior stigma" ('British Moths,' p. 189).

Hadena, Och.

This genus comprises a fairly well-defined group of insects, the imagines of some of which appear to be very closely allied. One east and central European species, *porphyrea*, is rare in Britain, and probably will always remain so, as we are on the borders of its most westerly limit of geographical distribution; whilst *peregrina* is still rarer; our south-coast being apparently the most northerly limit of this species which is abundant on the Mediterranean littoral. Rather dark or melanic forms of *Hadena adusta* and *H. suasa* occasionally occur, but, generally speaking, this group is not given to melanic tendencies. *H. protea*, *H. pisi* and *H. dentina* offer perhaps the greatest amount of ordinary variation, but the genus does not exhibit anything extreme in any of the species. The affinity and near relationship of this genus to *Mamestra* is very evident, in fact, the whole of the *Hadenidæ* should follow the *Apamidæ*. Most of the species in this genus, *contigua*, *thalassina*, *dissimilis*, *pisi*, *oleracea*, *glauca*, *dentina*, *genistæ*, *trifolii* and *peregrina* are placed by Staudinger in the genus *Mamestra*; whilst only *porphyrea* and *adusta* are left with *abjecta* and the modern genera *Apamea* and *Xylophasia* in *Hadena*. There is no doubt our genera are, in a general way, more natural, if

only the *Hadenidæ* followed the *Apamidæ*. Guenée writes of the genus:—"The imagines differ, as one might well suppose, in so numerous a genus. The greater part are distinguishable at a glance by the subterminal line broken into a W or M, and a spot, paler than the ground colour, which is placed under the reniform and divided inferiorly into two sharp teeth." Guenée then gives a short *resumé* of the six groups into which he sub-divides the genus, and adds:—"All the species of this genus have the same habits. They are most frequently found on trees, in woods or by road-sides. Their larvæ inhabit our gardens, but it is very rarely that they increase sufficiently to cause much damage. Even *oleracea*, in spite of its name, is not usually very abundant, and *dentina*, the next most common species, usually only destroys useless plants" ('Noctuelles,' vol. vi., p. 83). *Protea* is placed by Continental lepidopterists in the genus *Dryobota*, *atriplicis* in *Trachea* and *rectilinea* in *Hyppa*. I do not myself consider that the latter has any very close affinities with those species with which it is grouped, in spite of its superficial resemblance to *genistæ*. Perhaps one of the most remarkable facts in connection with this group, is the extensive variation in the larvæ compared with the comparative absence of variation in the imagines. The peculiar glaucous tendency in northern specimens, which was especially noted in *Agrotis subrosea*, *A. hyperborea* and *Pachnobia rubricosa*, is exhibited in this genus in *pisi* and probably in *oleracea*, whilst *Hyppa rectilinea* shows our local tendency to a darker coloration in a marked degree, the type being practically entirely slaty-grey, without the dark reddish band so characteristic of our British specimens. It is perhaps worthy of notice that *trifolii*, which is with us, such a comparatively constant species, should have received in America several names for the different racial forms it appears to develop there.

Hadena, Och., *porphyrea*, Esp.

This very beautiful and rare British species is not at all uncommon on the Continent, and I have recently compared a considerable number of specimens without noticing any striking points of variation. The type is thus described:—"Alis superioribus rufo-fuliginosis, maculis, stigmatibus, fasciaque postica dilutioribus, nigro inductis; inferioribus nigricantibus, atro-fasciatis, subtus puncto atro" ('Die Schmet. in Abbild.' p. 465). The figure to which this refers is of a rich reddish colour, but with none of the purplish tinge, which is so characteristic in all the Continental and also in the few British specimens I have seen. I am quite unable to state whether there are two forms of this species, one without the purplish tinge = *porphyrea*, Esp., the other with such a tinge = *satura*, Hb., but Hübner's fig. 75 has the purplish coloration. Of the early occurrence of this species in Britain, Mr. Stainton writes:—"A specimen of *Hadena satura* is in the collection of the Rev. Mr. Bird, who attracted it by light in Oxfordshire; Mr. Doubleday has a specimen from Cambridgeshire. It is nearly half as large again as *adusta*, dark varieties of which are continually being taken from *satura*" ('Ent. Ann.,' 1855, pp. 12-13). The species has since been recorded from Newcastle-on-Tyne, Kent (twice), Cambridge "Fens" (twice), Aberdeen &c.

Hadena, Och., *adusta*, Esp.

The British examples of this species vary but little, and as a rule have indistinct markings. The Rannoch, Howth, Glasgow and Aberdeen specimens are, perhaps, rather more tinted with red, whilst those in my possession which have the least of the latter colour came from Witherslack, Pitcaple and Warrington. The transverse lines are usually ill-developed, except the subterminal; and the stigmata generally indistinct and badly defined, so that the fore wings have a very unicolorous appearance. The Shetland specimens, on the other hand, are paler in ground colour, have the basal, and also the elbowed and subterminal lines, whitish, the space beyond the elbowed line very pale, so that the subterminal is not very conspicuous, and the area between the complete basal and angulated lines forms a band owing to the extensive development of the central shade and ⊢-like mark. This mark is made of two distinct parts, the claviform, and a streak developed on the angulated line, which frequently unite, as was remarked in *Cleoceris viminalis*. The orbicular varies in size, and is occasionally absent, whilst one or two specimens, in a very long series show traces of a dark quadrate spot between the orbicular and reniform. As before remarked, the subterminal line is generally clearly marked, and in some specimens the W-part of it extends outwards into the fringe, but in one specimen from Pitcaple, it is reduced to a row of dots, and in another is almost obsolete. The cuneiform spots vary much, from total absence to a complete row. The reniform is occasionally lined with ochreous on its outer margin. The hind wings always show some tendency to sexual dimorphism, those of the males being paler, but the specimens from Warrington are very strongly developed in this respect. The type of this species is thus described by Esper:—"Alis superioribus crenulatis, rufis, nigro-nubeculosis, stigmatibus strigisque duabus angulato-flexuosis flavis, limbo nigricante; inferioribus albidis, venis margineque externo nigricantibus" ('Die Schmet. in Abbild.,' p. 483). Of the figures (Pl. 149, figs. 1-2) to which this description refers, I note:—"They are much redder than anything we get in Britain." Of the Shetland form, Herr A. Hoffman writes:—"They have a reddish ground colour and are more distinctly marked than the ordinary form, and agree more with the specimens from the Upper Hartz" ('Stett. Ent. Zeit.,' 1884, p. 364). Hübner's *valida* (figs. 606-608) appears to agree with the typical form. Of *H. adusta* from Aberdeenshire, Mr. Reid writes:—"I never saw pale forms of this species, neither have I seen them unicolorous black; reddish specimens with rather darker markings (*adusta*, Esp.) are not rare, but our most common form is the dark variegated one (*duplex*, Haw.). I have (or had) a most curious suffused brownish specimen (*satura*, St. ?), without any markings, and I once saw another; but on the whole, striking varieties are rare" (*in litt.*), whilst of Irish specimens Mr. Kane writes:—"The Irish *adusta* are generally blackish with a slight purple gloss. I have a couple of poor specimens rather pale, not worn, and a few blackish ones with somewhat obsolete markings" (*in. litt.*), and of the Warrington specimens Mr. Collins writes:—"I take dark variegated forms (var. *duplex*) most frequently of any, and never saw an unicolorous black specimen. I also get them reddish-brown, with transverse lines yellowish, and stigmata whitish, which would most

nearly approach Esper's type" *(in litt.)*. It is strange that whilst the Shetland specimens from Mainland and Unst are paler than usual, Mr. Gregson writes of those from Hoy:—"Rather dark" ('Young. Nat.,' vol. vi., p. 274). The few specimens which are occasionally captured in our more southern English counties are generally of a very pale tint, inclining to grey, with an absence of deep red and a minimum of dark shading, although the reddish tinge is generally traceable. I suppose these pale specimens, belong to the form called *baltica* on the Continent. It is strange that the specimens from the south coast of England are most like the Shetland form, although rather greyer. It is difficult to classify the varieties of this species, but there appear to be the following forms:—

1.—Pale reddish-grey, with distinct markings = var. *baltica*, Hering.
2.—Pale reddish-brown, very distinctly marked = var. *virgata*.
3.—Reddish-brown, mottled with blackish, distinct paler markings = *adusta*, Esp.
4.—Brownish-black, or blackish-fuscous, markings moderately distinct = var. *duplex*, Haw.
5.—Brownish-black, more unicolorous = var. *satura*, St.

α. var. *virgata*, mihi.—This is the palest form of the species, I have seen. It is of a pale reddish-brown tint, with the basal, as well as the angulated and subterminal lines ochreous, almost white; the ⊨-like mark well-developed and the space between and directly outside the stigmata dark, forming as it were a central band. Of *Hadena adusta* from the Shetland Isles, Mr. Jenner Weir writes:—"The specimens of this insect are remarkably rich in colour, and with the markings more defined than usual" ('Entomologist,' vol. xiii., p. 290). This is the form which Mr. Hoffmann refers to in a previous quotation as "more distinctly marked than the ordinary form, and agrees more with the specimens from the Upper Hartz;" whilst Mr. Robson writes:—"Examples of this insect from Shetland are much paler in ground colour and have the markings more distinct" ('Young Nat.,' vol. viii., p. 122).

β. var. *baltica*, Hering.—Of this variety, Staudinger writes:—"Multo dilutior" ('Catalog,' p. 100). This would appear to be the *vulturina* of H.-S., but not the *vultarina* of Freyer, which is a much darker form. Guenée combines the two, but his description appears to apply only to the former. He writes:—"Of a pale grey mixed with reddish; no cuneiform streaks on the subterminal, reniform concolorous. Inferior wings with the lunule well-marked, and a double dark smoky band" ('Noctuelles,' vi. p. 86). Hering's original note on this form is:—"During several years in July, I have met here with a NOCTUA which at first appeared to me *Hadena satura*, but later was named a var. of *H. adusta*, a species which also occurred in South Germany. It can be seen that it has nothing in common with *satura*, and more importance should be given to the opinion of several experienced entomologists that it is a var. of *adusta* although I am not able to share the opinion. That both occur together in South Germany proves nothing. In *H. baltica* there is a reddish tinge on the fore wings, which I can never find in *adusta*. The central area is singularly marked in both species, but in *adusta* it is bordered by a double dentate black line edged with white towards the base, whilst

in *baltica* there is only a single black line, whilst the main area of the wing is tinged with copper-colour. In the subterminal line the W is hardly visible, whilst the cuneiform spots are constantly absent. Lastly, in *baltica* the hind wings have a reddish tinge which I have never found in *adusta*" ('Stett. Ent. Zeit.,' 1846, p. 237). It would appear probable that the specimens taken in the South of England are of this form. I saw a very pale specimen of this species, with the reddish tint almost or quite obsolete, which had been taken in the neighbourhood of North London by Mr. Prout, and another well-marked pale, red-tinted specimen taken by Mr. Evans on the Devonshire coast. These were very different to the North of England and Scotch specimens of this species. It would appear probable that the normal South German form, which Hering suggests in his comparison above is not reddish, is of the same character as our var. *duplex*, Haw. Of var. *baltica*, Lampa writes:—"Mycket ljusare, framvingarne i yttre hälften violettgrå" ('Entom. Tids.,' 1885, p. 62). He records this var. from "Finland, Karelen &c."

γ. var. *duplex*, Haw.—This is the ordinary dark British form which appears to be the *pavida* of Bdv. and the *chardinyi* of Duponchel, of which Staudinger writes:—"Al. ant. obscurioribus, fere unicoloribus" ('Catalog' p. 100). Compared with the paler and redder Continental typical form, our specimens from Scotland and the north of England are much more unicolorous and have the markings, except the subterminal, generally very obcsure. Haworth's original description is:—"*Noctua* alis nebulosis, brunneo cinereoque variis, lineola nigra, strigis stigmatibusque pallidioribus; posticis albidis, fimbria venisque fuscis." "Alæ anticæ strigâ ante, alterâ pone medium undatis pallidis, connexis per lineolam nigram marginem tenuiorem versus: inter has strigas, stigmata ordinaria obsoleta cinerea, et pone hæc striga postica pallida alte bidentata" ('Lepidoptera Britannica,' p. 190). In our form, the complete basal and elbowed transverse lines, although usually distinguishable, and sometimes greyish edged with black in colour, generally lose their greyish tint and are only traceable by the black edging. This gives them a very unicolorous appearance. The subterminal, however, is generally very distinct. Freyer's *vultarina* belongs to this form. He says:—"The fore wings blackish-brown, darker than in *adusta*," whilst his Pl. 63, fig. 1, is almost unicolorous dark brownish to the elbowed line, with darker traces of basal lines and stigmata; the elbowed and subterminal lines are ochreous, with the space between them dark reddish; the extreme outer margin dark brown. I have two specimens from Pitcaple almost black in colour, one of which has the subterminal line practically obsolete, and the whole of the markings of both are particularly ill-developed and the specimens unicolorous.

δ. var. *satura*, St.—The *satura* of Stephens appears to be only a sub-var. of Haworth's *duplex*, with the ⊨-like mark more strongly developed, and the black edging to the transverse lines also strongly developed. The original description of Stephens is:—"Alis anticis rufo-fuliginosis, lineolâ nigrâ maculis stigmatibus fasciâque pallidioribus nigro adnatis, posticis fuscescentibus." He also adds:—"Closely resembles *adusta* of which it is possible it may prove to be a variety. The wings are, however, more deeply marked with black,

and a very conspicuous straight black lineola unites the third and fourth ordinary strigæ in the anterior wings" ('Illus.,' ii., p. 181). I should call the complete basal and elbowed lines the second and third strigæ. Of this variety Guenée writes:—"Generally darker, the upper part of the elbowed line more distant from the reniform than in the type; the ⊨-like mark which unites the two median lines better marked; the cuneiform marks on the subterminal more pronounced. The inferior wings darker" ('Noctuelles,' vi., p. 85). Humphrey and Westwood write:—"Dark varieties of this species (*adusta*) occur in many cabinets under the name of *H. satura*. Mr. Stephens also considered it possible that his specimens described under that name might be varieties of *H. adusta*, as indeed an inspection of Wood's figure 236, seems to prove. As, however, Boisduval keeps them distinct (but placed next to each other, whilst Guenée removes *satura* to his genus *Aplecta*), it will, perhaps, be useful to give Mr. Stephens' description, which is as follows:—'*Hadena satura* (Steph., 'Ill., Ha.,' 2, p. 181)—The wings are deeply marked with black, and a very conspicuous straight black lineola unites the third and fourth ordinary strigæ on the anterior wings, at the base of which is a black streak, and a dusky one near the base of the inner margin; the stigmata are pale brownish-ash with slender black edges, the posterior one somewhat tinted with yellow; on the hinder margin of the wing is a pale striga composed of numerous acute denticulations, of which two are more conspicuous, and form the usual W mark of the group; the cilia are brownish, interrupted with pale cinereous and preceded by a series of conical black spots; posterior wings dusky, with the margin, nervures, and a central lunule of a darker hue.' Mr. Stephens is not aware of the habitat of Marsham's two specimens, but thinks they were most probably taken near London, the insect having moreover been taken, he believes, at Coombe Wood. Mr. H. Doubleday also informs us that Mr. Weaver has this season (1842) taken a moth in Scotland, which may be the true *H. satura*" ('British Moths,' pp. 161-162). I believe this latter specimen did, in fact, turn out a genuine example of *satura*, but there is no doubt that Stephens' *satura* is nothing but *adusta*.

Hadena, Och., *protea*, Bkh.

I quite agree with Guenée when he remarks:—"Although this species often varies in the shade of its green colour, and in the greater or less distinctness of its markings, it does not merit the name which has been given to it. I am not able to classify the varieties into distinct races" ('Noctuelles,' vol. vi., p. 89). Borkhausen's description of the type is:—"The ground colour of the fore wings is a mixture of whitish-grey, brown and green, which is intermingled in mottled shadings; the markings are difficult to distinguish, yet, on closer inspection, one perceives four dark stripes, of which the first, near the base, ends in the middle of the wing in a small streak starting from the base. The second, in an undulating manner, turns its course in a slanting way towards the inner margin. The third, with a strong angle turns towards the outer margin and approaches closely the second near the inner margin. Lastly, the fourth is strongly dentate close to the hind margin. Between the two middle ones is seen a mark which

resembles the figure 4, and is formed by broad brownish streaks and which is turned upside down on the right wing. Between the same, is the first of the ordinary stigmata, the orbicular, whitish-grey bordered with a brown line, but deeper brown in the centre. The reniform is behind the figure 4, and is likewise whitish-grey with a brown border, and in the middle, as well as at the lower extremity, somewhat shaded with brown. The hind margin is light green, speckled with black and white towards the tip. Hind wings are sometimes whitish ashy-grey, sometimes ochreous-yellow shaded on the hind margin with grey-brown or light ash-brown" ('Naturgeschichte' &c., p. 386). The type is figured in Newman's 'British Moths,' p. 413, fig. 1. Humphrey and Westwood write:—"The fore wings are very variable in colour, being of a reddish-brown varied with grey and greenish, and with numerous dusky markings. The costa, with numerous oblique blackish dots and a few white specks towards the tip; the two ordinary stigmata are grey, with the middle dusky, and slightly edged with a fine black line. Towards the base of the wing is a whitish patch edged with blackish externally, beyond which the space is also darker; towards the middle of the hinder margin is another pale patch, above which is an oblique dark mark resting on an irregular black line, which is bent upwards towards the outer stigma; beyond this, the wing is of a clearer colour and whitish towards the apex, having a pale irregular submarginal striga considerably angulated towards the middle, outwardly edged with darker brown, and with a more regular series of conical minute brown spots tipped with black along the margin. The hind wings are pale brown with the base whitish, and beyond the middle towards the margin, run two slender pale strigæ; the margin itself with a row of small black wavy lines. The wings beneath are pale grey, very much powdered with blackish scales, and a central blackish dot in each, and a marginal row of minute dark conical dots; the cilia are cinereous with brown spots. This is the most variable species; some individuals having nearly all the green and reddish-brown tints of the fore wings obliterated, whilst others have them of a nearly uniform pale green with a few black streaks; others are nearly grey, with the inner margin, stigmata, and subapical fascia nearly white" ('British Moths,' p. 166). There is a quaint little paragraph in Newman's 'British Moths,' p. 414, relative to the name of this species. It is:—"It will be observed that I have restored the proper name *proteus* to this species, it having been previously changed to *protea* in order to make it agree with the genus *Hadena*. Entomologists have rather peculiar views about the construction of Latin, but I do not consider myself under any obligation to depart from the ordinary rules of the language as we find it in the classics." The funny thing is, that whilst Mr. Newman has a quiet little slap at entomological Latin, there is no reason whatever for his change of the name to *proteus*, Borkhausen's original name being *protea*.

There are so far as I can separate them only four forms of this species. These are:—

1.—Pale green, tinted with reddish = *protea*, Bkh.
2.—Dark green, tinted with red = var. *seladonia*, Haw.

3.—Black and reddish, with whitish inner margin, stigmata and subterminal area = var. *variegata*.

4.—Black and reddish, pale inner margin, stigmata unicolorous = var. *suffusa*.

a. var. *seladonia*, Haw.—This is very much like the type but has the green much darker and the black markings more strongly developed. Haworth's description is:—"*Noctua* alis viridi cinereoque variis, posticis fimbria fusca in qua striga albida." "Costa anteriorum alarum nigro multipunctata. Stigmata ordinaria, et tertia subbifida infima, pallidiora fere ut in præcedentibus (*ochracea*). Postica pars alæ etiam paulo pallescit. Striga pallida undata juxta marginem posticum, punctis trigonis nigris variis, at in ipso margine magis regularibus. Posticæ cinereæ, fimbriâ fuscâ in qua striga albicans, margine ipso undatim nigro strigato; ciliis cinereis punctis fuscis" ('Lepidoptera Britannica,' p. 199). This form is similarly marked to that in Newman's 'British Moths,' fig. 1, but has the ground colour much darker.

β. var. *variegata*, mihi.—This variety is figured in Newman's 'British Moths,' p. 413, fig. 3. It has lost the mottling characteristic of the type and var. *seladonia*, and the colours are now distinctly developed and separated, especially the white markings. It is the *seladonia* var. *β* of Haworth, who writes:—"Omnino pallidior et pulchrior; margine tenuiore, stigmatibus tribus, fasciaque apicis albidis; strigaque alba posticarum in qua ordo punctorum fuscorum" ('Lepidoptera Britannica,' p. 199). Of this variety, Mr. Mason of Clevedon writes:—"I took a beautiful variety of *proteus* at sugar on the evening of September 14th. It is evidently the same form as the lowest figure in Newman's work, but with the white markings more pronounced" ('Young Naturalist,' vol x., p. 233).

γ. var. *suffusa*, mihi.—This is the darkest form of the species and is figured in Newman's 'British Moths,' p. 413, fig. 2.

Hadena, Och., *glauca*, Hb.

There appear to be two forms of this species, one more bluish and with the central area having a darker appearance, the other less blue, of a whiter or greyer shade and hence more ashy and uniform in appearance. The latter greyer and more unicolorous form appears to be the *lappo* of Duponchel; the former and bluer is the type. Hübner's type may be thus described:—"Anterior wings of a slaty-grey, with a bluish tinge; two transverse bluish double basal lines outlined in black, the stigmata outlined in bluish; elbowed line black; subterminal consisting of 4 cuneiform marks and a black lunule at the anal angle; extreme hind margin dotted" ('Sammlung. europ. Schmet.' &c., fig. 410). Guenée writes:—"It varies little; but, although it was long since well-known and figured by Kléemann, the figures that have been given of it in latter works have been so bad, that everyone has believed that he has obtained varieties or even new species. As an example, I would mention, the apparent difference between the *glauca* of Hübner, which he has pictured entirely blue to justify its name, and the *aperta* of Greyer which is figured entirely black; yet both are doubtless, in ground colour, only exaggerations of the same

type" ('Noctuelles,' vi., p. 94). Of *H. glauca* from Hoy, Mr. Gregson writes:—"Ordinary size and colour" ('Young Nat.,' vol. vi., p. 274). Mr. Sydney Webb writes:—"The colours which adorn the stone-coloured wings of *glauca* are grey-brown, green-brown, ochreous and pale violet, which combine variously in different individuals. I have a specimen dark, with the exception of the hind margin which is paler, and another is entirely of the blackish hue of *Viminia rumicis*" (*in litt.*), probably var. *aperta*, Hb.-Gey.

a. var. *lappo*, Dup.—Duponchel's description is:—"The superior wings are of a greyish-black, lightly powdered with bluish, with the two ordinary stigmata almost white but outlined in black. The claviform of the same colour. There are three transverse lines,—the first, grey, dentate and parallel to the outer margin; the two others, black,* waved, and enclosing the before-mentioned stigmata. This NOCTUA has been sent by M. Schönherr to M. le Comte Dejean under the name of *lappo*. It had been called so because it had been found in Laponie" ('Histoire Naturelle' &c., vii., p. 255). I am indebted to Mr. Watts for some specimens of this variety from Belfast, which are very pale and ashy, compared with my long series of Yorkshire specimens, although occasionally a specimen of the latter is much less bluish and altogether more ashy and unicolorous than is usual. Guenée writes of this:—"A little smaller, paler, more ashy, and the markings clearly developed; the ordinary stigmata smaller, especially the orbicular, the claviform clearly outlined and pupilled; the subterminal line tinted with ochreous" ('Noctuelles,' vi., p. 94). Guenée adds:—"This description is made from the same specimen that served as the type for Duponchel. It is certainly only *glauca*" (*l.c.*). Staudinger says:—"Smaller, more ashy; scarcely deserves a name" ('Catalog,' p. 91). Of *lappo*, Zetterstedt writes:—"Alis anticis cinereo fusco nigroque variis, strigis 3 dentatis distinctioribus nigris extus griseo marginatis, maculis ordinariis parvis obsoletis cinerascentibus; posticis cinereo-griseis, fimbria tenui alba." "Hab. in Lapponia D. Schönherr, e cujus museo pretioso specimen typicum mihi ad describendum benignissime fuit communicatum." "Ab *H. grœnlandica*, cui maxime similis, præter magnitudinem forte nonnihil minorem, etiam alarum anticarum strigis nigris griseo marginatis, nec totis albis, et harum strigarum 2 interioribus fasciam efficientibus, minus dentatis et undulatis, marginali tantum evidenter dentata, dignoscitur. Maculæ alarum ordinariæ valde obsoletæ vix discernendæ" ('Insecta Lapponica,' p. 939).

β. var. *quadripositâ*, Zett.—This variety is thus described by Zetterstedt:—"Alis anticis cinereo fusco nigroque variis, striga ad marginem posticum dentata alba intus nigro marginata, maculisque disci quatuor rotundatis albido cinereis; posticis fuscis. Sub nomine, '*Noct. lappo* var. ?, *Noctua glauca*? Hübn. Pl. 57, fig. 410.' a D. Schönherr missa." "Hab.—Ut Lapponiæ incola a Cel. Schönherr dubie communicata (Lapponia?). Similis certe et affinis *H. lapponi*, Dalm. ut et *N. glaucæ*, Hübn.; sed ab illa strigis alarum mediis vix ullis, a *N. glauca* colore magis fusco, nec glauco, et ab utraque maculis 4 rotundatis per pares positis, exterioribus paullo majoribus, distingui-

* These are edged throughout with white in the figure.

tur nostra *quadripositа*. Ab *H. frigida* (No. 7) etiam vix nisi maculis illis nominatis 4 dignota" ('Insecta Lapponica,' p. 939). This is a form in which the glaucous tint is reduced to a minimum and replaced by fuscous. I have a specimen or two apparently of this form from Yorkshire.

Hadena, Och., *nàna*, Hufn. = *dentina*, Esp.

I have already stated *(ante* pp. 36-37) that Hufnagel's description of *nana* in the 'Berlinisches Magazin,' applies to this species. He writes of it:—"Anterior wings whitish-grey, shading into dark grey, with a whitish-grey dentate spot in the middle of the fore wings. Of the third size. On tree-trunks. Common." The name *nana*, therefore by the law of priority, belongs to this species and not to *conspersa*. This is a variable species, and its varieties are as difficult as either those of *adusta* or *protea* to classify. The ground colour varies from the palest whitish-grey to dark brownish-black, and the markings from almost total obsolescence to a dark central area containing pale stigmata. The character of this species turns entirely on the dark shade around the stigmata. When this becomes obsolete, and the stigmata are also of the ground colour, the insect presents a most unicolorous appearance, and some of the specimens from want of markings, appear most obscure. The dark central shade which is of a blackish-grey or blackish-brown, even in the most distinctly marked specimens, rarely passes below the claviform. The orbicular and reniform generally partake of the ground colour, but the claviform varies with the dark central band. We appear to get four fairly distinct forms:—1.—Whitish-grey = var. *leucostigma*, Haw. 2.—Ashy-grey = *dentina*, Esp. 3.—Ochreous-grey = *dentina*, Fab. = var. *ochrea*. 4.—Brownish-black = var. *latenai*, Pier. Guenée writes:—"This species varies little, and always in such a manner that its varieties may be recognised by an experienced eye" ('Noctuelles,' vol. vi., p. 95). Of specimens from the Shetland Isles, Mr. J. Jenner Weir writes:—"Some of those taken are very darkly coloured, whilst others present but little difference from the English type of the species" ('Entomologist,' vol. xiv., p. 279). The darker specimens are var. *latenai*, Pierret. Esper's diagnosis of *dentina* is:—"*Noctua* spiril. cristata alis superioribus cinereo-fuscoque variegatis, stigmatibus ordinariis, macula disci albida bifida" ('Die Schmet. in Abbild.,' p. 380).

α. var. *leucostigma*, Haw.—This is the whitest form of the species, and is described by Haworth as follows:—"*Noctua* alis cinereo-albicantibus arcu obsoleto ex maculis subfulvis composito, in quo stigmata tria albicantia, infimo fisso" ('Lepidoptera Britannica,' p. 198), to which he adds:—"Of the last but one *(plebeia*, Haw.) it may possibly be only a variety, as it agrees with it in almost everything, except being much lighter coloured; and in being fulvous, subfulvous or rusty-flavous, in every part where that is brown or black." Some of these pale whitish-grey specimens have, however, the central band as black as the darker forms. This appears to be the *hilaris* of Zetterstedt, who writes:—"*H. hilaris*: alis anticis cano fuscoque variis, macula bifida cum macula ordinaria interiori subtus confluente strigaque postica dentata albis." "Hab. in Lapponia passim; ad Tromsoe Nordlandiæ Norvegicæ d. 24. Jul. 1821, et ad Asele Lapponiæ meridional. Suecicæ d. 25. Jul. 1832,

pauca specimina inveni." "Similis *H. dentinæ*, sed paullo minor et magis albescens. Signaturæ pallidæ in alis anticis ut in *H. dentina* sed macula bifida cum macula ordinaria anteriori omnino confluens, ambæ maculam unicam majorem angulatam angulo extus bifido simul efficientes" ('Ins. Lapp.' p. 938). Subvar. *leucostigma-obsoleta*.—The ground colour as in *leucostigma* but more unicolorous; the dark parts of the wing round the stigmata &c., absent; the whole wing area uniformly pale. Of *dentina* ab. *hilaris*, Lampa writes:—"Något mindre och ljusare, framvingarnes grundfärg ställvis gråblåaktigt hvit; den hvita, tandade fläcken sammanflyter med den runda" ('Entom. Tids.,' p. 58).

β. sub-var. *obsoleta*, mihi.—Of the same ashy-grey ground colour as typical *dentina*, but without the darker markings round the stigmata, the whole wing area being comparatively unicolorous.

γ. var. *ochrea*, mihi.—This ochreous-grey form is the *dentina* of Fabricius and of Haworth. It is not at all uncommon in Britain, some specimens becoming of quite a brownish tint, with the yellow markings strongly defined. Fabricius' description is:—"Alæ anticæ cinereæ in medio in primis fuscescentes maculis ordinariis maculaque cinerea bifida. Distincta macula marginis interioris ad basin strigaque postica undata flavis" ('Mantissa,' p. 157). Guenée says of this:—"The *dentina* of Haworth is an example in which the subterminal line and the base are accompanied with yellow scales, an appearance one frequently observes in fresh specimens" ('Noctuelles,' vi., p. 95). Guenée would apparently here suggest that the yellow scales are peculiar to fresh specimens, but this is not so, as many fresh specimens are without, whilst worn specimens frequently have such scales. Sub-var. *ochrea-obsoleta*.—The ground colour as in var. *ochrea*, but more unicolorous; the ordinarily dark parts of the wing uniform with the ground colour; the whole wing almost uniformly ochreous.

δ. var. *latenai*, Pierr.—This is a melanic form of *dentina* and in Britain, so far as I know, very rare, although I believe some numbers were brought from the Hebrides by the Messrs. Salvage a few years since. Pierret's description is:—"*Hadenæ dentinæ* affinis; statura paulo major, alæ obscuriores, lineamenta maculaque odontidea magis conspicua. Patria Helvetia." He also adds:—"It resembles *dentina* very much and is perhaps only a local variety of it. However, some very remarkable differences in the facies lead me to describe it. Independently of the size, which is very large, this species is distinguished from *dentina* by the intensity of the colour of the superior wings, and by the black markings of these wings which are more pronounced. The dentate spot, too, is larger and better marked" ('Ann. Soc. Ent. France.' 1837, p. 177). The figure (Pl. 8, fig. 3), to which this description refers is dull purplish black, the dentate mark below the orbicular being much elongated. Of this variety Staudinger writes:—"Multo obscurior" ('Catalog,' p. 91); whilst Guenée writes:—"*Latenai*, Pierret, is only a specimen blackened by the cold of the mountains" ('Noctuelles,' vol. vi., p. 95), the statement showing the old erroneous idea of a connection between cold and a general melanochroic tendency. Herr Hoffmann, referring to the dark specimens taken in Shetland, says:—"Probably they are var. *latenai* which occurs also

among specimens of the normal form in the Upper Hartz Mountains" ('Stett. ent. Zeit.,' 1884, p. 363).

Hadena, Och., *peregrina*, Tr.

This species, which is known as a British species from the two specimens captured in the Isle of Wight, is common on the shores of the Mediterranean. Treitschke's diagnosis of the species is:—"*Hadena* alis anticis argillaceis, macula conica obscuriori, striga postica dentata albida, maculis sagittiformibus brunneis; posticis albis fusco venosis" ('Die Schmet.' &c., iii. p. 330). Treitschke then continues:—"In size, form and markings, this comes near *dentina*. In colouring, however, it is quite different, and the ground colour is of a whitish brown, and might perhaps be compared with certain specimens of *Agrotis cursoria*. The head, thorax and collar are quite plain, the body somewhat lighter above with fine tufts on the sides. On the extremity of the body of the males is a yellowish-brown intermixed tuft. Antennæ like those of *dentina* whitish-yellow. On the fore-wings not a trace of the first basal line is visible, but, to the second basal line, which is whitish bordered with dark brown, is attached a hollow claviform. Over the orbicular, which, like the reniform, has a whitish centre with a brown border, runs a light costal streak, as in *dentina*, but it is not pectinated and joins the band. The angulated line consists of fine brown lunular marks (edged with white), and the dentate subterminal line is of the same colour. Between these lies a mottled space, with particularly handsome markings. On each nervure, is seen a cuneiform mark, and before the points, which are turned towards the base, is a white dot. The subterminal line has two projections turned towards the fringe. The fringes are bordered by a row of dark brown dots and a white line and are interspersed with light and dark brown. The hind wings are pale white sprinkled with brown along the nervures; the brown scales form a slight band towards the white fringes" ('Die Schmet.' &c., vol. v., pt. vi., p. 330). Of *Hadena peregrina*, Tr., Mr. Stainton writes:—"Not very closely allied to any of our known species. In September, 1857, Mr. Bond took a specimen at Freshwater, in the Isle of Wight; the insect is a native of Southern Europe and attached to low coasts" ('Ent. Ann.' 1859, p. 147). A second specimen was afterwards captured in the same locality.

Hadena, Och., *trifolii*, Rott. (*chenopodii*, Fab.).

There is no type description of this species, but it was named by Rottemburg on Rösel's figure, vol. I., Pl. 48. Of this Rottemburg says:—"Not very well figured and does not altogether agree with the moths I have bred from the larva figured" ('Der Naturforscher,' ix., 131). This species varies but little in Britain and then only in the shade of the ground colour, which is usually of a somewhat pale ashy-grey. Occasionally, specimens are brownish-ochreous and appear more unicolorous, but such varieties are not at all frequently met with. The diagnosis of Fabricius is:—"*Noctua* cristata alis planis cinereis nigro maculatis: striga postica bidentata alba, thoracis crista brevi bifida." "Alæ anticæ cinereæ atomis in primis costæ marginisque postici nigris. In medio maculæ ordinariæ. Ante marginem posticum

striga cinerea bidentata" ('Mantissa,' p. 156). This would appear to be the *verna* of Esper, whilst there is a pale ochreous form described under the name of *saucia* by the same author. In our British specimens, two or three minor points of variation are worthy of mention. The transverse row (sometimes double) of white dots found in certain species of *Mamestra, Xylophasia, Apamea* &c., directly outside the angulated line is very noticeable in this species (It is also remarked in Treitschke's description of *peregrina*). The subterminal is sometimes perfectly obsolete, although generally well-developed; the orbicular, too, varies very much in size and is frequently distinctly marked as a whitish spot, whilst at other times it is lost in the ground colour. These minor points of variation are very inconstant and intermediate forms are frequently found. The most striking character of this species is the dark shading in the lower part of the reniform which is occasionally very strongly developed. Some specimens have a tendency also, to occasionally become somewhat unicolorous, due apparently to a partial failure of scale or pigment development or both. Several such specimens were exhibited by different members at the meeting of the City of Lond. Ent. Society on March 17th, 1892. In this work, I have studiously neglected the consideration of North American forms, as some species, which appear to be frequently almost identical with ours, very properly go by different names at present, and are spoken of as "representative species" by American lepidopterists. Dr. Speyer ('Canad. Entom.' 1877, p. 28) considers *albifusa*, Walk., as a var. of *trifolii* (*chenopodii*), and in the 'Can. Ent.' 1881, p. 230, Grote describes a probable var. of *trifolii* from Oregon under the name of *oregonica*, whilst in the same magazine for 1881, p. 128, *albifusa*, Walker is given as synonymous with *trifolii*, Rott. There certainly appears to be no very essential difference between the specimens called *oregonica*, Grote in the British Museum collection, and our *trifolii*. There is, as I have said, unfortunately no description to Rottemburg's name of this species, but Mr. Kirby, who has been kind enough to look up the matter in the papers and books which he has to hand at the British Museum, writes :—"The references to *Phalæna trifolii* by Hufnagel and Rottemburg and to Rösel's figure are all understood to refer to *Hadena chenopodii*" (*in litt.*). Rosel's figure is certainly a poor one of typical *tripolii*.

α. var. *saucia*, Esp.—This is a pale ochreous tinted form of the species, which Esper describes as follows :—"Alis superioribus cinereo flavescentibus, stigmatibus striisque abbreviatis nigricantibus, fascia postica maculata rubescente" ('Die Schmet, in Abbild.' &c., p, 505); whilst the figure to which it refers may be described as :—"Pale ochreous, with dark outlines to stigmata, dark transverse lines with an inner edging of red to the subterminal" (*l.c.* Pl. 152, fig. 5). In Britain when our specimens have a tendency to become ochreous, the tint tends to brown not to yellow.

β. var. *indistincta*, mihi.—Varieties of the grey form occasionally occur in which the ground colour is unicolorous dark grey, with the ordinary markings and lines obsolete sometimes even the dark reniform spot. The specimens frequently look badly scaled as well as wanting in pigment, giving one the idea that the result is due to imperfect development (Compare with description of *oregonica*).

γ. var. *farkasii*, Tr.—In this variety the ground colour is much suffused with dark brown and ochreous and this darkening of the ground colour tends to a corresponding unicolorous appearance in the specimens, owing to the more striking markings being absorbed, this being especially the case with the transverse lines and stigmata. The brown specimens are comparatively rare, and comprise but a small proportion, compared with the typical grey form of the species in Britain. Treitschke writes:—"I have named this new species after my friend Mr. Farkas of Ofen who discovered it 8 years ago and kindly sent me a female in good condition. Since then, I have seen several other specimens which were mostly taken in Hungary. There was also one without a name among some French moths. In size and shape it is like *ypsilon*; head and thorax light yellow-grey; antennæ yellow-brown, body and feet grey; between the thorax and body stand many long white grey hairs. The forewings have a ground colour of brown mixed somewhat with yellow. The costa is darker but spotted with yellowish-white. The middle area is dark brown and is strongly scalloped towards the inside and outside and becomes narrower at the inner margin. In the usual position are the two paler ferruginous coloured discoidals, and between the two is seen a trace of a third; the next area is broad, uniform yellow-brown, whilst behind the subterminal line, the ground colour becomes, as well as the fringes, darker; the latter are intersected with yellowish-grey. The hind wings have a dull white ground; the nervures and a broad border before the white fringes, are dusted with brown-grey. There is also a faint lunule in the centre of the wing. On the underside the whole area is dull white. Through the middle of all the wings runs a scalloped brown band which is darkest towards the costa but then becomes more faint" ('Die Schmet.,' x., pt. 2, p. 74).

δ. var. *albifusa*, Walker.—This variety, or a variety of *Hadena trifolii* which has been referred to this form, was captured in Britain by Colonel (then Major) Partridge at Portland, and described as a species new to the British list by Mr. C. G. Barrett under the name of *Hadena albifusa*, Grote. Walker was the nomenclator of the species, and Grote referred it to *H. trifolii* as a variety or local race. The specimen, as described by Mr. Barrett, appears to be rather brighter than the specimens of *albifusa* in the British Museum. Mr. C. G. Barrett writes of the Portland specimen:—"In a box of NOCTUÆ sent for examination by Major Partridge, Commandant at the Isle of Portland, I found a specimen of *Hadena* allied to *dentina*, and more distantly to *chenopodii*, but evidently quite distinct from any known British species. Judging by descriptions, it appeared to be near to *H. sociabilis* or *H. marmorosa*, but, failing to satisfy myself by correspondence, I sent the specimen to my friend, Mr. W. F. Kirby, who took great pains with it. Finding that it did not agree with any European species in the national collection he searched further, and had the satisfaction of finding that it agreed very well with *H. albifusa*, Grote, a native of North America. Major Partridge informs me that he took it at sugar, on the night of August 15th, on the undercliff near Portland Castle, and not far from the anchorage. It is, therefore, possible that it may have escaped from some passing American vessel after making the ocean voyage in the pupa state, or otherwise

concealed among merchandise, but its fine condition forbids the idea that it can have *flown* any great distance. It is equally possible that it may have reared on the spot, the *produce* of an accidentally introduced specimen. It would be very curious if this North American species should succeed in establishing itself with us. The ground colour of the fore wings of this specimen is pale grey, with a very faint yellowish gloss, and is clouded with dark grey along the costa, which also is pretty regularly spotted with blackish. Both transverse lines are indistinct, blackish edged with pale, the first much interrupted and angulated, the second indented into crescents. The orbicular stigma is large, roundish, and whitish, the renal also large, dark grey, with a perpendicular pale shade down its middle, the claviform very broad, almost lunate, grey, all three edged with black. From the whitish orbicular stigma, a pale oblique band, to near the anal angle, meets another broad, pale band from the apex of the wing. Hind margin much clouded with dark grey, subterminal whitish, interrupted, indented, and with a conspicuous W in the middle. At the base of the wing are several curved blackish lines between the nervures, cilia pale grey, spotted with darker. Hind wings whitish to beyond the middle, with a broad, ill-defined, dark grey band along the margin; cilia white, with a line of pale grey dots or flecks. Head, antennæ, thorax and abdomen, grey-brown. It looks something like a small pale *dentina*, with which species Major Partridge tells me that he at first placed it but, from the distinct, central, pale, oblique band, it bears also some resemblance to *contigua*" ('Entomologist's Monthly Magazine,' vol. xxv., pp. 228-229). The pale yellow gloss I find to be very characteristic in American specimens of this form. Prof. Smith noted one or two inaccuracies in Mr. Barrett's communication and at once wrote:—"In the January No. of the 'Ent. Mo. Mag.' appeared an article on *Hadena albifusa*, Grote, in Britain, which requires some additional information, and perhaps correction. The record of the capture of a foreign insect should never be made without the most careful investigation. In this case, the circumstances of the capture of the insect are sufficiently certain, but with all due respect to the eminent entomologists who made the conclusions, they are not entirely warranted. In the first place, Mr. Grote never described any *Hadena albifusa*, though Mr. Walker did in the 'Cat. Brit. Mus. Noct.,' p. 753. This would have been unimportant, but in 'Bull. Buff. Soc. Nat. Sci.,' i, 104, Mr. Grote referred this species of Mr. Walker's to *Mamestra trifolii* = *chenopodii*, a species common all over Europe, and, I believe, in England as well. In America, the species is, as a rule, very uniform in colour, rarely becoming as brightly marked as in the specimen described by Mr. Barrett. It is otherwise rather variable, but within the same limits shown by the series of European specimens seen by me. Mr. Kirby is probably correct in the identification of the form as *albifusa*, but as *albifusa* is but a form of a common European species, and a form not geographical, the specimen collected by Major Partridge had its origin either on the Continent, or what is more probable, it is a somewhat aberrant form, such as sometimes occurs everywhere, especially in species that are known to vary" ('Ent. Mo. Mag.,' vol. xxv., p. 228). I quite agree with Professor Smith as to the probability of its origin, as an

aberrant form, on the ground where it was found. Portland is well known for its tendency to produce particularly pallid varieties of some of our common and local species, *e.g. Epunda lichenea* var. *viridicincta*, *Heliophobus hispida* var. *pallida*, *Agrotis ripæ* var. *weissenbornii* and very many other similar examples might be quoted, and it is here of all places in Britain, that one might expect the occurrence of such a pallid form. The most interesting part of the matter appears to be the occurrence of an isolated example, as an aberrant form of our type, of a variety which is recognised as a fairly constant race in North America, although this is only what one might expect to frequently happen when the variation of the species of both Continents is better understood.

(?) ϵ. var. *oregonica*, Grote.—Grote's original description of this doubtful geographical race is as follows:—"Under this name I register specimens from Oregon which appear to belong to *trifolii* but differ by the concolorous fore-wings, wanting the dark dashes to the subterminal line which has only a faint M-mark. The hind wings have a faintly yellowish tone. The claviform is reduced and rounded. The dark reniform entirely contrasts, otherwise I see no differences and we have to do probably with a geographical variety. Kansas specimens are somewhat intermediate. Fine specimens of the variety are before me" ('Canadian Entom.,' xiii., p. 230). Mr. Grote now writes:—"I still believe it may be a variety but am not sure. I have not seen Professor Smith's paper in the *Ent. Mo. Mag.*, but if he considers it also a var. it probably is one" (*in litt.*, 26, 4,'92).

Hadena, Och., *atriplicis*, Linn.

I am unable to find in this species any variation except the tendency, found in many dark green species, of a change to yellow or brownish. The pale mark under the orbicular is sometimes very strongly tinged with pink, and there is some variation in the size and shape of the stigmata. The Linnæan description of the type is:—"*Noctua* spirilinguis cristata: alis deflexis nebulosis litura fulva" ('Systema Naturæ,' xth., p. 517). This unsatisfactory description is supplemented by a much better one in the 'Fauna Suecicæ' p. 317, where we read:—"*Phalæna Noctua atriplicis*, spirilinguis cristata, alis deflexis: superioribus nebulosis litura exalbida bifida." "Alæ superiores luteo fuscoque nebulosæ, postice striga repanda flavescente; juxta maculas ordinarias a latere interiore litura albido flavescens, oblonga, postice bifida, acuta." I have some specimens which are in perfect condition, in which the beautiful green has been changed to yellow, or apparently so, unless, indeed, some of the yellow specimens emerge with that coloration which is very improbable.

Hadena, Och., *dissimilis*, Knoch.

For positive variation, perhaps this is the most variable species in the genus. The varieties may be classed, however, under three heads; (1) The variegated form. (2) Almost unicolorous, brownish. (3) Almost unicolorous, dark grey. Guenée writes:—"It varies infinitely in size, colour and markings. We will consider as the type, the specimens which are (usually) of a smoky colour, sometimes uniform, with the stigmata concolorous, sometimes tinged with reddish on the disc,

with the stigmata paler. In all the subterminal is very distinct, and the M which it forms has the points very sharp and prolonged into the fringe" &c. ('Noctuelles,' vi., p. 99). Knoch's actual type is described as follows:—"*P. Noctua* spirilinguis cristata alis deflexis crenatis: superioribus hepaticis macula conica linea terminali bidentata." "Alæ anteriores supra hepaticæ fœminæ ('Tab. iv., fig. 3), furvæ, ad basin macula fere triloba fusca dilucide terminata, deinde conica nigro limbata; tum stigmatibus ordinariis valde obsoletis lineaque fœminæ undata transversa præter terminalem bidentatam. Posteriores pallide fuscæ nitidæ versus marginem exteriorem nigricantes, lineola ad angulum ani undata" ('Beiträge zur Insecten' &c., p. 57). Of the figures to which this description refers I wrote:—"Pl. iv., figs. 3 and 4 are both of the almost unicolorous, dark red-brown form, with blackish claviform and a whitish subterminal line." The variegated form is the *suasa* of Borkhausen, the dark ashy-grey form is the *w-latinum* of Esper, whilst the extreme unicolorous blackish-grey form appears to be the *confluens* of Eversmann. The *aliena* of Duponchel appears to be a form sliightly intermediate between the type and var. *suasa*. The following are the various forms that have been described:—

1.—Pale brownish, mottled with black = var. *suasa*, Bkh.
2.—Dark brown, markings traceable = *dissimilis*, Knoch.
3.—Dark brown, mixed with ashy-grey, almost unicolorous = var. *w-latinum*, Esp.
4.—Blackish-grey, almost unicolorous = var. *confluens*, Ev.

Mr. T. D. A. Cockerell notes:—"*Hadena dissimilis* var. *discolor*, Speyer = *atlantica*, Grote, see 'Can. Ent.' 1877, p. 22; 1881, p. 128" *(in. litt.)*.

a var. *suasa*, Bork.—This is the mottled form of the species, of a brownish tint with pale orbicular and reniform, blackish claviform leading into a black spot at the base of the reniform, and a distinct pale subterminal line. Borkhausen's description is:—"Anterior wings liver colour or brown, mottled with lighter and darker shading. In the middle of the wing towards the costa are the ordinary stigmata, somewhat paler than the ground colour, but bordered with brown. Under the orbicular is the dark claviform, outlined with black, touching which, in some specimens, is a black basal line, the angulated line sometimes traceable, with a compound black mark at the angulated point. Near the hind margin is the subterminal, whitish or ochreous in colour, making a Latin W in the centre and edged with black. Near the apex on the costa, are three pale brown or ochreous spots. Hind wings pale brown darker on the outer margin" ('Naturgeschichte" &c., iv., p. 457). This appears to comprise without doubt the *aliena* of Duponchel according to his description, although his figure (Pl. 30, fig. 1) is very unsatisfactory. He writes:—"The superior wings of a yellowish-grey, marbled with reddish; the costa paler; the fore wings traversed by 3 greyish-white lines, bordered with brown on both sides; the two first at the base and wavy, the third is at the extremity of the wing and angulated, making in its centre, a very distinct M-mark, as in *suasa* and *oleracea*, which appears very distinct because shaded with dark brown; the two stigmata slightly paler than the ground colour, but indistinct; a third, oblong

reddish stigma under the orbicular, surrounded with blackish-brown and placed on the basal line; a blackish longitudinal basal streak reaches almost to this line as in *Apamea basilinea*" ('Histoire Naturelle' &c., iii., p. 323). Guenée says of this:—"Generally a little larger, of a greyish testaceous yellow, darker on the disc, and at the outer margin, with the same markings as in the type, but the subterminal, although very well marked, is less striking and is always preceded by cuneiform markings in the middle, and with fine reddish markings in the lower part. Inferior wings paler, and thus rendering the markings more distinct" ('Noctuelles,' vol. vi., p. 100). Guenée warns entomologists against confounding this variety with the *aliena* of Hübner, which is a distinct species. This variety would also appear to comprise Guenée's var. A of which he writes:—"All the markings very distinct, the ordinary stigmata large and close together. The subterminal sharply dentate and very strongly marked." "West of France and England" ('Noctuelles,' vol. v., p. 99).

β. var. *w-latinum*, Esp.—Esper's figure (Pl. 136, fig. 3) of this var. is most unsatisfactory, but appears to be our dark reddish-brown form scattered over with blackish or greyish scales, and with only the subterminal defined. Guenée writes:—"Ashy colour is the prevailing tint on the superior wings, and is varied here and there with reddish-ferruginous, this last colour surrounds the stigmata, borders the subterminal, and sometimes forms marblings in the median space. There are no cuneiform marks before the subterminal. The inferior wings are paler, especially in the ♀." Guenée also adds:—"I have one very remarkable female of this sub-variety which is of a deep ferruginous red, almost like *oleracea*. It is to this form, more especially, that the figure of Esper belongs" ('Noctuelles,' vol. vi., p. 100). I believe the first part of Guenée's remarks, refer rather to var. *confluens*, Eversmann, which are particularly blackish-grey in colour, but his remark *re* the similarity of specimens of this variety to *oleracea*, I quite agree with. They are very similar, and sometimes bear a marked superficial resemblance to *oleracea*. I have this reddish-brown unicolorous var. *w-latinum*, from Strood, Deal, Darlington, Warrington, and many other places, but var. *confluens* appears to be much more restricted.

γ. var. *confluens*, Ev.—This is the darkest form of *dissimilis*, and is of a blackish-grey coloration, with the markings almost obsolete except the pale outlines to the reniform and orbicular. Eversmann's description is:—"Alæ anticæ fusco-nigricantes spatio submarginali unicolore, maculis ordinariis albidis, striga submarginali in medio argute bidentata; posticæ nigricantes ciliis albis." He then adds:—"Paulo minor quam *suasa*, sed ei simillima et forsan nihil, nisi ejus varietas; differt colore nigricante et spatio submarginali unicolore sine umbris. In spatio eo interdum series punctorum alborum reperitur, eodem modo ac in *M. suasa*" ('Faun. Volg.-Ural.,' p. 245). The only British specimens of this variety that I have seen, were bred by Mr. Mera, from ova laid by a female captured on the Essex coast.

Hadena, Och., *oleracea*, Linn.

This common species is most invariable with the exception of the ground colour, which is sometimes red-brown but more generally of a

deep fuscous-brown. The orbicular is occasionally very strongly outlined with white, sometimes it forms a white dot, whilst occasionally it is obsolete. The reniform is orange, sometimes however more yellow in tint. The subterminal is usually white, but now and then almost obsolete. When well-marked, it has frequently a peculiar white shading in the inside of the hollows of the W mark in the subterminal. The hind wings of the male are variable, sometimes very pale at the base. I have one specimen with the dark hind marginal band broken. The hind wings of the females are generally darker than those of the males, but not much more so than the darkest of the latter. Our Southern specimens are either bright red-brown or dark reddish-fuscous. I have never seen any of the forms referred to by Mr. Gregson who writes of the specimens from Hoy as follows:—"Like *rubricosa* this appears to have lost its ruddiness at Hoy, and appears in light greys of various shades" ('Young Nat.,' vol. vi., p. 274). The type is thus described by Linnæus:—"*Noctua* spirilinguis cristata, alis deflexis; superioribus fuscescentibus bimaculatis striga marginis postica bidentata" ('Systema Naturæ,' xth., p. 517). The *spinaciæ* of Borkhausen also represents the type. Taking, therefore, the dark fuscous specimens as the type, we have only the red form to deal with as a variety.

a. var. *rufa*, mihi.—The anterior wings bright red-brown, without the dark fuscous shading in the ground colour of the type. The stigmata are generally well-marked and the subterminal distinct. The hind wings, too, are rather paler. My specimens of this brighter form have come from Westcombe Park and Deal, but I dare say it is widely distributed.

Hadena, Och., *pisi*, Linn.

The first thing that strikes one in the general appearance of this species is the mottled look some specimens have compared with others. This appears to be principally due to the development of the central shade and the amount of dark shading on the inner edge of the subterminal. The basal lines in the more varied specimens are also well-marked while they are obsolete in the more unicolorous forms, the orbicular also varies from a well-defined pupillated spot, to perfect obsolescence. The subterminal line is almost always well-marked and strongly ochreous, although, in a few specimens, it consists merely of a row of dots with a larger one near the anal angle. This dot near the anal angle varies very much both in size and shape. In colour, there is a great deal of variation. Our specimens from the South of England are generally red with more or less ochreous in their tint and a large proportion are pretty well mottled. In the Northern counties of England, the bright red forms are rare, and are generally replaced by dull red-brown specimens, whilst the Scotch specimens, and some North of England examples have a strong purple tint. In Aberdeenshire, the purple becomes strongly suffused with a glaucous tinge, and I believe red forms are practically unknown. Besides these, specimens of the palest reddish-grey colour are occasionally found, and I have seen a melanic specimen with the red entirely suffused with black scales. This was bred by Mr. Acton of Warrington. I have specimens approaching this from Mr. Collins of the same place, so that it

is very probable that when properly worked for in this district, melanic specimens will prove to be not particularly uncommon, although very rare at the present time. The type of this species is thus described by Linnæus:—"*Noctua* spirilinguis cristata, alis deflexis ferrugineo-cinereis bimaculatis: striga postica pallida" ('Systema Naturæ,' xth., p. 517). Linnæus further adds:—"Alæ superiores griseo-nebulosæ, postice striga flexuosa alba, quæ ad angulum ani maculam albam majorem constituit" ('Fauna Suecicæ,' No. 1206). The glaucous tendency in this species is somewhat similar to that already mentioned as occurring in *Agrotis subrosea, A. hyperborea* and others, although I am not aware whether the extreme development of purely glaucous forms occurs on the Continent in *H. pisi*, as it does in those species and in *Hyppa rectilinea*. I have occasionally noticed a tendency for longitudinal ochreous streaks to be developed between the nervures in the red form, between the subterminal and elbowed lines. Similar streaks are particularly well-developed in *Agrotis nigricans* var. *striata*. There would appear to be no doubt that the North British red-brown form strongly mottled with grey is the Linnæan type. The rare and beautiful Scotch form, certainly shows a glaucous tendency, but it can hardly represent the type, as these specimens are too strongly purple to be called "ferrugineo-cinereis," although the term "cinereis" was used by the older entomologists for every grade of "dirty white" to a beautiful "bluish," or as we term it, "glaucous" shade. On the other hand, some specimens sent for my inspection by Mr. Tunstall of Warrington, were of a deep red-brown, strongly shaded with grey on the outer half of the wing, the grey extending to the central shade, and appearing again at the base, so that I think it is very possible that this is the form referred to as the type by Linnæus. Of the Irish specimens of this species Mr. W. F. de V. Kane writes:—"For some years I have been interested in this moth, and when I bred a very red form like those from the South of England, I thought it to be a rare aberration, but subsequently, I found that it was the commonest coloration in England. I have a long series, and some very peculiar ones. A few are red and slightly marbled. Most, however, are purplish with every degree of mottling down to almost unicolorous grey-brown, which I take to be the rarest form. One mottled grey-brown specimen has only a trace at the anal angle of the subterminal line. Another dark-grey specimen with markings almost obsolete, has this line broad, white, and extremely conspicuous. In fine, the Irish forms generally vary from purplish to grey-brown, sometimes nearly approaching *glauca*, with large stigmata, sometimes chequered and mottled, and sometimes marked strongly with dashes" (*in litt.*, 26, 2, '92). I was unaware until I saw Mr. Kane's Irish specimens of a purely brown form without any red in the ground colour. However, as I have no such varieties in my long series, I simply mention the fact that such exist without including them in the following table. Of the North of England specimens, Mr. Robson writes:—"The northern form of this common insect is cold dark brown, the southern form is warmer in tone and redder. A very richly coloured and well-marked specimen of the red form is called *spendida* by Mr. Gregson. I do not know what my classical friends will think of the name" ('Young Naturalist, vol. viii., 122-123).

The following is an attempt to classify some of the forms of this species:—

1.—Pale grey, with a reddish-tinge, markings distinct = var. *pallida*.
2.—Bright red (sometimes strongly tinged with ochreous), markings distinct = sub-var. *distincta-rufa*.
2a.—Bright red, markings obsolete except subterminal = var. *rufa*.
3.—Red-brown, mottled with grey, markings distinct = *pisi*, Linn.
3a.—Red-brown, almost unicolorous except subterminal = *splendens*, St.
4.—Purplish-red or -brown, markings distinct = sub-var. *distincta-scotica*.
4a.—Purplish-red or -brown, markings obsolete except subterminal = var. *scotica*, St.
5.—Suffused blackish var. *suffusa*.

α. var. *pallida*, mihi.—This is the palest form of *pisi* with which I am acquainted. The ground colour is of a pale grey with a reddish tinge, the transverse markings distinct, the subterminal pale, and showing a tendency to blend with the ground colour. I have a strange specimen of this pale form in which a dark fascia replaces the complete basal line, and with the other markings obsolete except the pale subterminal. The form is very rare, I believe, in Britain. It would appear to be the var. **B** of Guenée of which he writes:—"All the markings are present, but they are very pale, and the ground colour itself is of a whitish-ochreous with the subterminal line white. The inferior wings also very pale" ('Noctuelles,' vi., p. 102). Guenée adds that his specimen of this variety came from New York.

β. var. *rufa*, mihi.—This, with sub-var. *distincta-rufa*, is the most common form in the South of England. Var. *rufa* has the anterior wings of a bright red coloration (sometimes tinted strongly with ochreous) the stigmata, central shade &c., more or less obsolete, the whole insect being almost unicolorous except the pale and distinct subterminal line. Sub-var. *distincta-rufa*.—This sub-variety is of the same ground colour as *rufa*, but it has a distinct central shade, paler basal lines and angulated line, and well-marked stigmata, as well as the characteristic pale subterminal, so that it has altogether a very mottled appearance. The most northerly part of England whence I have seen this bright red variety is Warrington, but it is very rare there.

γ. var. *splendens*, St.—This is the more unicolorous form with a reddish-brown ground colour like the type. Stephens' type came from Cumberland and is described as:—"Alis anticis rufo-fuscis, strigis tribus saturatioribus, externâ albo terminatâ, stigmatibus pallidioribus." He also adds:—"Rather less than *pisi* which it resembles. Anterior wings reddish-brown with three darker transverse strigæ, the exterior (subterminal) terminated by an interrupted white line; the stigmata rather small, pale reddish-ash, the anterior immaculate, the posterior with dusky clouds. Posterior wings ochreous-ash, with the margin, an interrupted transverse striga, central lunule and nervures dusky" ('Illus. Haust.' p. 192). It is most closely allied to Linnæus' *pisi*, but is without the paler marblings. It is Haworth's var. *β* of which he writes:—"Alis anticis fuscis striga postica interrupta alba; posticis

cinereis puncto lunari medio fimbriaque fuscis, et in fimbria fascia abbreviata albicante" ('Lepidoptera Britannica,' p. 193); whilst of *splendens*, Guenée writes:—"Of a deep red-brown, with the lines darker, and the subterminal partly effaced, persisting only at the anal angle" ('Noctuelles,' vi., p. 102). This is most particularly a North of England form rarely occurring in the South, where the reddest forms (*rufa* &c.) take its place.

δ. var. *scotica*, mihi.—Although I call this variety *scotica*, it is in no way confined to Scotland, being well distributed in the North of England localities with the type and var. *splendens*, and it also occurs in Ireland. I have seen specimens from Warrington, but the grandest forms come from Aberdeenshire. To make the nomenclature uniform with that of var. *rufa*, I would call the more unicolorous form with purplish ground colour and pale subterminal *scotica*, the variegated and mottled specimens sub-var. *distincta-scotica*. My specimens of the sub-var. from Aberdeenshire are of a rich purplish colour, tinged with ashy-grey, with a dark central shade, and pale-edged transverse lines, the stigmata pale and distinct, the subterminal well-defined and very pale. I have never seen such from South of England localities.

ε. var. *suffusa*, mihi.—This form has the red colour entirely lost in a suffusion of melanic scales, the ordinary markings appearing still darker than the ground colour. Even with us in Britain, where melanic forms are so prevalent, this is very rare. I have only seen one perfectly melanic specimen which was bred by Mr. Acton of Warrington, although I have some almost as dark from Mr. Collins of the same place.

Hadena, Och., *thalassina*, Rott.

Of this species, my largest specimens have come from Leeds, the reddest from Sligo, the greyest from Chattenden, whilst there appear to be both mottled and also more obsolete forms occurring in all localities. The pale basal mark appears to tend more to ochreous in Scotch specimens and I have one specimen with the black, longitudinal basal line much shorter than usual. The orbicular varies not only in size and shape, but also in direction, and appears to be never obsolete. In some specimens, the reniform and the upper parts of the elbowed and subterminal lines merge into the ground colour. The cuneiform spots are frequently obsolete and rarely number more than three. The ⊨-like mark under the stigmata appears to be developed, when present in this species, directly from the claviform, whilst, in the best marked specimens, a transverse row of tiny white dots runs parallel to the angulated line and between that and the subterminal. Of *H. thalassina* from Hoy, Mr. Gregson writes:—"Light and beautiful" ('Young Nat.,' vol. vi., p. 274). Of this species Newman writes:—"The colour of the fore wings is reddish-brown, brightly variegated with darker shades; both the discoidal spots are clearly defined by a slender black circumscription; the orbicular has also a white circle within this black one: there is a pale blotch at the base of the costal margin, which gives its name to the species, and there are three transverse pale lines, the first before the orbicular and nearly direct; the second beyond the orbicular and much bent; and the third parallel with the hind margin, and near its middle projecting a W-mark towards the hind margin; resting on

this third pale line are two or more acutely pointed dark wedge-shaped marks which point towards the base of the wing; in connection with the second of these transverse lines, and between it and the third, is a transverse series of six white dots, all of them seated on the wing-rays, and each preceded, as well as followed, by a black dot: the hind wings are reddish grey-brown, the wing-rays being slightly darker and the fringes slightly paler: the thorax is crested, and, like the fore wings, much variegated" ('British Moths,' p. 420). Rottemburg's description of the type is as follows:—"Fore wings reddish-brown, mottled with various darker and lighter patches; a white, transverse, zigzag line, edged with red-brown, near the hind margin; the orbicular and reniform stigmata near the middle of the fore wings towards the costa, both brownish in the centre and bordered with white. Hind wings light grey, darker towards the outer margin with a whitish fringe. Head and thorax the colour of the fore wings, the abdomen the colour of the hind wings. The whole moth has a bright glossy appearance and is about the size of *H. pisi*" ('Der Naturforscher,' ix., p. 119).

The following forms appear to have been described:—1. Greyish-brown = var. *humeralis*, Haw. 2. Reddish, mottled = *thalassina*, Rott. 3. Reddish, more unicolorous = *achates*, Hb.

a. var. *humeralis*, Haw.—Haworth's diagnosis of this greyer form of *thalassina* is:—"*Noctua* alis nebulosis brunneo-cinereis, strigis tribus albis; basi pallidis lineola nigra; posticis fuscis." "Præcedenti simillima (*duplex* = *adusta*), at minor, pulchrior, strigis longe pallidioribus; alis posticis fuscis; nec albidis fimbriâ fuscâ, ut in priore" ('Lepidoptera Britannica,' p. 190). This grey form is not at all uncommon in the various localities in Kent in which I have collected.

β. var. *achates*, Hb.—Of var. *achates*, Staudinger writes:—"Al. ant. magis unicoloribus rufescentibus" ('Catalog,' p. 90). Hübner's figure may be described as:—"Anterior wings reddish-brown, with the typical basal patch small and ochreous, with a short longitudinal black line below it; the basal line paler and double; the stigmata also paler but outlined in black; a pale patch under the stigmata; a short costal streak reaches to reniform; the angulated line wavy and indistinct; the subterminal whitish; the outer edge of nervures darker. Hind wings dark grey, base paler, distinct lunule" ('Sammlung europ. Schmet.' &c., fig. 498). This more unicolorous red form does not appear to form a local race, but to occur now and then with the type in the same localities.

Hadena, Och., *contigua*, Vill.

The three last species considered (*oleracea*, *pisi*, and *thalassina*), have not got the dentate mark, so characteristic of certain species of *Hadena*, under the orbicular. This, on the contrary, has it very srtongly developed. The orbicular is usually pale and occasionally pupillated, the costal area between the reniform and apex sometimes whitish with a slight reddish tinge. This pale area is sometimes extended to include all the space from the costa to the inner margin, between the angulated and subterminal lines, whilst occasionally the whole of the area towards the costa and apex, extending from the or-

bicular to the anal angle is unicolorous greyish, the angulated and subterminal lines blending into the ground colour. The ⊨-like mark, when present, is formed from the claviform. Of *Hadena contigua* from Cannock Chase, Mr. C. G. Barrett writes :—"Pretty reddish specimens of *Hadena contigua* occurred" ('Entomologist's Monthly Magazine,' vol. xxiii., p. 197). Viller's diagnosis of the type is :—"*Noctua* cristata, alis planis fusco cinereoque nebulosis, striga postica bidentata alba, thoracis crista bifida" ('Car. Lin. Ent.,' iv., 468). The greyer form, therefore, is the *contigua* of Villers. It is also the *spartii* of Brahm, who writes :—"Fore wings somewhat small, dark grey, with here and there a brownish tint. The base is light grey mixed with brown with a small black dash; just before and beyond the middle stands a light grey dark-bordered waved line, and in the space between are the ordinary stigmata" ('Insekten Kalen.,' ii., 323). The type is Haworth's *dives* var. β of which he writes :—"This beautiful insect is, perhaps, a sexual variation only of *N. dives*, but all the "Brocade Moths" have very nearly the same markings, which are more easily perceived than described. Its thorax and the posterior margin of its upper wings are much deeper, as are all its other characters, and with more of the bluish blossom-like tint" ('Lepidoptera Britannica,' p. 190). This variation is not strictly sexual, although the females are inclined to be slightly darker and to have more of the bluish tint than the males.

a. var. *dives*, Haw.—Haworth's *dives* represents the paler variety of this species in which the space between the elbowed and subterminal line is pale, almost white. He writes of it :—"*Noctua* thorace cano strigâ nigrâ transversâ, alis diversicoloribus fascia antrorsum obliquâ albâ interruptâ; posticè canescentibus." "Alæ anticæ nebulosæ, fusco fulvo alboque variæ: maculâ âlba costali ipso basi, alterâque anticâ majore fere marginis tenuioris: tunc fasciâ fractâ in medio antrorsum obliquâ, compositâ ex stigmate anteriore rotundo albo, maculâ bifidâ albidâ adnato; et maculâ aliâ albâ marginis tenuioris, Postica pars alæ pallescit vel cinerascit strigâ albâ dentatâ punctis paucis sagittatis intus adnatâ ut in aliis hujus sectionis. Alæ posticæ albidæ, nervis strigâque ipsius marginis postici fuscis" ('Lepidoptera Britannica,' pp. 189-190). The pale form appears to occur generally with the type. I have both forms from Sligo in Ireland, and Glasgow in Scotland.

Hadena, Och., *genistæ*, Bkh.

I am unable to notice any variation worth speaking of in this species, except that the females are generally slightly darker than the males. The ⊨-like mark, however, is a compound structure made up of the claviform and a second stigmal marking which meets the claviform and has its origin on the angulated line. The type is thus described by Borkhausen :—"The ground colour is an agreeable mixture of slate colour and red-brown. On the base of the costa stands a whitish oval spot, which is bordered below by a black longitudinal streak which starts from the base. Following this is a whitish, angulated, transverse line bordered with brown. Then follow the ordinary stigmata in a brown ground, the first, orbicular, the second, reniform in shape. Both are pale brownish, bordered with whitish and black, and the hinder has in its centre a yellow lunular spot.

Under the orbicular, is the round claviform. Beyond the stigmata are a whitish angulated line (also dentate) and, near the hind margin, a whitish zigzag line which forms a W in the centre. Between these lines the colour is slate-grey and in the middle there is a transverse row of white dots, each dot standing on a black nervure. On the hind margin is a row of black triangular dots; the fringes brown streaked with yellowish; the costa speckled with brown, and 3 or 4 yellow dots towards the apex. Hind wings yellowish-grey, hind margin ashy-grey" ('Naturgeschichte' &c., ix., p. 355). Of this species Newman writes:—"The fore wings are beautifully mottled and marbled with various tints of grey and brown; the orbicular is round and has a slender black circumscription; the reniform has not so perfect a circumscription; the median area is grey in both; immediately below them is a longitudinal blotch of rich dark brown; at the costal base of the wing is a rather large grey spot, and below this a very distinct linear longitudinal black mark; beyond the discoidal spots is a broad pale grey band extending entirely across the wing, and beyond this a pale grey zigzag line accompanied by dark margins, and a few dark wedge-shaped marks which point towards the base of the wing; the hind wings are grey-brown with darker wing rays and paler fringes" ('British Moths,' p. 422).

Hyppa, Dup., *rectilinea*, Esp.

This is a beautiful and variable species, and despite its superficial resemblance to *H. genistæ*, I think Staudinger was right in separating it generically. The specimens vary from being uniformly grey with an ⊢-like mark, to grey with an intensely dark red-brown band. The orbicular varies from complete obsolescence to a large longitudinal oval stigma, and the reniform also from complete absence to a well-developed stigma on the darker banded specimens. The tiny white lines or white shading developed in the W-part of the subterminal in *oleracea*, are, in this species very strongly developed, and reach from the subterminal to the elbowed line, making a pale patch in the area between these lines. The cuneiform spots are sometimes well-developed and reach back into the fringe. Esper's diagnosis of the type is:—"*Noctua* spirilinguis cristata, alis deflexis fusco-cinereis, macula baseos rotundata albida; striga longitudinali recta nigra alterave versus discum remotis; macula anguli interni alba, strigis duabus nigris obliquis fœta" ('Die Schmet. in Abbild.' &c., p. 379). His fig. 1, plate 127, is unrecognisable. Of this species Newman writes:—"The colour of the fore wings is a mixture of pale grey almost white, and rich sepia-brown; the lighter colour occupies the base of the wing, more particularly the costal half of the base, and also the hind marginal area; the median area of the wing is occupied by the sepia-brown, and includes the discoidal spots: the orbicular is small, obscure, and flattened longitudinally, sometimes reduced to a mere line; it varies also in colour, sometimes being pale grey, at others concolorous with the brown area by which it is surrounded; in some instances it is a dark line united to the reniform, of which it appears a mere appendage; the reniform is more distinct but narrow, its usual colour is grey with a slender median shade of brown; the hind marginal area contains cloudy brown marks and darker wedge-shaped marks, the

points of which are directed towards the base of the wing; the outer lower angle of the grey blotch which occupies the costal portion of the base of the wing is often prolonged into a kind of hook, the point of which is directed towards the base of the wing; it must however, be admitted that the markings of the wings are far too inconstant to afford any reliable characters" ('British Moths,' p. 423). This species is noticeable as offering a parallel instance to those of *Agrotis hyperborea, A. subrosea* and others, in which the Continental form from northern latitudes is generally different from the ordinary form we take in England. Occasionally we get a type specimen entirely grey with only an ⊢-like mark, but more generally our British specimens have a distinct red-brown central band which is very striking. Altogether this is a most interesting species.

The forms we get may be grouped as follows:—

1.—Grey, with an ⊢-like mark = *rectilinea*, Esp.

2.—With central area below stigmata banded = var. *semivirgata*.

3.—With central area from costa to inner margin banded = var. *virgata*.

α. var. *semivirgata*, mihi.—The ground colour as in the type but with the area below the stigmata, including the ⊢-like mark, banded as far as the inner margin. This and the following are the usual forms of the species in Scotland. They also occur in Scandinavia, but there, the type without the dark central band is much more common than with us.

β. var. *virgata*, mihi.—The central area between the complete basal and the angulated lines, filled in with deep reddish-brown, the stigmata generally being traceable in the banded area. This is the variety **A** of Guenée who writes:—"The median space entirely occupied by maroon-brown which becomes almost black in its lower part. The basal streaks are so thick and contiguous that they leave only the upper half of the basal area clear. The stigmata almost absorbed by the brown." "Scotland" ('Noctuelles,' vol. vi., p. 106).

8. Family:—*Gonopteridæ*, Gn.

This family forms a part of Guenée's sub-class *Variegatæ*, but is removed by Staudinger so as to connect the *Orthosidæ* and *Xylinidæ*, and I must say that the neighbourhood of the *Orthosidæ* or *Cosmidæ* seems a fairly satisfactory one for it, taking all its larval habits and methods of pupation into consideration. Guenée was rather dissatisfied with his location of the species and writes:—"This genus (*Gonoptera*) contains only a single species, for the *libatrix* of North America does not differ sufficiently from our European species to constitute a distinct species. It is very difficult to place this among our indigenous species, where there is, in fact, nothing analogous. Its larva is distinguished strikingly from the other genera of the family by the number of its feet, which are all equal; it lives on bushes and is always found at the end of the branches. It is there also that it spins its cocoon, composed of very pure silk and contained loosely between the leaves. The chrysalis is equally remarkable for its opaque dull colour, and by the little crest which one sees in the middle of the collar and which is afterwards reproduced in the imago" ('Noctuelles,' vol. vi., p. 405).

Scoliopteryx, Germ. (*Gonoptera*, Latr.), *libatrix*, Linn.

In some specimens the red spots of this species are restricted almost entirely to the central area, the ground colour of such being generally darker. Beyond the angulated line the outer margin is generally redder and occasionally ochreous. Some Scotch specimens, especially those from Perth, are also darker than others. The Linnæan description is as follows:—"*Bombyx* spirilinguis cristata, alis incumbentibus dentato-erosis rufo-griseis: punctis duobus albis" ('Systema Naturæ,' xth., p. 507), to which he adds:—"Alæ superiores incumbentes, postice erosæ, supra griseæ fascia lineari arcuata cinerea; posteriore retrorsum ex duplici lineola alba; anteriore fasciola alba versus basin antrorsum arcuata angustiore. Punctum album ad basin antennarum; aliud ad basin alarum, aliud in medio alæ ad aream flavam; aliud in singulo femore. Pedes barbari" ('Fauna Suecicæ,' p. 304).

a. var. *suffusa*, mihi —Anterior wings, dull greyish-fuscous with no red on the outer margin. I have one specimen of this variety from Strood. Examples without the red on the outer margins of the wings appear to be very rare.

9. Family:—*Xylinidæ*, Gn.

As restricted by Guenée, this family had some little cohesion, but it has since become a receptacle for almost everything that simulates dry sticks &c. Staudinger has transferred *Xylomiges conspicillaris*, *Asteroscopus nubeculosus*, *A. sphinx* (*cassinea*), *Dasypolia templi* &c., into this group for apparently as much want of scientific reason, as if he had bodily transferred the genera *Pygæra* and *Xylophasia*. As it stands, it is very doubtful whether it does not possess members, which might very well be transferred to two or three existent families. In position, Staudinger places it between the *Orthosidæ* and *Plusidæ*, whilst Guenée places it between the *Hadenidæ* and *Heliothidæ*. As is well-known, Guenée misplaces the *Hadenidæ*, but had this latter been put with the *Apamidæ*, the group would have had a fairly natural position between the *Orthosidæ* and *Heliothidæ*. Guenée points out the very different ways in which the species in the various genera pupate, and the very diverse methods of construction of their cocoons. He also draws attention to the peculiar way in which some of the pupæ have an enlargement which receives the trunk and last pair of legs, somewhat analogous, but of a different shape and differently situated, to the extension in certain *Sphingidæ*. He also very rightly remarks:—"The perfect insects are, in general, much less remarkable than their larvæ. The sexes only differ *inter se* by the form of the antennæ and of the abdomen, and varieties are much rarer than in the preceding families" ('Noctuelles,' vol. vi., p. 108).

Xylocampa, Gn., *areola*, Esp.

This insect has the bases of the orbicular and reniform, joined by a third stigmal marking under the median nervure, whilst under this mark and the two stigmata which it joins, is a black longitudinal line which has its origin in the black longitudinal basal mark, includes the claviform and is sometimes extended to the angulated line. In the palest specimens, the claviform is ill-developed, but well-marked in

the darker ones. The subterminal line is very indistinct in some specimens, the position being indicated by an external transverse row of small black dentate marks. As in many other species, which have the peculiar ashy ground colour of this species, many specimens (especially if freshly emerged) have a delicate rosy tint as in the parallel instances of *Cuspidia tridens*, *Noctua glareosa* &c. I have a specimen which has no markings except a transverse row of linear black dots on the outer margin, but this is evidently due to some form of disease, as the edges of the wings show that it has not undergone complete development. The following appear to be the principal forms:—1. Ground colour pale ashy-grey, slightly fuscous = *areola*, Esp. 2. Ground colour blackish-grey, strongly marked with a longitudinal, black central line = var. *suffusa*. 3. Strongly tinted with rosy = var. *rosea*. The palest form is Esper's type. His figure has a bluish-grey tint, especially around the stigmata and on the outer margin, whilst his diagnosis is:—"Alis cinerascenti-fuscis, postice seriebus duabus denticulatis nigris in fascia alba, macula magna rectangula disci, minoribus baseos et versus marginem internum" ('Die Schmet. in Abbildungen,' p. 448; pl. 141, fig. 4).

a. var. *suffusa*, mihi.—This is of a blackish-grey ground colour with distinct markings, especially the central line, which runs from the base through the claviform and under the orbicular and reniform to the elbowed line. The area around the stigmata and the outer margin is also strongly marked in blackish. My darkest specimens have come from Brentwood, Bournemouth, and Farnboro' (Kent), where they occur occasionally with the paler type.

β. var. *rosea*, mihi.—This is a slight modification of the type in which the ground colour is suffused with rosy. It is, in fact, the *lithorhiza* of Guenée where he writes:—"Of an ashy-grey colour, slightly rosy" ('Noctuelles,' vi., p. 111).

Cloantha, Bdv., *polyodon*, Cl. (*perspicillaris*, Linn.).

This species is hardly known as British. There are two records only, both given in Newman's 'British Moths,' p. 425. Of Clerck's figure I made the following description:—"Anterior wings brownish-fuscous with the basal area white, a broad, white, longitudinal patch running out of the basal area, along the central nervure as far as the whitish-ochreous reniform with which the patch is joined by three fine white lines. The space between the elbowed and subterminal lines white, especially in the upper parts; the subterminal, W-shaped and white; the costal area dark brownish-fuscous; a fine white edge to inner margin; area under white patch in stigmatal area ochreous-yellow. Hind wings grey, paler base" ('Icones,' Pl. ii., fig. 2). Of the early occurrence of this species in Britain, Mr. Stainton writes:—"A single specimen of *Cloantha perspicillaris* was taken by the late Mr. Paget near Yarmouth, the capture of which is recorded in the 'Entomologist,' June, 1841, page 128, whilst the specimen is in the collection of Mr. Doubleday. The species is figured and described in Humphrey and Westwood's 'British Moths,' vol. i., p. 230; pl. LI., fig. 1. According to Guenée, the species is widely dispersed on the Continent, but 'never very abundant.' 'The larva feeds in July and August on *Hypericum*'" ('Ent. Ann.,' 1855, p. 16); whilst Mr. Stainton further

writes:—"A specimen of *Cloantha perspicillaris* found in a spider's web, at Ashford, Hants, was exhibited by the Rev. Mr. Hawker, at the May meeting of the Entomological Society" ('Ent. Ann.,' 1855, p. 47). Guenée writes:—"Engramelle has figured (346 a b) under the name of 'La Pâle,' a Noctuelle which does not at all resemble *Leucania pallens*, and which appears to me only an accidental variety of our *perspicillaris*" ('Noctuelles,' vol. vi., p. 113).

Xylina, Och., *ornitopus*, Hufn.

The Continental specimens which I have seen of this species, appear to be slightly greyer than our British specimens which are of a somewhat purer white ground colour. I find no point of variation worth noticing except that the lower edge of the reniform is sometimes outlined with black as in *furcifera*, and that the ⊢-like mark is also formed as in that species. Hufnagel's original diagnosis of this species is:—"Fore wings white and grey, mottled with fine grey markings and a yellowish reniform stigma" ('Berl. Mag.,' iii., 309, n. Cat.). Fabricius describes the same species under the name of *rhizolitha*. He writes:—"*Noctua* cristata alis subdentatis cinereis: lineola baseos intermediaque atris, thoracis crista bifida." "Alæ griseæ lineola baseos distincta atra, in medio lunulæ lineolaque nigræ, apice puncta nigra. Posticæ supra fuscæ, subtus cinereæ puncto medio strigaque postica fuscis" ('Mantissa,' pp. 182-183).

Xylina, Och., *lamda*, Fab. (*lambda*, Stdgr.).

This species is almost unknown as British, except for the information in Newman's 'British Moths,' p. 428, although many collections contain supposed British specimens of this fairly common and variable Continental moth. Staudinger mentions three forms:—(1) the ashy-grey type; (2) the almost unicolorous *somniculosa* of Hering; and (3) the variegated white-lined *zinckenii* of Treitschke. The last is figured by Newman in his 'British Moths,' p. 428, fig. 1, and the first by the same author *l. c.* fig. 2. The Fabrician description of the type is as follows:—"*Noctua* cristata, alis deflexis fusco cinereis: lineola baseos duabusque in medio atris." "Statura et magnitudo omnino *N. psi*. Caput et thorax obscure cinerea, valde cristata. Alæ anticæ obscure cinereæ, nitidæ fascia baseos mediique obsoletis obscurioribus. Lineola atra ad basin, duæque in medio: interiori longiori" ('Mantissa,' p. 174). Guenée writes:—"The description of Fabricius suits this species well enough, but one is hardly able to conceive why he compares this Noctuelle in size and appearance to *psi*, even when one takes into consideration the abuse of comparison to which we are accustomed from this author. Further, it is hardly likely that Fabricius knew a species which must have been very rare in his time" ('Noctuelles,' vol. vi., p. 119). I quite fail to see why the then supposed rarity of the species is any reason for assuming that Fabricius did not know it, and the comparison of it with *psi* is but little, if any more far-fetched, than many other comparisons made by that author. It is beyond doubt that the description applies to this species, and I think Staudinger was quite right in restoring the names. Of this species Newman writes:—"The palpi are slightly porrected: the antennæ are almost simple in both sexes: the fore wings are rather narrow,

their colour is bluish-grey in some specimens, prettily varied with darker and lighter grey in others, the colour being very confused and almost uniform: there is, however, almost invariably at the middle of the base, a curved black line which bifurcates at the extremity, and a second short, but decided black line beneath the reniform spot, and between this and the hind margin are a pair of white dots placed transversely; the discoidal spots are more or less distinct, always partaking of the colour of the general area: the hind wings are smoky-brown, rather paler at the base; the fringe is paler and intersected throughout by a median darker line: the head and thorax are of the same colour as the fore wings, the body as the hind wings. The moth appears in September, and has been taken in Sweden and the north of Germany; a single specimen was reported to have been taken at New Cross, in the 'Entomologist,' vol. iii., p. 203, and almost immediately afterwards, Mr. Cooke, the well-known and energetic naturalist of Oxford Street, received another unnamed among some insects recently collected at Guildford" ('British Moths,' p. 428). Of the occurrence of this species in Britain, Mr. H. G. Knaggs writes:—"Mr. E. Meek has just placed in my hands for identification a very handsome NOCTUA. It is the *Xylina zinckenii* of Treitschke, and was taken by an incipient entomologist last September, in the neighbourhood of New Cross" ('Ent. Mo. Mag.,' iii., p. 163); Of this specimen Mr. E. Newman writes:—"A single specimen of this insect, the *Noctua lamda* of Fabricius ('Mantissa Ins.' p. 174, No. 257), is reported to have been taken by Mr. Harrington, on the trunk of a willow tree near New Cross, on the 30th of September last; but in my correspondence with Mr. Doubleday, I find that eminent lepidopterist has not seen the insect, so some doubt must attach to the name for the present. Herrich-Schäffer gives two very beautiful figures of the species ('Noctuides,' tab. 28, figs. 135-136), but both this author ('Schmetterlinge von Europa, ii., 305) and Guenée ('Noctuelites,' vi., p. 119) give it the name of *zinckenii*, and sink the Fabrician name of *lamda* as a synonym, the last named entomologist thinking it 'unlikely that Fabricius should have known a species that must have been rare in his time.' The fore wings are bluish-grey, variegated with both lighter and darker markings, the ground colour being lighter than in *X. conformis*, and the dark markings being thus rendered more conspicuous. It is also smaller than *X. conformis*. Nothing is known of its larva or life-history, except that it occurs as far north as Sweden, and also in the North of Germany, both in autumn and spring; so that it must either hybernate in the perfect state, or pass through two generations in the year" ('Entomologist,' vol. iii., pp. 203-204). Mr. E. Newman then wrote:—"No sooner do we hear of a specimen of this novelty occurring at New Cross, than a second has been taken at Guildford: it was sent up unnamed to Mr. Cooke, of Oxford Street" ('Entomologist,' vol. iii., p. 227); whilst the Hon. Spencer Canning (apparently the captor of this second specimen) writes:—"In the note I sent you some time ago, I mentioned having caught a NOCTUA of which I had not then found out the name. I took it to an entomologist, and he wrote back that it was the new species, *Xylina zinckenii*. It was taken at sugar on a young elm tree, in the month of October, between Dorking and Guildford" ('Ent. Mo. Mag.,' iii., p. 235). Mr. J. Moore also writes:—"I have to re-

cord the capture of a most splendid specimen of *Xylina zinckenii* at sugar in Darenth Wood, on the 3rd of October: I took it from the reverse side of the tree to that which I had sugared. I was accompanied at the time by Messrs. F. Standish, Pryer, and other friends" ('Entomologist,' vol. v., p. 204). After a note by Mr. Knaggs, in which he criticised Guenée's notes (just previously quoted) referring to the statement of Fabricius when he compared *lamda* with *Cuspidia psi*, Mr. Henry Doubleday wrote:—"In the 'Entomologist's Annual,' my friend Mr. Knaggs states that M. Guenée's remarks upon what Fabricius says of this species (supposing it to be his *lamda*) surprise him. I think them very just, as I cannot see any resemblance between it and *Acronycta psi* either in form, colour or markings. It is very nearly allied to *X. conformis*, and some of the specimens approach this species so closely that, but for their smaller size, they might easily be confounded with it. I possess two from Lapland which have hardly a trace of the ordinary black markings on the superior wings" ('Ent. Mo. Mag.,' iii., p. 235). I quite agree in a general way with Mr. Doubleday's remarks, but at the same time there is a broad resemblance between *X. lamda* and *C. psi*, and the comparison is no worse than many others made by Fabricius with his limited knowledge of the species of the Noctuæ. His description certainly applies to this species. Of *X. zinckenii*, Mr. E. Hopley writes:—"The following must be amongst the earliest captures of this rarity. A brother collector, a neighbour, lately brought me as a present, what he and his friends at the time (October, 1865) considered a strange example of *Acronycta psi*. At this date it may be borne in mind, that Dr. Knaggs had not identified anything British born with *X. zinckenii*. It appears that my friend was out pupæ digging in the northern environs of London, when, rising from the root of a poplar, he was surprised to observe this fine example of what struck him as one of a second brood of *A. psi* at rest upon the bark. He had neither pill nor collecting box—merely a small cradle for his "diggings." However, he fortunately had a pin, and a cylinder hat, in which the illustrious stranger was duly installed. Until kindly taken out for me, it had ever since remained in his duplicate box" ('Ent. Mo. Mag.,' vol. v., p. 252); whilst Mr. J. T. Carrington writes:—"Mr. Bond has a fine example of *X. lamda*, taken near Erith, in September, 1875, by Mr. W. Marshall" ('Entom.,' ix., p. 191).

a. var. *somniculosa*, Hering.—Of this more unicolorous variety, Staudinger writes:—"Magis unicolor" and adds that it scarcely deserves a name. Guenée writes:—"The ground colour of an uniform greyish-violet, with the markings partly obliterated, above all on the outer margin: the median shade alone remains, and the longitudinal black streaks appear more distinct and are the only markings which are edged with white. Prussia" ('Noctuelles,' vol. vi., p. 119), whilst M. Sven Lampa writes:—"Rather unicolorous, grey not reddish, with faint markings. Hind wings and fringes rose-reddish. Antennæ of ♂ with only two bristles on each joint" ('Entom. Tidskrift,' 1885, p. 77). Several Scandinavian localities are also given for this variety so that this is probably the more unicolorous form referred to by Mr. Doubleday, and before noticed, when he writes:—"I have two specimens from Lapland which have hardly a trace of the ordi-

nary black markings on the superior wings" ('Ent. Mo. Mag.,' iii., p. 235). Hering's original notice of *somniculosa* is :—"M. Kretchner, an active collector in Berlin, sent me recently a few NOCTUÆ, which he took for an unknown species, with the remark that he possessed several others which tallied exactly with them. After careful examination, I agree with him, that these NOCTUÆ bred by him this summer, are a new species and according to his wish describe them in the 'Entom. Gazette.' The new NOCTUA—*Xylina somniculosa*, stands between *conformis* and *zinckenii*. At first sight, it appears rather to resemble the former, but on closer inspection it approaches in size and markings the latter. It is smaller than *conformis* and the fore wings are shorter ; antennæ finer, at the point they start there is no white spot as in *conformis* ; the feet are not speckled, however ; the colour is lighter, almost whitish. The thorax is likewise lighter ; the body, which in *conformis*, is grey like the thorax, is of a decidedly lighter reddish-grey colour in *somniculosa*, almost like *zinckenii*, where the colour of the body and thorax are entirely different. The thorax, however, as in the two related species, is bordered by a black longitudinal streak towards both sides of the fore wings. The latter, however, are generally of a lighter colour, and are more distinctly grey, and less mottled than in *conformis*. The basal line in *conformis* ends in two clearly defined points which become paler towards the costa, and has a white border line towards the outside in front of these points. In *somniculosa* these points are absent : but the line inclines towards the outer margin and turns into an obtuse angle, and then loses itself towards the inner margin, which is never the case, with the basal line of *conformis*. The white border line on the outside of the streak is like that in *conformis*. The reniform in the latter is yellow, with a strong tinge of red. In *somniculosa*, it is hardly visible and the red tint is entirely missing. Towards the inside the reniform is darker than in *conformis*. In the latter, the reniform is joined below by a dark black arched streak, this is wanting in *somniculosa ;* the orbicular in *conformis* is scarcely perceptible, in *somniculosa*, it is entirely absent. Instead of the split fork-like claviform turning towards the base as in *conformis*, there is found in *somniculosa*, only a short stout black streak bordered with white towards the inside, from the inner end of which a fine zigzag line runs towards the inner margin. No other markings are found on the fore wings ; the fringes are finer and less striking in colour. The hind wings are red-brown and less grey than in *conformis*. The under sides of the wings are paler and show scarcely a trace of the clearly defined dark arched line in *conformis* which surrounds the spot in the middle of the hind wings. *Zinckenii* has, compared with *somniculosa*, much more vivid markings. The mixture of white and dark black-grey in the mottled colouring is wanting in *somniculosa*. It is especially to be remarked, that *zinckenii* shows both discoidals distinctly, and each is bordered by a dark line below, like the reniform in *conformis*. This is entirely wanting in *somniculosa*. The fringes in *zinckenii* are more clearly white, bordered with a row of darker spots before. In *somniculosa*, they are uniform grey, quite the same colour as the remaining part of the fore wings" ('Stett. ent. Zeit.,' 1841, p. 165).

β. var. *zinckenii*, Tr.—Treitschke's diagnosis of this variety is :—

'*Xylina* alis anticis cinereo albidoque marmoratis, lineola baseos atra, albo inducta, maculis ordinariis albidis nigro cinctis, linea marginali interrupta" ('Die Schmet.' &c., vol. v., pt. 3, p. 16); to which he adds:—"*Zinckenii* is (compared with *conformis*) smaller in size, the fore wings shorter, the males more strongly marked and brighter, the colour more ashy-grey. The head and collar are uniform in colour; on the back is a tuft ornamented with a black collar. The antennæ are like those of *conformis*, brown, white at the base. The colour of the abdomen runs towards red-brown, is mixed with black, and is lined on the sides and at the extremity with hairy tufts. The thorax and feet are white-grey, not so red as in *conformis*. The fore wings generally have a mottled appearance, but they look more uniform in many specimens. The black, white-bordered, basal longitudinal streak is present but it does not divide into 3 wedge-shaped marks but into 2 spots. Of the transverse basal lines only the first is distinct, the second is entirely absent. The orbicular is always visible, although in *conformis* it is almost always absent. It is bordered with a black dash, which runs under the reniform as an angular line and unites both the discoidals. The reniform is smaller than it is in *conformis*. Towards the inner margin stands an elongated black streak edged with white. The outer subterminal line breaks off in the middle of the wing (whilst in *conformis* it is continuous) and persists in its lower part only as single white dots. Lastly the fringes are quite different, being uniform grey with a delicate white border. The hind wings are shorter compared with those of *conformis*, but in colour not very different. The fringes are also the same, brownish- or reddish-white" ('Die Schmet.' &c. vol. v., 3rd pt., p. 16). Staudinger writes of it:—"Magis variegata, albo-picta" ('Catalog,' p. 119). M. Sven Lampa writes:—"Grey, intermixed with white and clearly defined black markings: the fringes yellowish; antennæ, grey in the males, with the pectinations in the form of tufts" ('Entom. Tidskrift,' 1885, p. 77). Lampa also gives this variety as occurring in Finland and several Scandinavian localities. This is the *sommeri* of Germar, who writes:—"*Sommeri*, Heyer. *X. sommeri*: cristata, alis anticis griseis fusco marmoratis, fasciis linearibus dentatis albis, fusco marginatis; lineis sagittatis atris; maculis ordinariis obliteratis, atro cinctis; anteriore rufo-umbrosa, posticis fuscis, subtus omnibus lutescentibus, disco obscuriore" ('Fauna Ins. Europæ,' 16).

Xylina, Och., *furcifera*, Hufn.

The ordinary Continental form is very much paler than our British specimens. The former are pale violet-grey in tint, whilst the latter are deep violet-grey approaching black in colour. The black mark which joins the bases of the reniform and orbicular is very strange, and the ⊢-mark extends from the end of the claviform (without including it) to the angulated line, as in *Tæniocampa gothica*. Hufnagel's description of the type is:—"Bluish-grey, with a few brownish markings, notably one like a two-pronged fork. Habitat on tree-trunks and fences" ('Berlinisches Magazin,' iii., 402). Guenée says:—"The type of this *Xylina* is not found in France nor in southern countries. It is of a slaty tint above and of a rosy-grey or lightly vinous below" ('Noctuelles,' vol. vi., p. 118). The pale form is

figured and described by Esper as *bifurca* in his 'Die Schmet.' &c., p. 359; pl. 125, B figs. 6-8, and as *conformis* by Fabricius ('Mantissa,' p. 183). The species was first introduced as British, when Mr. Stainton exhibited two specimens, taken near Cardiff on ivy-blossom in October, 1859, at the Entom. Soc. of London, an account of the exhibit being published in the 'Zoologist,' 1861, p. 7452. Mr. W. Buckler afterwards wrote:—"I send you this to tell you that Mr. T. Philipson, of Newport, Monmouthshire, has taken *X. conformis* at sugar on October 2nd, in that county, and a friend of his took another example a few days previously" ('Ent. Mo. Mag.,' vol. vi., p. 190). Mr. J. B. Hodgkinson writes:—"I have now on my setting board a fine ♂ and ♀ of *X. conformis*, taken November 8th and 10th, rather a late time to go out mothing" ('Ent. Mo. Mag.,' vol. vii., p. 188). I am unaware whether these specimens are supposed to have been taken in Lancashire or sent to Mr. Hodgkinson from Wales. Mr. Llewelyn recorded it from Neath in 1874 ('Entomologist, vii., p. 260). Mr. J. T. Carrington writes of *Xylina furcifera*:—"Mr. Llewelyn records this moth from near Neath, a new locality, in 1874. It has also been bred in Glamorganshire, by Mr. Evan John, likewise by Rev. Joseph Greene" ('Entom. x., p. 32). The last record is by Mr. W. H. Grigg in the 'Ent. Mo. Mag.,' xvii., p. 134.

a. var. *suffusa*, mihi.—Anterior wings of a deep violet-black, or black with a slight violet tinge. It would appear to be Guenée's var. A of which he writes:—"Of a deep violet-grey above and of a ferruginous-grey below" ('Noctuelles,' vol. vi., p. 118). Guenée also adds:—"Common in the centre and North of France in September and October." In Britain, this species is, so far as we at present know, almost entirely confined to Wales, and the Western Counties of England. The Rev. J. Greene, Mr. Tugwell, and other collectors have bred the species, but the specimens have been always of an exceedingly dark coloration. I am somewhat in doubt, however, from specimens I have, whether the French specimens, referred to by Guenée under his var. A, are not less dark than ours, and intermediate between a grey form with scarcely any purple in it and our almost black one. I have, however, no positive information on the point. This variety was first taken in Britain in 1859 near Cardiff, *vide*, 'Zoologist,' 1861, p. 7452.

Xylina, Och., *semibrunnea*, Haw.

This species appears to be comparatively rare in Britain and to vary but little. Guenée writes:—"It differs from *petrificata* by the superior wings being narrower; by the inner margin almost to the centre being occupied by a darker shade, in which a conspicuous and distinct velvety-black coloured line with a bluish tint, is cut by the angulated line; by the inferior wings being paler with darker nervures and hind margin, and of which the underside only shows the lunule, and none, or very little, of the darker median line; by the abdomen which is larger, with blackish-blue crests on all the segments" ('Noctuelles,' vol. vi., p. 121). This gives me the idea that Guenée did not distinguish altogether between this species and some of the vars. of its congener *petrificata*, which I have had repeatedly sent to me as *semibrunnea*. There can be no doubt, however, concerning Newman's figure of the species—'British Moths,' p. 429. Haworth's diagnosis

is:—"*Noctua* alis anticis subnebulosis, extus cinereo-brunneis, intus brunneo-fuscis." "Alæ anticæ costam versus dimidiatim cinereo-brunneæ, vel rufo-cinereæ, sed latus interius versus omnino brunneo-fuscæ, sive pene ustulatæ, undique at supra obsolete striatæ, atque paululum nebulosæ" ('Lepidoptera Britannica,' p. 171). Distinct as is this species from the next (*socia*) in the imago state, I must confess my inability to express in words the actual difference. This species is, of course, more uniformly dark, but some of the *socia* are as dark or even darker than *semibrunnea*, especially about the inner margin, but I have never seen an approach to the same distribution of the dark coloration in the two species. The distinct small dark longitudinal mark near the anal angle is a very constant character in this species. Humphrey and Westwood write:—"This species measures $1\frac{7}{12}$ inch in the expanse of the fore wings, which are remarkably long and narrow, the anterior or costal division being of an ashy-brown colour, and the hinder division dark brunneous; they are slightly clouded with darker tints, especially in the region of the stigmata, all three of which are present but very indistinct; the veins are dotted with black, and near the apex of the wing they are striped with thin black lines; towards the inner margin, however, the stripes become much broader and are interrupted towards the anal angle; the apical margin is marked by a row of deeply-angulated dark spots; the hind wings are paler and shiny, with the base and cilia pale, and with a dusky central lunule; the abdomen has a row of blackish tufts down the middle; the wings beneath are paler, with a dark spot on the middle of each. This is a rare species, but has been taken at Coombe Wood and also at Mickleham, in October, by Mr. Douglas, from the flowers of the ivy" ('British Moths,' p. 155).

Xylina, Och., *socia*, Rott.

This is a very variable species so far as the quantity of shading is concerned, and there is also considerable variation in the ground colour. The latter extends from yellow-ochreous to bright red, and the inner margin from no trace of a darker shade to intense black. Guenée writes:—"It is distinguished from the following *(semibrunnea ?)* by the superior wings being broader at the tip, the dark shading which is confined to the centre and not on the inner margin; by the inferior wings being more unicolorous and marked below with a distinct median line, very near the lunule; lastly, by the abdominal crests which are only found on the third and fourth segments" ('Noctuelles,' vol. vi., p. 121). Humphrey and Westwood write of this species under the name of *petrificata*:—"This species, which has been confused with the preceding (*semibrunnea*) measures $1\frac{2}{3}$" in the expanse of the fore wings, which are of a greyish ochre colour, with darker clouds, a dark longitudinal stripe towards the base, and another behind the stigmata, which are pale ochre-coloured, the space between them being dark; the costa is marked with several blackish dots, and beyond these a series of dark cuneated marks, forming an angulated striga, emitting several paler streaks; the margin itself is dotted with brown; the hind wings are brown, with the base paler, and a subcentral row of obscure dots on the veins; the abdomen is ochre-

coloured, without the dark tufts. Very rare, but taken in Devonshire by Captain Blomer and Mr. Marshall, as also in Norbury Park by Mr. Walton, in September" ('British Moths,' p. 155); whilst Rottemburg wrote in 1776:—"Though the fore wings are somewhat long and narrow, and thus resemble Hufnagel's 'Sharks,' the crest on the thorax is wanting. The fore wings are of the same ground colour as those of *Cucullia verbasci* but the dark shading is absent, and there are many fine longitudinal blackish and brownish nervures running through the wings which are dusted with similarly coloured dots. Hind wings ashy-grey with dusky fringes." He also adds:—"The species is almost of the size of *verbasci*. The larvæ feed on lime trees, are green in colour with a few white lines and dots. The pupa has no point like the pupæ of *umbratica*, *verbasci*, *argentea* etc., which proves that this moth does not belong to the same genus. I have found the larva in the beginning of June, this pupated towards the middle of the month, and emerged about a month later" ('Der Naturforscher,' ix., 142). The type would therefore appear to be of a brownish-ochreous colour with darker striations. This form appears to be rare in Britain. Almost all my specimens are of a yellow-ochreous tint, modified in some cases with rosy but rarely changing into brown.

The following is an attempt to classify the different forms:—

1.—Pale yellow-ochreous, markings obsolete = var. *pallida*.

1a.—Pale yellow-ochreous, with dark central shade (under reniform) = var. *umbrosa*, Esp.

1b.—Pale yellow-ochreous, with dark inner margin = *petrificata*, Fab.

2.—Reddish-ochreous (sometimes strongly red), markings obsolete, = var. *rufescens*.

2a.—Reddish-ochreous, with dark shade under reniform = sub-var. *puncta-rufescens*.

2b.—Reddish-ochreous, with dark inner margin = sub-var. *suffusa-rufescens*.

3.—Brownish-ochreous, with darker longitudinal striations = *socia*, Rott.

α. var. *pallida*, mihi.—This form is of a pale yellow-ochreous colour, almost entirely unicolorous, with traces of the stigmata hardly discernible (being of the same tint as the ground colour), and occasionally with the slightest trace of a darker central shade and a subterminal line. I have a long series of this yellow-tinted form in my collection, chiefly from Waterford, Clevedon etc.

β. var. *umbrosa*, Esp.—This is simply a sub-var. of *pallida*, being of the same pale ochreous coloration, but with an indistinct blackish spot or blotch directly under the stigmata. This throws up that edge of the angulated line with which it is in contact, and makes it appear as a lunular mark. The subterminal is rather darker than the pale ground colour. Esper's diagnosis is:—"Alis denticulatis ochraceis, macula disci oblitterata nigricante, duabus maculis dilutioribus loco stigmatum, striis punctisque fuscis" ('Die Schmet. in Abbild.' &c., p. 413). This is a remarkably good description of this particular variety. My specimens have come from the same localities as var. *pallida*.

γ. var. *petrificata*, Fab.—The diagnosis of Fabricius is:—

"*Noctua* cristata alis dentatis griseo fuscoque nebulosis, posticis fuscis, capite antice quadrifido." "Alæ anticæ dentatæ cinereo fuscoque variæ maculis ordinariis pallidis" ('Mantissa,' p. 182). This is another sub-var. of *pallida* with the inner margin strongly fuscous (in a specimen from Dr. Chapman that I have it is quite black). This fuscous colour forms a longitudinal patch extending from the base to the angulated line, filling up all the area below the longitudinal black line at the base of the median nervure. There is a narrow edging of the pale ground colour along the extreme edge of the inner margin. The central spot under the stigmata is well developed, and the outer margin is darker. The stigmata pale as in the other forms. The character of the variety is well brought out by Fabricius when he writes "posticis fuscis" the posterior portion of the wing (inner margin) being fuscous.

δ. var. *rufescens*, mihi.—This is a form in which the ochreous of var. *pallida* is beautifully tinted with rosy. There are three distinct red forms, corresponding with (1) var. *pallida*, almost unicolorous; (2) var. *umbrosa*, with a dark discal spot; (3) var. *petrificata*, with a dark longitudinal patch along the inner margin. Var. *rufescens*, therefore is almost unicolorous, whilst the sub-var. with the discal spot, I have termed *puncta-rufescens*; and the sub-var. with the longitudinal patch *suffusa-rufescens*. I am especially indebted for my specimens of this form to Mr. Mason of Clevedon, but I also have them from Waterford etc.

Calocampa, St., *vetusta*, Hb.

The ground colour of this species varies from pale ochreous inclining to whitish, to a deep, rich brown. The double orbicular, seen in *L. solidaginis*, can be traced, though with difficulty. There are two cuneiform spots developed, only one of which usually reaches the reniform, although in a specimen I have from Barnsley, both do so. There is generally a pale patch under the reniform, but in the dark Barnsley specimen before referred to, and in the darkest Aberdeen specimen I have, the dark inner marginal patch is continuous from the base to the outer margin. In some, this dark patch is not continued beyond the angulated line (just below reniform), although generally it reaches the subterminal, and, as I have just mentioned, occasionally reaches the outer margin. Hübner's type 'Samm. europ. Schmet.,' fig. 459, is somewhat similar to our ordinary British specimens, and is of a pale ochreous-brown with the inner margin of a darker brown coloration. An ashy longitudinal shade runs along the median nervure and spreads considerably over the wing area in the neighbourhood of the reniform, thus altering altogether the ochreous ground colour of this part of the wing, and also its general appearance, when compared with the more ruddy Sligo and some of the Aberdeen specimens. This more pallid form, is rather more common in Scotland than the redder form, whilst in England nearly all the specimens are of the pale form.

a. var. *brunnea*, mihi.—The Irish (and some Scotch) specimens differ from the type in the almost entire absence of the ashy-grey central shade which runs along the median nervure and spreads over the central area of the wing. These specimens are of a distinct warm,

brownish-ochreous tint, with the inner marginal area, below the median nervure, of a deep and rich red-brown; the basal streak exists in the form of two black lunular marks on the costa, and two others, outlined with intense black on the inner margin; the reniform is generally dark grey and outlined with pale; a pale wavy subterminal is edged internally with black, and it has two cuneiform streaks on it reaching to the reniform. This browner form is what we usually know as the Irish form and is much redder than are our own normal British specimens. I have a long series and am particularly indebted to Messrs. Percy Russ and W. F. de V. Kane for Irish examples. Scotch examples are occasionally of this form, but English specimens appear to be comparatively rare.

β. var. *suffusa*, mihi.—There is some variation in size in this species, but, on the whole, there is but little difference in the English, Irish and Scotch specimens, some from each country running above and some below the average size. Guenée describes a small Scotch specimen of which he writes:—"A little smaller, with nearly $\frac{2}{3}$ of the inferior wings of an intense fuscous black (noir-brûlé) as well as the fringe and the thorax. The rest of the wing of a more obscure greyish than in the type. From Scotland" ('Noctuelles,' vol. vi., p. 116). Little attention, therefore, need be paid to the size of Guenée's specimen here described, but the intense black of the inner margin appears to be peculiar to certain specimens from the North of England and Scotland, as well as a tendency to suffusion in the paler parts of the wing. I would include, therefore, all such suffused specimens under this varietal name.

Calocampa, St., *exsoleta* (*exoleta*), Linn.

The name of this species is spelt *exsoleta* in the works of Linnæus. The central area of the wing of this species, longitudinally from the base to the anal angle and to the apex is sometimes clear, leaving the costa and inner margin darker; sometimes however, this central area is also much suffused with blackish scales. The orbicular is frequently doubly ocellated with an exterior ring, one ocellus in each of the upper and lower parts, and hence it shows clearly the origin of the double orbicular in the allied species, above all in *L. solidaginis*. The elbowed line is represented by a double row of dots, more or less ill-developed, and the cuneiform spots, which, in this species, never appear to reach the reniform, vary in number, whilst in one specimen they are altogether obsolete. The Linnæan description of the type is:—"*Noctua* spirilinguis cristata, alis lanceolatis convolutis exsoletis dorso fuscescentibus, collari compresso. *Phalæna* color ligni putrescentis admodum exsoleti" ('Systema Naturæ,' xth., p. 515). The Pitcaple and Aberdeen specimens appear to be the darkest. Some of the Irish forms are tinged with brownish, whilst a specimen from Londonderry which I have is without the dark shading on the inner margin.

Lithomia, Curt., *solidaginis*, Hb.

Staudinger places this in *Calocampa* with *vetusta* and *exoleta*, Guenée in *Cloantha* with *polyodon* (*perspicillaris*) although in a different section, for which he utilises Curtis' name. There is considerable

variation between the specimens from Cannock Chase and most other British localities, those from the Chase being as a rule paler, with more white, and rarely having the central fascia particularly distinct. Those from the Barnsley district have the latter well-developed, sometimes developing, as also it does in certain Aberdeen specimens, into a distinctly dark basal area extending from the base to the normal central fascia. In Scotland, occasionally, some specimens are very dark and unicolorous with the outer area of the same coloration as the basal. Probably the strongest point of variation is in the orbicular, which frequently consists of two separate stigmata. These are sometimes united, sometimes one is absent, whilst occasionally both are missing. If only one be present, it is almost always the one nearer the reniform. The claviform is generally indistinct or obsolete, whilst the reniform may consist of a large pale blotch or be pupillated. The central shade, when present, runs through the orbicular spot nearest the reniform, not between these stigmata as is usual. The subterminal varies in colour from white to grey, and there is some tendency to vary in the number of cuneiform spots, the number, however, generally falling between two and five. Hübner's type may be described as:—"Anterior wings of a slaty colour with a double basal line outlined in black, the inner margin of this basal line, edged with a narrow reddish-brown band throughout its length; the orbicular small, round and indistinct; the reniform large and pale with a brownish line inside; a broad, dark, wedge-shaped dash extends from the reniform to the orbicular; the angulated line distinct, black and wavy; the subterminal slaty, with two black cuneiform spots on it; outer margin brown; central fascia reddish-brown. Hind wings pale ochreous, with two wavy lines parallel to the hind margin and a dark lunule" ('Sammlung europ. Schmet.,' fig. 256). In Britain, we appear to get but few specimens in which brown or even ochreous is at all prominent in the central shade, although the latter tint is well-developed along the costa and as an edging to the subterminal. Humphrey and Westwood write of *solidaginis*:—"This species measures nearly $1\frac{3}{4}$ inch in the expanse of the fore wings, which are of a light grey colour, with several black lines towards the base; the central part dark brown, edged with two dentated black lines; in the place of the anterior stigma are two small round grey dots, placed obliquely, and the outer stigma is large, earshaped, and pale grey margined with black; beyond this is a grey dentated line, emitting several long arrow-like wedge-shaped black dashes, and the margin slightly spotted with brown; the hind wings pale brown, with a yellowish tinge; the base whiter, with a faint central bar; the tippets and frontal lobe of the thorax edged with black. The caterpillar is reddish-brown, irrorated with dusky, and with a few whitish dots on each segment, and a pale yellow line on each side edged with black. The moth appears in August and September, and has been taken in Lancashire at a place called the "Brushes," about two miles beyond Staleybridge, near Manchester, where they occurred in abundance in 1837" ('British Moths,' p. 157).

The forms we usually get in Britain are:—

1.—Pale ashy-grey, central shade almost obsolete = var. *pallida*.

2.—Ashy-grey, with brown central shade = *solidaginis*, Hb.

2a.—Ashy-grey, with dark blackish central shade = var. *virgata*.
2b.—Ashy-grey, blackish from base to central shade = var. *suffusa*.
3.—Dark unicolorous ashy-grey = var. *cinerascens*, Stdgr.

α. var. *pallida*, mihi.—This is the Cannock Chase form of the species, which is of a pale ashy-grey colour with much white between the angulated line and outer margin. The central shade is always ill-developed, in fact, is usually more or less obsolete in this pale form. Comparing this with some specimens of the darker banded form taken by Mr. Harrison of Barnsley, the Rev. C. F. Thornewill writes:—"The specimens from Barnsley are very different in tint compared with those we find on Cannock Chase. I had previously heard of the difference from Mr. Porritt of Huddersfield, who also informs me that the species appears to be becoming scarcer in that district, whilst the very reverse is the case with us" (*in litt.*); whilst Mr. Fenn adds:—"The specimens of *solidaginis* from Barnsley are darker than anything I have captured, although some years ago I took the insect very freely at Rannoch" (*in litt.*). The Rannoch specimens, which I have, come near var. *pallida*, and have the outer margin beyond the subterminal very pale, although the area between the angulated and subterminal lines is not so pale as in the Cannock Chase specimens.

β. var. *virgata*, mihi.—This is a simple sub-var. of the type in which the brown central shade or fascia is replaced by black, sometimes very intense, and sometimes covering not only the central area of the wing, but extending to the base (= sub-var. *suffusa*). This (*virgata*) appears to be the more ordinary form obtained in south Yorkshire. It is a very rare form on Cannock Chase, where var. *pallida* is so abundant. At 'The Brushes' (Manchester), it is a not uncommon form, neither is it at Aberdeen. In sub-var. *suffusa*, the whole area from the central fascia to the base is suffused with blackish. I have only this form from Aberdeen. The ochreous area along the costa is also very much reduced.

γ. var. *cinerascens*, Stdgr.—Staudinger's short diagnosis of this variety is:—"Magis unicolor, cinerascens" ('Catalog,' p. 120), and the locality he gives is "North Germany." This would appear to be the dark ashy almost unicolorous form of the species we occasionally get from Aberdeen. I have a specimen perfectly unicolorous with the exception of a few black dots on the outer edge of the reniform, and two black cuneiform spots. The ochreous markings along the costa are replaced by the dark ashy-ground colour in this variety. I have this form only from Aberdeen.

Cucullia, Schrk.

Probably there is nothing in Guenée's 'Histoire Naturelle des Insectes; Noctuélites' ('Noctuelles,' as I have shortly designated the work when referring to it in these vols.) so complete and interesting to the student of this group as his account of the genus *Cucullia* and its species which is to be found in vol. vi., pp. 123-152. Every student of the group must read it for himself, if he wishes to understand the genus thoroughly, as it is impossible to quote his remarks with anything like the fulness they merit; in fact, those on the habits and manners of the larvæ, pupæ &c., would be out of place in a work of this kind, which, professedly, deals with the imagines and their variations.

There is also another remarkably good monograph of the genus by Rambur in the 'Ann. Soc. de France,' 1833 to which the attention of students is directed. Guenée writes of the imagines of *Cucullia*:—"They do not lack, more than the larvæ, striking characters, but by a strange law of nature, they are as uniform and as wanting in brilliancy as their larvæ are beautiful and variable. This absence of colour and markings makes the species very similar to one another, and it frequently happens that the most dissimilar larvæ, one might almost say the most opposite, give birth to imagines so alike, that one is only able with difficulty to distinguish them, *e.g.*, *lactucæ* and *lucifuga*, *blattariæ* and *verbasci* etc. One of the most remarkable points about these species is the development of a collar from which their generic name has arisen. The insect is able at will to decrease or augment its size, depressing or raising the lobes by the contraction or expansion of the membrane on which the lobes are placed. The specimens in our collections have then this cowl more or less prominent, according as the insect has died by a spasmodic contraction which has extended it and directed it forward, or, on the contrary, as the muscular energy, giving way gradually, has depressed the collar and it has almost resumed its ordinary position. But, in all cases, the development of these two parts always remains greater than in those of other Noctuæ. In their habits, these insects buzz in the evening with the greatest activity around flowers, like the *Sphingidæ*, which they recall in many ways. The country *par excellence* for the *Cucullicæ* is Southern Russia, from whence at times we get the most beautiful and numerous species. The North of Europe has supplied us with a certain number, as also has North America. But southern countries are very poor in them. Authors have known and confounded many species, hence the synonomy is most difficult; and to prevent this confusion in future, it is to be desired that no new *Cucullia* will be figured without the larva by the side of the imago. In this way, one will easily evade all errors" ('Noctuelles,' vol. vi., pp. 124-125). Guenée also adds:—"I wish to observe in conclusion that it is useless to seek for stable characters in the abdominal crests, the species being alternately provided or unprovided with these crests. The form of the palpi can no more be considered as furnishing specific characters" (*l.c.* p. 126). Of our British species, *scrophulariæ* and *lychnitis* are somewhat difficult to distinguish, but the other species are distinct enough. *Gnaphalii* still remains a great rarity. There is very little variation in the species. *Umbratica* was sub-divided into four by the early British authors, who believed that they detected the characters of certain distinct Continental species in the slight variations that this species undergoes in Britain, whilst *chamomillæ* really does vary somewhat in colour and the arrangement of the dark markings.

Cucullia, Schrk., *verbasci*, Linn.

In this species, there is more reddish-brown in the ground colour of most of our British specimens, than in that of its allies. Some specimens are almost uniformly brownish with no very great difference between the ordinarily paler central area of the wing, and the darker costal and inner marginal areas. Sometimes these dark parts have a tendency to blackish, and when, in addition, the dark inner marginal

shade is edged on its outer half, as it sometimes is, with whitish, it throws it up very distinctly. In one ♀ from Weymouth, the white has a tendency to spread in the central area. Two ♂ specimens from a Gloucestershire brood exhibit a similar tendency and have at the same time, pale hind wings, thus copying *scrophulariæ*. Strange to say the Weymouth specimen mentioned has also pale hind wings. The colour of the hind wings varies, but the variation is not sexual, the colour of those of both sexes extends from pale grey with a narrow blackish marginal band to wholly black, but those of the females are generally darker than those of the males. Guenée writes :—"The specimens from the South of France are larger, darker, with the paler area more ashy" ('Noctuelles,' vi., p. 127). The type is thus described by Linnæus :—"*Noctua* spirilinguis cristata, alis deflexis obsoletis margine laterali fuscis." "*Phalæna* similis *Ph. exsoleta*, sed dimidio brevior" ('Systema Naturæ,' xth., p. 515). I would add that there is considerable difference in the size of various specimens; and bred specimens, which appear to have been kept somewhat short of food in the larval stage, generally present a considerable narrowing of the wings frequently accompanied by positive signs of malformation.

Cucullia, Schrk., *scrophulariæ*, Capieux, Esp.

It is almost impossible to explain why Newman should say that "it is extremely difficult to distinguish this from the preceding species (*verbasci*) when in the perfect state" ('British Moths,' p. 432), as only occasional pale specimens of *verbasci* could in any way be mistaken for this decidedly paler and more coarsely scaled species. It is, however, very much more like *lychnitis*, which is, as insisted on by Guenée, a much narrower-winged species. *Lychnitis* moreover, appears at a later period of the year in June and July, *scrophulariæ* emerging in April and May (Guenée gives March and April), so that if collectors keep their spring emergences distinct, they should have very little trouble in coming to a correct conclusion. The anterior wings have the central area pale ochreous, sometimes almost whitish-ochreous, the costal margin blacker than (not so brown as in) *verbasci*, the inner marginal band narrower, whilst the darker nervures give the central area a more striated appearance, the linear mark just above the anal angle is also blacker. The hind wings of the male appear to be nearly always pale with a narrow brownish border, but there is some difference, and I have what appears to be a male, in which the hind wings are dark. The hind wings of the female generally have a broader band, but they are sometimes unicolorous-blackish. Guenée very rightly observes, too, that this species has "the fore wings less strongly toothed than *verbasci*, proportionately broader and less pointed at the apex. The colour more yellow, with the dark parts of a brown colour, inclining to blackish rather than to ferruginous, the costa more ashy, the terminal side of the dark triangle,less marked and not reaching the 2nd inferior (vein); the discoidal spots more marked and more numerous, above all in the females. The two sub-costal streaks blacker and less isolated. The inferior wings paler with the border more conspicuous. The abdomen shorter and more conical" ('Noctuelles,' vi., pp. 127-128). These are the exact points of distinction as we know *scrophulariæ*. In 1891, it was questioned whether this species was British, when I wrote :—"This

species is undoubtedly British, although I notice that Mr. Dale doubts its being so. I am afraid that doubt is often thrown on our rare species being indigenous because the writer has been collecting many years and has not happened to find the species. *C. scrophulariæ* has been erroneously recorded dozens of times, without doubt, by those who have found *C. verbasci* feeding on *Scrophularia*, but the larva of *C. scrophulariæ* is very different. Its usual food appears to be *S. nodosa* and not *S. aquatica*, although *C. verbasci* feeds on both these plants. In 1889, whilst collecting in Kent, I picked up six strange larvæ not at all like *verbasci*, being much stumpier and less strongly marked, near a well eaten plant of *S. nodosa*. These pupated at once, and whilst three emerged last year, one has just appeared. The imagines are not at all like *C. verbasci* but they are very much like *C. lychnitis*, although perhaps rather larger and more coarsely scaled, but still it would be difficult to distinguish them in the imago state. The three species are well distributed and definitely distinguished on the Continent (principally in the larval stage), where *scrophulariæ* appears to be the commonest. Dr.. Staudinger gives the following distribution:—'*C. verbasci*, central and southern Europe, southern Sweden, Livonia, Asia Minor and Armenia.' '*C. scrophulariæ*, central Europe, southern Sweden, Livonia, Piedmont, Corsica, north part of the Balkan district, and Southern Russia.' '*C. lychnitis*, Germany, France, South England, Corsica, Southern and Western Russia.' By this it will be seen that *verbasci* and *scrophulariæ* each spread equally north, but that *scrophulariæ* has a more southern range, whilst *lychnitis* is far more restricted and more decidedly a southern species. I find on reference to the 'Entomologist,' vol. ix., pp. 259-260, that Mr. Harwood quotes from a letter of the late Mr. H. Doubleday as follows:—'*Cucullia verbasci* and *C. scrophulariæ* are as distinct as any two species of the genus; but I believe that few English entomologists are acquainted with the latter species which appears to be very scarce in this country at the present time. The Rev. A. H. Wratislaw of Bury St. Edmunds, found a brood of larvæ three years since, but he has not met with them again. M. Constant says it is sometimes abundant in autumn and then disappears for some years. I sent three or four larvæ to Mr. Buckler, and bred a few moths myself. The larva is quite different from that of *C. verbasci*, being shorter with fewer markings. The moths appear the middle or end of May, a month or six weeks later than *C. verbasci*. I send for your acceptance a pair that M. Constant gave me. You will see that this species is more like *C. lychnitis* than *C. verbasci*. The larva of *C. verbacis* often feeds on *Scrophularia aquatica*, but I believe *scrophulariæ* only feeds upon *S. nodosa* which always grows in dry places.' I presume this reference, by a lepidopterist who undoubtedly knew both species thoroughly, has been overlooked by Mr. Dale, or he would not have suggested that the species was "an entomological myth," although the Rev. O. P. Cambridge is of opinion that 'his Bloxworth examples may not be any more than *C. verbasci*,' in fact, if they are very like *verbasci* they probably are that species. I suppose there are some true *scrophulariæ* in various collections, but all I have ever had sent to me have turned out to be *verbasci*. I have never formed an opinion on Haworth's *scrophulariæ*, but it may be *lychnitis*, although that seems in no way to affect the former as a British species. In the Rev. E. N.

Bloomfield's 'Lepidoptera of Suffolk,' p. 23, we read:—'Larvæ of this rare species were taken by Mr. E. Skepper and the Rev. A. H. Wratislaw. Some of these were sent to Mr. Doubleday, and were described and figured by Mr. Buckler.' It is also recorded on the same page from Lakenheath, Barton Mills and Higham in Suffolk, by Messrs. T. and J. Brown" ('Ent. Record' &c., vol. ii., pp. 63-64). This was written in June 1891, and in the following month, Mr. South, after stating the opinions of Messrs. Harwood, Robson and Dobrée, that *scrophulariæ* resembled *lychnitis*, wrote:—"Possibly, however, *scrophulariæ* may be a form of *verbasci*," although he had previously stated that "the insect known as *Cucullia scrophulariæ* has always been an enigma to me," a condition of mind certainly, not likely to strike one as being at all favourable to the formation of any useful conclusion. I fail to see any similarity to *verbasci* in the specimens I have of undoubted *scrophulariæ*. Capieux described the larva of the species as "the Braunwurz Noctua, *N. scrophulariæ*." Treitschke's diagnosis of the imago is "*Cucillia* alis anticis medio ex albido flavis, marginibus fuscis; posticis albidis, fascia fusca" ('Die Schmet.' etc., vol. v., pt. 3., p. 130). He further writes:—"The present species (*scrophulariæ*) has a yellow tinge, whilst *verbasci* is more blackish and dark brown. The parts which in the latter are yellowish, for example the median nervure on the forewings, are uniformly white in *scrophulariæ*, and the blurred white spots in *verbasci* are more distinct in its ally. The forewings are shorter and of more equal width, the moth on the whole being smaller. The spots above the median nervure are fainter. A similar comparison may be made between *verbasci* and *scrophulariæ* as between *thasiphaga* and *blattariæ*, but the larvæ of the latter are very different from the species under consideration. The underside of *scrophulariæ* is, compared with the upper surface, much whiter, and less dusted with brown. Capieux of Leipzic, of whose zeal I was myself a witness, first described the larva. He found it in the middle of July in shady places on *Scrophularia nodosa*, but they are found also on *Verbascum* near Vienna, but always later than *verbasci*" (*l.c.* pp. 131-133). This species varies more in size, I believe, than any other in the genus, some of my specimens being exceedingly small. Esper's diagnosis is:—"Alis deflexis obsoletis, marginibus lateralibus fuscis (Minor *Phalœna verbasci*, alisque linearibus tenuioribus). Differt larva virescenti alba. Habitat in *Scrophularia*" ('Die Schmet. in Abbildungen,' etc., p. 5).

Cucullia, Schrk., *lychnitis*, Rbr.

Guenée writes:—"There is no doubt in my mind about the validity of this species. Its time of emergence suffices to confirm all the characters which distinguish it" ('Noctuelles,' vol. vi., p. 128). He then adds that "Herrich-Schäffer mixed the species with *scrophulariphaga* and *thapsiphaga*, evidently not knowing the species in nature." This latter suggestion of Guenée is certainly a most fruitful source of error when authors determine closely allied species. Guenée writes:—"The superior wings are very narrow, slightly toothed, with the lower half of the fringe darker, of a very clear yellow-ochreous, neither tinted with reddish nor with grey, the pale part which is above the inner triangle reduced to a single indistinct white spot before the crescent; this triangle less intense and reduced almost to a

single black line, shaded with brown on both sides. The dark costal shade having a washed-out appearance, ashy, pale. The ordinary stigmata paler than the ground colour and distinctly surrounded with dots. The inferior wings very pale, the nervures slightly dark and without a cellular lunule, their undersides almost entirely whitish in the male. Abdomen, long but slender; the collar bordered with clear brown" ('Noctuelles,' vol. vi., p. 128). Rambur's original description is as follows:—"This species is still further removed from *C. verbasci* than is *scrophulariæ*, but yet it is very near the latter, although, however, it may still be a very distinct species. It is the same size as *scrophulariæ*, but its wings are proportionally a little narrower, and it is of a paler yellowish-red colour. The costal edge of the superior wings is less dark, of a grey-brown slightly reddish, marked with transverse lines. The clear whitish space bordering the dark inner margin of the wing is sometimes slightly apparent. The inner margin is less dark and the clear space near the anal angle is larger, whilst the line which borders this space anteriorly is well-marked. The two crescents which are of the ground colour of the wing do not apparently differ. The stigmata are rather indistinct. The orbicular is enclosed by four black dots placed as in a square; the reniform is also enclosed by black dots which vary in number from two to three on its inner edge, and four to six on its outer. The hind wings are paler. The cowl is bordered posteriorly with ashy-brown" ('Ann. Soc. France,' 1833, p. 17).

a. var. *rivulorum*, Gn.—Guenée's description of this variety is:—"A little larger; superior wings a little more dentated, of a warmer ochreous, with the costa darker, very distinctly marked with blackish-ash. The stigmata more distinctly outlined. The inferior wings darker, the cellular lunule more distinct" ('Noctuelles,' vol. vi., p. 129). Staudinger writes of it:—"Major, magis ochracea" ('Catalog,' p. 122).

Cucullia, Schrk., *asteris*, Schiff., Fab.

There are some slight points of variation in this species. The ashy or slaty colour in the centre of the wing is sometimes paler than at others, and there is also a slight variation in the width of the darker costal area producing a corresponding change in the central area. Guenée says nothing of the imago, but writes:—"The caterpillar presents two varieties which are very well figured by Hübner" ('Noctuelles,' vol. vi., p. 133). Staudinger refers to Schiffermüller in the 'Syst. Verz.' as the nomenclator, but his description is simply:—"Sternblum Eule aus Sachsen" (p. 312) which is really worthless. Esper simply refers to and quotes Fabricius' description:—"Cristata, alis integris striatis cinereis; marginibus nigris: exteriore punctis tribus nigris," to which Fabricius adds:—"Statura et magnitudo omnino *N. verbasci* at alæ integræ. Antennæ supra albæ, subtus ferrugineæ. Alæ in medio pallidæ lateribus fuscis. In costa puncta tria alba, in margine tenuiori lunula alba. Posticæ fuscæ disco ciliisque albis" ('Mantissa,' p. 180).

Cucullia, Schrk., *gnaphalii*, Hb.

This exceedingly rare species in Britain was first figured by Hübner. The description I made of the type is:—"♂. Anterior

wings slaty-grey, with numerous dark brown shades, especially along the inner margin; a dark dot just above the anal angle; dark between stigmata; three short black streaks at the base of the costa. ♀. With the same markings" ('Sammlung europ. Schmet.,' figs. 582-583). Newman writes:—"The moth appears on the wing in June; Mr. Doubleday has three British examples of this insect, which were raised from caterpillars found feeding on the golden-rod in Darenth wood. This species was described by the late Mr. Stephens in his 'Illustrations of British Entomology,' vol. iii., p. 87, under the name of *Cucullia thapsiphaga*, in 1829, and figured in the 'Transactions of the Entomological Society of London,' vol. ii., pl. iii., fig. 7, under the name of *Cucullia solidaginis*, in 1837. It is without doubt the *Cucullia gnaphalii* of Continental authors" ('British Moths,' p. 434). Guenée writes:—"Superior wings, as in *abrotani*, of an ashy-grey, more or less tinged with yellowish, except at the extremity, with the disc browner, in which the two ordinary stigmata stand out conspicuously, being near one another, almost equal in size, irregular, grey with the centres brown" etc. ('Noctuelles,' vol. vi., p. 134).

Cucullia, Schrk., *absinthii*, Linn.

The strangest point in the variation of this species is connected with the stigmata. The reniform is made of four o's arranged in contact like a double figure 8, the orbicular is also 8-shaped. One specimen I have, has the orbicular made of 6 distinct dots, another with 3, but generally there are only 2, corresponding with the upper and lower parts of an 8. There is some little difference in size, and the shade between the reniform and orbicular makes some difference in the depth of the colour in the central area according to the amount of its development. The sexes are similar. The type is thus described by Linnæus:—"*Noctua* spirilinguis cristata, alis cinerascentibus nigricante fasciatis punctatisque; inferioribus albidis." "Media. Alæ superiores canescentes, striatæ: fasciæ duæ, nigricantes, undatæ, inæquales; inter has puncta 4 minima in tetragonum disposita; margo posticus nigro punctatus. Alæ inferiores albidæ, subtus puncto nigro" ('Fauna Suecicæ,' p. 314).

Cucullia, Schrk., *chamomillæ*, Schiff., Fab.

This species varies considerably in tint, and hence has several named varieties. Schiffermüller and Denis in the 'Systematisches Verzeichniss' &c., give no specific description of the imago but correctly connect the species by means of the larva with its food plant. They say:—"It may perhaps be supposed that this is the larva which Rösel figured without the moth, and called 'the camomile' larva in the heading. This error must be cleared up. Rösel's larva is our second species, which we always find on *Artemisia* or the allied plants. Even Rösel remembers that it is said to be found on 'Stabwurz.' Our third species, which feeds on flowers of camomile is very different from the former, and much more strikingly marked" etc. ('Sys. Verz.' etc., p. 73). I have therefore had to take Fabricius' as the typical description. He writes:—"*Noctua* cristata alis anticis lanceoletis striatis canis: punctis duobus centralibus minutissimis nigris, subtus immaculatis." "Nimis affinis *N. umbraticæ* vix dis-

tinguenda, at larva diversissima. Antennæ ferrugineæ. Caput fuscum strigis cinereis. Thorax hirtus cinereus striga antica marginali nigra. Abdomen griseum basi fasciculis aliquot dorsalibus. Alæ anticæ supra striatæ, canæ in medio punctis duobus hirsutissimis (minutissimis ?) costaque punctis tribus cinereis. Subtus cinereæ punctis tribus costalibus albis. Posticæ striatæ cinereæ ciliis albis, subtus immaculatæ lunula parva centrali fusca" ('Mantissa,' pp. 180-181). Of this species Guenée says:—"After having examined a large number of specimens of this species, I own that I am unable to find any distinct character to separate *chamomillæ* from *chrysanthemi*, and I believe, like Treitschke, that they ought to be reunited, especially as the supposed differences in the larvæ, appear to be no more conclusive than those in the perfect insects" ('Noctuelles,' vol. vi., p. 142). I quite agree with Guenée as to the apparently ridiculous phrase "punctis duobus hirsutissimis" in the Fabrician description quoted above. He says that in the place of this phrase, we ought probably to read "punctis duobus minutissimis." Our English specimens appear to be either the type, a form much streaked with paler, or approaching var. *chrysanthemi*, a dark form much less streaked with the paler tint. I have also a form with a distinct dark blackish brown central band extending from the basal to the elbowed line, the dark band throwing up the reniform rather more distinctly. It appears to agree with Guenée's description of *chrysanthemi* exactly, although much darker in the central area than Hübner's figure. Humphrey and Westwood comparing this with *umbratica* and its vars. write: —"*Chamomillæ* is smaller than the others, and much deeper in colour than any of them, with the marks of the fore wings, more clouded and indistinct: the hind wings, with the fringe, are all deep full brown, but the specimen appears to be a female, and some reputed male specimens of *chamomillæ*, in the British Museum, are paler and clearer, but possessing the same general character" ('British Moths,' p. 224).

a. var. *calendulæ*, Tr.—Of this variety Staudinger writes:—"Dilutior, pallidior et imago et larva" ('Catalog,' p. 123). Treitschke himself writes:—"Long observation, which Mr. Kindermann and other naturalists have made, as well as preserved larvæ sent to me, have furnished proof that *chrysanthemi* must be united with the type as a dark variety. As there is every gradation in the moths, so the larvæ are found with or without the red-brown transverse bands, and with stronger as well as paler markings. They also eat various foodplants, which perhaps may account for the paler or darker shading. From Sicily, Dahl brought another variety under the name of *calendulæ*. It has been sent to several entomologists, but judging from the preserved larvæ, it turns out to be only *chamomillæ* in its palest form, and probably through climate and breeding, somewhat smaller than usual. The larva is almost straw-colour, the flame-like hooks are, however, only faintly observed" ('Die Schmet.' &c., x., 2nd pt., p. 127). Guenée writes of this as follows:—"It is near *chamomillæ*, but I believe it to be quite distinct. The superior wings are a little less lanceolete, of an ashy hue, scarcely reddish, with the costa only of the latter tint, which contrasts with the ashy ground colour; the disc and base are covered with scales rather than hairs. The ordinary stigmata are always

surrounded, above all in their upper edges with black. The elbowed line is more distinct and forms rounded teeth. There are fewer streaks, and these rather red than blackish, whilst lastly, the disc is quite concolorous with the rest of the wing. The inferior wings paler, more iridescent with whiter fringes" ('Noctuelles,' vi., p. 143). The only locality that this pale variety is recorded from is Sicily. It is remarkable how many pale vars. are recorded from this locality.

β. var. *leucanthemi*, Rbr.—This variety is more mixed with ochreous. Staudinger writes:—"Al. ant. flavo-mixtis" ('Catalog,' p. 123). Rambur's figure may be described as follows:—"Anterior wings dull ochreous-grey, with longitudinal black lines principally on the nervures, very fine and more numerous towards the inner margin. The costa and area beyond the angulated line ochreous, the outlines of the orbicular and reniform indistinctly marked. Hind wings ochreous-grey, paler towards inner margin" ('Cat. Sys. des Lep. de l'Andalousie,' Pl. ix., fig. 3).

γ. var. *chrysanthemi*, Hb.—This would appear to be our more common British form, of a rather dark blackish-grey tint with distinct black linear markings especially near the hind margin. Staudinger simply writes:—"Obscurior" ('Catalog,' p. 123). The description I made of the type is as follows:—"Anterior wings blackish-grey, with a transverse row of pale rhomboidal markings near the hind margin between the dark nervures; another transverse row of pale marks crosses the centre of the wing; the lower part of the basal area yellowish in colour. Hind wings dark grey, base slightly paler" ('Sammlung europ. Schmet.' etc., fig. 686). Guenée says of this form:—"Darker above all on the disc, and with a tint slightly olive; the black streaks thick and more numerous, the subterminal space sometimes appears paler, whilst the centre of the wing is darker and more blackish; so that the outline of the elbowed line is more distinct, although the lines are more obscured in the intensity of the ground colour. Stigmata often better indicated and sometimes surrounded on all sides" ('Noctuelles,' vol. vi., pp. 142-143). To which he adds:—"I have only described the more striking specimens which approach most to the figure of Hübner, which is, in any case, exaggerated" (*l.c.* p. 143). It is probable that Haworth's *fissina* (p. 166) is synonymous with this variety, but at any rate his description is most vague. Treitschke writes of it:—"*Cucullia* alis anticis fusco cinereis, nigro striatis, macula subcentrali albida; posticis fuscis, venis obscurioribus;" to which he adds:—"The fore wings are shorter and broader than in *chamomillæ*. They are of a black colour, tinged with yellow, paler at the base and towards the costa, the central area being darker and thus clearly marked. In place of the discoidals are rust-coloured and black dots, and below them, there is a yellow-grey spot, in the position of the dull whitish one in *chamomillæ*. The nervures are streaked with brown up to the fringes which are strongly scalloped. These latter are a pale yellowish brown. The whole wing surface is mottled and covered with small longitudinal dashes. The central nervure is however clearly distinguishable" ('Die Schmet' etc., vol. v., pt. 3, p. 114). Treitschke afterwards (*l.c.* vol. x., 2nd part, p. 127), referred this to *chamomillæ* as a variety (*vide* extract under *calendulæ*, *ante* p. 117).

Cucullia, Schrk., *umbratica*, Linn.

The Kent and Sligo specimens have pale males and comparatively dark ♀'s with a strong tinge of ochreous. In the specimens from Morpeth and Darlington, the males and females are equally dark, but the hind wings of both forms are much paler in the males than in the females. The early British authors made three or four species out of this. The points of distinction between these, are thus drawn up by Humphrey and Westwood:—"*Umbratica* has the front wings a paler grey than the others, with the tinting in front rather pale ochreous than brown, while the hind wings are very clear, and with a suffused narrow border of light brown." "In *tanaceti* the grey is stronger, and the ochreous tint becomes brown in the fore wings, and the hind wings have a broader and darker border or shade at the edge." "*Lucifuga* has still more brown in the fore wings, and the hind wings are entirely dusky brown, with a narrow fringe somewhat paler." "*Lactucæ* is very similar, but has the fore wings relieved here and there with a clearer grey, while the hind wings, though all brown, are lighter near the body, and have a broadish pale fringe" ('British Moths,' p. 224). There are, of course, distinct Continental species with the above names, which species, our early British authors believed their varieties of *umbratica* to be, but, as the knowledge of our British species increased, it was discovered that the forms thus described did not correspond with the distinct Continental species bearing the same names. The Linnæan description of the type is as follows:—"*Noctua* spirilinguis cristata, alis lanceolatis canis striatis, thoracis valvulis lunatis" ('Systema Naturæ,' xth., p. 515).

α. var. *tanaceti*, Haw.—Of this variety Humphrey and Westwood write:—"This species measures $1\frac{3}{4}$ or nearly two inches in the expanse of the fore wings, which are of a darker or more slaty-grey than in the last species, shaded to brown on the fore and hind margins, and with streaks and dots of black much more distinct; the black basal streak is present, reaching nearly to the middle and followed by a shorter one (behind the place of the stigmata, which are slightly indicated by black dots); the costa is marked near the apex with several pale dots, and the apical margin with black streaks; the inner margin has a more distinct streak interrupted before the anal angle by an angulated pale line, being the basal rudiment of the third ordinary striga; the apical angle bears two black dashes; the veins are brownish; the hind wings nearly white, with a broader dusky margin than in the preceding. The caterpillar is slaty or ash-coloured with numerous black spots arranged in longitudinal lines, and with a rather broad dorsal and lateral yellow line. It feeds on tansy, wormwood, chamomile &c., and the moth appears in June and Sept. according to Boisduval, but Stephens gives the end of July. It is a rather rare, but widely dispersed species" ('British Moths, pp. 225-226). Haworth, who treated *tanaceti* as a distinct species, described it as follows:—"*Noctua* cristata alis deflexis striatis canis: lineis duabus atris, posticis albis subtus immaculatis." "Affinis *N. chamomillæ*. Antennæ ferrugineæ basi albidæ. Caput cinereum. Thorax cinereus striga antica fusca. Abdomen basi albidum, alæ anticæ striatæ, canæ lineola a basi fere ad medium ductâ, et alia in medio breviore, apice parum flexa. Puncta tria costalia. Subtus obscuræ nitidæ. Posticæ

albæ supra margine nigricante, subtus immaculatæ" ('Lepidoptera Britannica,' pp. 165-166).

β. var. *lucifugà*, Haw.—Haworth described this as a distinct species as follows:—"*Noctua* cristata, alis deflexis striatis, fusco canescentibus, posticis fuscis, fimbriâ saturatiore" ('Lepidop. Britannica,' p. 166). Of var. *lucifuga* Humphrey and Westwood write:—"This species measures two inches in the expanse of the fore wings, which are of a slaty-brown colour, with black longitudinal lines, streaks and veins; the costa pale at the base and beyond the middle, with several small whitish spots; the apical margin also with longitudinal whitish lines edged with grey; the disc indistinctly dotted; the apical margin with a transverse ashy-white streak; hind wings deep ashy-brown; the cilia pale. The caterpillar is dark greenish or ashy colour, with numerous black spots, some of which form a row on each side of the back, which is red-brown down the middle, and at the sides, the latter bordered by a slender whitish line above the feet. The perfect insect appears in July, and is comparatively rare, although frequenting the same localities as the last species (*tanaceti*)" ('British Moths,' p. 226). Of the way the true *lucifuga*, which, of course, is not British, has been mixed up with *chamomillæ* and *umbratica*, Guenée writes:—"*Lucifuga* of Treitschke appears to me to be *lactucæ*, that of Duponchel, *chamomillæ*, that of Borkhausen, *umbratica*, as also are those of Stephens and Esper. As to that of Hübner, I do not agree with M. Rambur, who calls it *umbratica*, because he has figured a male with the inferior wings brown (they should be white if it was *umbratica*). The superior wings are otherwise much less pointed, and all the black streaks are very well placed. Notwithstanding the exaggeration of the reddish tint of the costa, this figure of Hübner appears to me to be not only a true *lucifuga*, but the best figure we have of it" ('Noctuelles,' vol. vi., p. 145).

γ. var. *lactucæ*, Haw.—Of this variety Humphrey and Westwood write:—"This species measures nearly two inches in the expanse of the fore wings, which are of a rather dark greyish or slate colour, relieved by paler grey shades, and with a reddish, obscure spot towards the centre, and various streaks and angulated slender lines of brownish-black; the apex with several pale slender lines; the inner margin deep ashy-brown, with several pale and dusky waved streaks; the apical margin with a slender interrupted black line, the hind wings brown with the base rather paler; the veins dusky. The caterpillar is yellow with a row of red dots down the middle of the back, and each segment with two large patches on each side, as well as several small black dots above the feet; the head black, with a yellow slender line down the face. It feeds on various species of *Sonchus*, lettuce etc., and the moth appears in July. Taken, rarely, in the woods round London as well as in Yorkshire" ('British Moths,' p. 226). Haworth described this as a distinct species as follows:—"*Noctua* cristata alis deflexis striatis canis fusco obsolete undatis, subtus fuscis: posticis disco albo." "Summa affinitas *N. umbraticæ*. Striga antica thoracis interrupta. Alæ striatæ undis aliquot fuscis at absque puntis centralibus costalibusque, subtus fuscæ basi margineque pallidæ punctis tribus costalibus, albidioribus. Posticæ fuscæ disco albicante" ('Lepidoptera Britannica,' p. 166). Of the errors connected with the true

lactucæ, Guenée writes:—"This *Cucullia*, long as it has been known, is yet erroneously named in certain collections, and authors have made numerous errors over it. The *lactucæ* of Treitschke, Hübner, and Stephens, are *umbratica*, that of Borkhausen is also probably the same, except the larva which is the true species. Lastly, that of Fabricius does not appear to me to be clearly the true species, for he writes:—'Alis primoribus lanceolatis,' et 'posterioribus disco albo'" ('Noctuelles,' vol. vi., p. 145).

9. Family:—*Heliothidæ*, Bdv.

This small (so far as British species are concerned) family, contains some beautiful and interesting insects, although they are not, as a whole, given to much variation. One species, *armiger*, is rather remarkable, from its distribution occurring abundantly in America and Australia. *Chariclea delphinii* (if ever really a native) is now supposed to be extinct in Britain, whilst *Heliothis scutosa* is of great rarity here. The peculiar coloration of the upper wings of the species of *Anarta* are particularly well-suited to their protection, and illustrate remarkably well the influence of "natural selection" in bringing about protective resemblance. Guenée says:—"The perfect insects of this family are almost all very easy to recognise with their wings strongly spotted with black on a clear ground. The legs are furnished with spines as in the *Agrotidæ*. They love most to fly in the daytime, and one finds them thus much more often than clinging to trunks of trees" ('Noctuelles,' vol. vi., p. 166).

Chariclea, St., *delphinii*, Linn.

This species occasionally turns up in our magazines as British, but it is included on the most doubtful authority. A specimen was sold in Stevens' sale rooms in May 1890, described as follows:—"*Chariclea delphinii*, a fine specimen, taken by J. A. Edwards, in a clover-field at Pangbourne, Berks, July 1857," and many of the very old collections contained type specimens of this as they did of many other foreign species; and in the end, it became very difficult to separate what was really indigenous from what was not. The following seem to be the chief facts known of this as a British species. Haworth says:—"This is perhaps the most beautiful of all our genuine NOCTUÆ, and it is likewise certainly one of our rarest; as has already been observed in the 'Transactions of the Entomological Society of London,' p. 35, where about five specimens are recorded to have been found in England." His description is:—"*Noctua* alis læte rubicundis; fascia trilobata basi alia angusta postica, strigaque geminata saturatioribus," and to this he adds:—"Habitat near London, most rare with us" ('Lepidoptera Britannica,' p. 248). Humphrey and Westwood write:—"This lovely insect measures about $1\frac{1}{4}$ inch in the expanse of the fore wings, which are of a rosy tint, with lilac shades; a pale trilobed slender striga, preceded by a brown shade, is placed before the anterior stigma, which is small, round, and pale buff-coloured, resting upon a square blotch of the same colour; between it and the outer stigma is a slender curved rosy striga; the outer stigma being purplish, followed by a slender curved pale striga edged on both sides with a brown streak; the apical margin pale, with a dark apical line;

the hind wings pale, with a dusky submarginal bar and central lunule; the margin itself rosy. It varies in the splendour of the fore wings, our figure giving its least brilliant appearance. The caterpillar is pale lilac-ash, spotted with black and with yellow lateral marks. It feeds on the wild larkspur. The perfect insect is extremely rare, but has been taken at Chelsea, Windsor, and in Bulstrode Park" ('British Moths,' p. 227). In 1857, Mr. Gascoyne wrote of this species:—"In No. 60 (Nov. 21st, 1857) of the 'Intelligencer,' you say in reply to a correspondent,—'whoever offered you *Chariclea delphinii*, you may be sure it was a hoax; no one has it to part with.' The 'Manual' says 'has occurred near Windsor.' Other writers doubt its being indigenous. At the time your remark about the "hoax" was made, a correspondent had kindly offered me a specimen of this insect, one of three he had taken. I am happy to say, in my case, it was no hoax, as a beautiful specimen has reached me, and now graces my cabinet. I asked for the history of the capture, and have the following reply:—'Three *delphinii* were taken in the garden either in June or July; one (the first) was found by one of my children on a gravel walk, and I pinned it myself; the other two were taken an evening or two afterwards by the gardener, while hovering over some stocks, and were in very fair condition'" ('Ent. Weekly Intelligencer,' 1857, pp. 90-91). Mr. Dale writes of this species:—"*Chariclea delphinii*. My specimen appears to be a hundred years old, damaged, and without an abdomen. It came out of the collections of old Dr. Lathom" ('Ent. Mo. Mag.,' vol. v., p. 247). Guenée describes two varieties of the larva of this species; one red, the other, blue. He says:—"The two varieties, rosy and blue, are very distinct, and appear to have become assimilated to the flowers of the food-plant, which also present the same two colours. The imago, however, does not vary" ('Noctuelles,' vol. vi., p. 169). The Linnæan description of the type is:—"*Noctua* spirilinguis cristata, alis deflexis purpurascentibus: fusciis duabus flavescentibus; inferioribus obscuris" ('Systema Naturæ,' xth., p. 518). No recent records of the capture of *delphinii* in Britain appear to occur.

Chariclea, St. (*Heliothis*, Och.), *umbra*, Hufn.

Like so many similarly coloured species, *umbra* has specimens of two distinct shades, some being of a deep reddish-orange, others of a paler and much yellower tint: even the red ones appear to become yellow when worn, but some are yellow without being worn. There is considerable variation in the depth of the colour and in the distinctness of the transverse lines, some standing out clearly against the ground colour, others, merging into it, and becoming very indistinct. The subterminal varies considerably, as does its outer edge of orange colour, and the outer, usually dark red, margin frequently assumes a purplish-grey tint especially in the paler specimens. The hind wings vary considerably in the width of the dark outer border which sometimes occupies a large portion of the wing; the basal area is also frequently suffused. Hufnagel's description of the type is:—"Orange yellow, with broad reddish-yellow bands on the hind margin. The hind wings pale yellow with a blackish border." He also adds:—"Flies at flowers in the evening in June" ('Berlinisches Magazin,' iii.,

p. 294). Newman says of the ground colour "reddish-brown with purple bands" and Haworth (under the name of *marginago*), "ferruginous with reddish-fuscous bands," so that all authors unite in calling the dark form the type.

α. var. *marginata*, Fab.—In this form, the orange-red ground colour of the forewings become yellow and the outer margin is generally less bright in colour. The diagnosis of Fabricius is:—"*Noctua* cristata, alis deflexis flavescentibus: strigis ferrugineis, postice fuscis" ('Mantissa,' p. 166).

β. var. *rutilago*, Haw.—A very slight variety, in which the complete basal line is darker than the central shade and extended so as to form a fascia, is separately described by Haworth. His description is:—"Alis anticis a basi ad strigam secundam, paulo saturatioribus quam in medio" ('Lepidoptera Britannica,' p. 235). He appears, erroneously, to refer this to the *rutilago* of Fabricius. Humphrey and Westwood write:—"The *rutilago* of Haworth is a variety with the basal portion of the wing more saturated" ('British Moths,' p. 236).

Heliothis, Och., *dipsacea*, Linn.

In my short series of this species I find two specimens (♂ and ♀) with the ground colour much darker, and without the green tint which characterises the others. They have, too, the transverse band between the subterminal and angulated lines much more distinctly defined. In the paler specimens, the reddish transverse central shade is continuous throughout, whilst on the other hand, the darker specimens have the central shade ill-developed between the stigmata (which are pale in all specimens) where it is replaced by a dark blackish quadrate spot, but, on the contrary, there is a dark longitudinal band along the inner margin, from the basal line to the subterminal shade, with which it unites; the darker specimens, also, have the basal area more suffused. In the hind wings of some specimens the spots are quite white, whilst in others, they are dull greyish-white or ochreous. Guenée says:—"This species varies little, excepting in colour, which is of a more or less greenish olive, but which quickly disappears in insects that have flown" ('Noctuelles,' vol. vi., p. 182). The Linnæan description of the type is as follows:—"*Noctua* spirilinguis, alis superioribus glaucescentibus punctis maculisque fuscis; inferioribus nigro alboque variis." "Alæ superiores supra cinereo-glaucescentes adspersæ punctis minutissimis fuscis et fascia fusca in medio: fasciæ rudimentum versus apicem. Subtus pallidæ puncto aterrimo, dein macula nigra, tum fascia fusca. Inferiores supra nigræ: fascia dimidiata alba in medio; macula alba versus basin; macula transversa intra marginem posticum. Subtus pallidæ macula centrali et fascia posteriore fuscis" ('Systema Naturæ,' xiith., pp. 856-857). This describes the insect fairly well but very few of our specimens can be described as having the upper wings "cinereo-glaucescentes." British specimens appear to belong principally to the *maritima* of Graslin with the fore wings having the ground colour yellowish, "butter colour" Graslin terms it.

α. var. *maritima*, Gras.—This appears to be so far differentiated as a local race on the Continent that Staudinger treats it as a sub-species,

altering its name, however, to *maritimus*. Graslin's original description is as follows :—" Anticis oleaginis pallidis, aut oleaginis flaventibus, aut fulvis subcinereis ; duabus fasciis fusco-rubigineis : priori infernè intùs productâ. Posticis albidis subviridis, aut fulvo-pallidis, nigro variegatis sicut in *dipsacea*. Acumine palporum nudo nigro " ('Ann. Ent. Soc. France,' 1855, p. 68). To this he adds :— " At first sight *H. maritima* offers great resemblances to *dipsacea*, but it forms, however, a very distinct species, as may be seen from the description and from its earlier stages. It is very variable in shape and in ground colour ; generally, it is near *dipsacea* in size, but I have seen specimens larger and some very much smaller " (*l.c.*). He then describes the form which he considers the type of the species *(maritima)* as of a " clear olive or greyish-green with two parallel bands of red-brown, sometimes drawing on ferruginous or blackish ; the first of these bands which is larger and darker, distinguishes *maritima* and *dipsacea* at first sight. In the latter, the band is wavy interiorly and it finishes by falling almost perpendicularly on the inner margin. In *H. maritima* it is less wavy and turns in a striking manner away from the body on approaching the inner margin." The second form he describes as " a very remarkable variety which is the most numerous after the type " (just described) having the fore wings of a ferruginous colour, slightly greyish, showing a slight rosy iridescence, with the two bands red-brown. Sometimes these are confluent at their lower parts, where they absorb almost half the wing." Another form is then described with " the ground colour of the fore wings of a pale yellowish-grey tinted with reddish, with the bands, especially the first, brownish-ferruginous in colour and the inferior wings a little paler than the variety figured." " Lastly," he adds, " some examples are intermediate between these varieties, approaching, more or less, one or the other " (*l.c.* pp. 69-71). These forms appear to comprise all those with a more or less yellowish ground colour. Of Graslin's figures, I noted :—" Fig. 1 is yellowish, with a slight green tint, and a dark red-brown central shade (or band) ; the subterminal area red at the costa and inner margin, but greyish in the centre ; the complete basal line is represented by three dots, the orbicular by four dots. A remarkably good figure, but most certainly a form of *dipsacea*. Fig. 2, like the figures of so many of the older authors, is useless owing to the colour having changed since the figure was drawn and painted " ('Ant. Soc. Ent. France," 1855, Pl. 7, figs. v. (1-7). I have some British examples identical with fig. 1.

β. var. *luteitinctis*, Grote.—Grote writes of this :—" It appears to represent in North America, the var. *maritima*, Grasl. of *dipsaceus*, but differs from that by its larger size, the pale ochreous ground colour of the forewings, which are even brighter yellow than in *maritima*, and broad black markings on the hind wings. *Dipsaceus*, in America, has two varieties, *interjacens* and *luteitinctus*, neither exactly covered by any European varieties known to me ; the latter is interesting as showing the tendency of the species to vary on both Continents in the colour of the secondaries. Western States (Illinois) " (*in. litt.* 26. 4. '92).

γ. var. *interjacens*, Grote.—Grote's original description of this is as follows :—" This form seems to be intermediate between *armiger* and *dipsaceus* (the American species, which is identical with the latter

or represents it, has been described as *phlogophagus*, G. and R). It *(interjacens)* has the faded ochreous colour of *armiger*, and in the type, form is nearly as large, with the markings of *dipsaceus*, there being on the primaries an angulated median shade, while, on the secondaries, the marginal band is distinct as well as the discal lunule. The reniform is dark and distinct, with a partial black annulus. Fringes as in *dipsaceus*. There are two forms of *interjacens*; one, typical, larger, with more obliterated markings; the other, smaller, and more distinctly marked. California" ('Bull. Ent. Soc. Brooklyn,' 30). To this he adds :—"Probably a climatic variety of *dipsaceus*" (*in. litt.*).

Heliothis, Och., *scutosa*, Schiff., Fab.

This rare British species is at once distinguished by the white longitudinal nervures which cover the fore wings. Guenée says :—"It varies in shape, and also a little in colour. The figure of Curtis (595) represents a very dark variety" ('Noctuelles,' vol. vi., p. 182). Schiffermüller's is really only a catalogue name and simply says :—"The fore wings olive or brown, coloured with pale spots" ('Sys. Verz.,' &c., p. 89). Esper's diagnosis is copied from that of Fabricius who writes :—"*Noctua* lævis alis deflexis fusco alboque variis : posticis basi albis; macula fusca; apice fuscis albo maculatis." "Statura et magnitudo *N. glyphicæ*. Corpus griseo fuscum. Alæ anticæ fuscæ in medio albæ maculis tribus fuscis cinctis, apice fuscæ strigis punctisque marginalibus albis, subtus limbo albo punctis tribus magnis atris. Posticæ basi albidæ macula magna fusca, apice fuscæ striga obsoleta maculisque duabus albidis, subtus albæ puncto medio, striga maculaque apicis fuscis" ('Mantissa,' pp. 142-143). Of the first occurrence of *H. scutosa* in Britain, Mr. Stainton writes :—"First recorded as British by Curtis, who figures and describes it in his 'British Entomology,' folio 595; the specimen from the collection of Mr. Heysham, 'was taken on the banks of the river Caldew, a little below the village of Dalston, in July, 1835.' I am not aware of any specimens having occurred subsequently. According to Freyer, the larva feeds on *Artemisia campestris*" ('Ent. Ann.,' 1885, p. 16). Of this species Humphrey and Westwood write :—"This species has the fore wings dark brown, with the veins and a subapical striga ochreous-white; the disc of the wing with three large brown spots edged with black, representing the three stigmata, the anterior one preceded and followed by ochre-white spots; the apical with a row of black dots. The hind wings whitish-ochre, with dark veins and a blackish central spot, and marginal border in which are two round ochreous spots on the outside towards the middle. The caterpillar is green, with black setigerous tubercles and black lines on the back and sides; it feeds on *Artemisia campestris*, and the moth has occurred 'on the banks of the river Caldew, a little below the village of Dalston, in July last;' also on the coast not far from Skinlurness, in Cumberland" ('British Moths,' p. 237). It was then recorded by Mr. Thornthwaite, in 1875, from Norfolk ('Entom.,' ix., 18), and again in 1876 ('Entom.,' x., p. 99). The later records appear to be as follows :—'Entom.' xi., p. 231; 'Ent. Mo. Mag.' xv., p. 137 and xvi., p. 229. A figure of this moth and a remarkably good account of what is known of this species as British are given by Mr. Fitch in the May (1877) No. of 'The Entomologist.' After describing

the moth and larva he writes:—"The moth appears on the wing in May, June, July, August and September; all these months being given by different authorities consulted; whether it is double-brooded, or, like many of its congeners, uncertain in its appearance, seems doubtful; probably only the latter, though Heinemann refers distinctly to the two broods. Professor Hering says:—'very capricious in its appearance, rare in some years whilst in others very common.' Thus, the double-brooded theory has probably arisen from the uncertainty of its appearance in varied localities; but, if it be true that the larvæ only feed on the flowers and seeds of mugwort, we can scarcely have more than one distinct brood, though the time of its duration in the pupa state may be variable, as we know to be the case in many other lepidoptera. On the Continent, this species is very widely distributed, and is not rare, though Britain is probably its extreme northern limit in Europe. Dr. Staudinger, in the Staudinger-Wocke 'Catalog,' says:—'Europa centralis (exceptus Batavia et Belgica); Livonia; Gallia meridionalis; Piedemontium; Turcia septentrionalis; Rossia meridionalis; Altai Montes.' Guenée says:—'Autriche, Hongrie, France méridionale, Angleterre;' whilst Heinemann widens into—'Verbreitet bis Nord-deutschland, aber zerstreut.' As to its occurrence in Britain there is some doubt. It is figured by Curtis and Wood, included in Stephens' 'Museum Catalogue of British Lepidoptera,' and described in Stainton's 'Manual;' all on the authority of the Cumberland specimens; but in Doubleday's list it never got further than the 'Reputed British Species,' and in consequence was unnoticed in Newman's 'British Moths.' In the 'Entomologist' for February, 1875 ('Entom.' viii., 42), Mr. J. B. Hodgkinson endeavoured to show cause against *scutosa* being deleted from our lists, but with, I am afraid, but little, if any, immediate success; however, this species has lately been brought prominently forward by the news of its re-discovery in Norfolk, and the history of the four or five specimens taken in Cumberland, more than forty years ago, will now be read with increased interest. I have taken some trouble to learn more of these old, and, I believe, thoroughly genuine captures. Mr. Rothwell has supplied me with every information, and writes me that, 'being a diligent collector of lepidoptera when at school in Cumberland, I well remember taking many specimens which created quite a commotion amongst the collectors of Carlisle and the neighbourhood,—Mr. Hodgkinson, sen., Mr. Heysham, Mr. Cooper, &c.; and doubtless the species you refer to *(scutosa)* was one of them.' He especially mentions the 'Bee Sphinx *(bombyliformis)*, the green Forester *(statices)*, and the Portland moth *(præcox)*.' After some further correspondence Mr. Rothwell informed me that he had 'turned up' three boxes of his old collection, and very kindly invited me to inspect them. This I did, and though neglected for upwards of forty years, I found a by no means dilapidated collection, which contained a number of really good species, especially amongst NOCTUÆ, but no *scutosa*. This was disappointing, but the information elicited, quite satisfied me of the authenticity of Mr. Hodgkinson's history, who, from his acquaintance and connections with the captors and localities, was fully justified in championing the British connections of this species. I showed Mr. Rothwell specimens of the moth, which he failed to recognise distinctly,

rather an expected occurrence, considering the lapse of time; but he said, 'It looks like one of the moths I used to take flying about the mugwort that grew so plentiful on the sand-hills, about half a mile from the coast.' This was circumstantial evidence, indeed, said as it was in ignorance of the species being a day flyer, and having no idea of the foot-plant of its larva. The Cumberland locality, especially rich in entomological specimens as it was, has been overtaken by the march of improvement; the port of Silloth now occupying the ground. Though the larva is also said to feed on the common mugwort (*Artemisia vulgaris*), *A. campestris* appears to be its special pabulum. This plant has a very restricted range in Britain, being wholly confined to sand-hills. Watson, in his 'Cybele Britannica,' only gives it as an inhabitant of one, and doubtfully of three, of the eighteen provinces into which great Britain is there divided. Babington says:—'Sandy heaths in Norfolk and Suffolk; rare.' Hence of all districts we might expect these eastern counties to produce *scutosa*, and it is from Norfolk that the capture of two specimens has lately been recorded by Mr. Thornthwaite ('Entom.' ix., 18; x., 99); and, as an entomologist so experienced as Mr. C. G. Barrett is satisfied with their *bonâ fides*, it is needless to remark further on these recent captures. Though the occurrence of *scutosa* at light seems rather at variance with the known habits of the species, still *Heliothis* is a most uncertain genus in many respects. The figure is from a series in my collection, taken in Morocco, by the late Mr. Trovey Blackmore" ('Entom.,' x., pp. 106-108). Mr. C. G. Barrett writes:—"In the Rev. Henry Burney's collection, I saw one of the two specimens of *H. scutosa*, taken 50 years ago by Mr. Heysham, near Carlisle. It is a female in good condition, and darker in colour, and more strongly marked than those obtained in Norfolk some years ago by Mr. Thornthwaite. I think that no doubt need be entertained of the genuineness of this example of one of our rarest British species" ('Ent. Mo. Mag.' vol. xxv., p. 225).

Heliothis, Och., *peltigera*, Schiff., Hb.

Of this species Guenée says:—"The specimens from India do not in any way differ from those of Europe" ('Noctuelles,' vol. vi., p. 180), whilst Humphrey and Westwood write:—"This species is variable in the depth of its markings" ('British Moths,' p. 236). This species is more generally found in Britain than its congener *armigera*. Schiffermüller's name is really without description, as he simply says:—"Blasszimmetfarbene rand fleckechte Eule" ('Sys. Verz.,' p. 89). I therefore quote a description of Hübner's figure:—"Anterior wings yellow-ochreous (slightly brownish) from the base to the elbowed line, in which area we find the basal line represented by three black dots, the reniform black and the orbicular represented by a minute black dot; the elbowed line is double and consists of a brownish line near the reniform and a wavy brown line some little distance beyond; the subterminal outlined with yellow; the space between the elbowed and subterminal, greyish, between the subterminal and outer margin, ochreous-brown; a dark longitudinal lunular costal patch between the elbowed and subterminal lines. Hind wings with a dark outer band, the base paler grey, a dark lunule; a pale mark on the outer edge of the wing in the centre of the dark band" ('Sammlung europ. Schmet.,' fig. 310).

a. var. *pallida*, Ckll.—In 'The Entom.,' vol xi., p. 24, we read that "Mr. Eedle exhibited a very light specimen of *Heliothis peltigera*." This was named var. *pallida* by Mr. Cockerell in 'The Entom.,' vol. xxii., p. 4.

Heliothis, Och., *armigera*, Hb.

This species varies excessively. Some of the most remarkable specimens I ever saw were in the collection of the Rev. G. Raynor and were taken in Australia. Hübner's fig. 370 represents the type of which I made the following description:—"Anterior wings pale greyish-ochreous, more yellowish towards the basal part, greyer from the angulated line to the outer margin. Posterior wings grey, with a dark lunule and dark hind margin" ('Sammlung europ. Schmet.,' fig. 370). Guenée writes:—"It varies exceedingly in colour, above all the females, but the varieties are not constant enough to form races" ('Noctuelles,' vol. vi., p. 181). Mr. Stainton writes:—"*Heliothis armiger*, Hb., first recorded as British by Mr. Edleston in the 'Zoologist' for 1843, p. 260—'a beautiful female specimen having been taken in September, 1840, off the door of an outhouse belonging to my friend Mr. John Thomas, of Oldfield Lane, Salford, who liberally added it to my cabinet.' A specimen taken near Mickleham is in the collection of Mr. Bedell, and other specimens have been taken in various localities" ('Ent. Ann.,' 1855, p. 16).

a. var. *fusca*, Ckll.—In 'The Entom.,' vol. xi., p. 24 we read:—"Mr. Eedle exhibited a dark brown variety of *Heliothis armigera*." This variety was named by Mr. T. D. A. Cockerell, var. *fusca*, of which he simply states:—"*H. armigera*, var. *fusca* ('Entom.,' xi., 24)" ('Entom.,' xxii., p. 4).

β. var. *ochracea*, Ckll.—Mr. Cockerell records a variety under this name without a description, but with a reference to the 'Fourth Report U.S. Ent. Com.,' 1885, pl. iii., fig. 7 ('Entom.,' xxii., p. 4).

γ. var. *umbrosus*, Grote.—Of this variety Mr. Grote writes:—"This form occurs commonly in the Southern United States, where its larva is known as the Boll Worm. It has been taken readily flying in the daytime, in the cotton fields in Georgia and Alabama. The moth is somewhat larger, paler, of a more olivaceous colour compared with the European type, and the ordinarily darker markings of the wings, are all less evident and distinct. It is figured by Glover in an unpublished work on American insects" (*in litt.*). Mr. Cockerell gave me a specimen of this variety of which he wrote:—"The example belongs to a sub-var. with the stigmata margined with ferruginous. I call it sub-var. *cumaculata*" (*in litt.*). Mr. Grote also further writes to me:—"This is a large almost immaculate form with a pale olivaceous tinge to the thorax and hind wings, found commonly in the Southern States. In the North, the colour is more ochreous but always paler than any European specimens I have seen which have had the primaries of an obscure dirty ochreous. This species wants the angulated median shade or band on the primaries characteristic of all the forms of *dipsaceus*" (*in litt.* 26, 4, '92).

Anarta, Tr., *myrtilli*, Linn.

This species has, like its larger brother *Lycophotia strigula*, two distinct colour forms. Most of the specimens are bright red with

distinct white transverse lines and markings, but occasionally, specimens are of a deep purplish-red tint with much more suffused markings, especially in the basal area. This latter form represents the Linnæan type, and my darkest specimens have come from Mr. Finlay of Morpeth. The most characteristic mark in this species is the small white spot which lies just between the bases of the orbicular and reniform, and which is frequently continued laterally to form a white ring to the orbicular. In one specimen from Sevenoaks it is continued upwards as if to form a central shade, and in another from the same locality, it is not only continued upwards to the costa, but downwards to a white spot frequently found in contact with the claviform, almost to the inner margin. There is considerable difference in the width of the outer black margin on the hind wings, and in some specimens, the extreme base is much suffused, considerably clouding the upper part of the yellow area. The type is thus described by Linnæus :—"*Ph. Noct. myrtilli* spirilinguis cristata, alis griseis striga alba; inferioribus antice luteis posticeque nigris." "Alæ superiores nigricantes, purpurascenti-ferrugineo nebulosæ cum striga repanda alba ad basin et alia prope marginem posticum; macula alba triquetra in medio. Alæ inferiores supra anterius luteæ, posterius atræ margine postico albicante" ('Fauna Suecicæ,' p. 311). From this it would appear that the dark blackish- or purplish-red coloured form is the type, and our commoner red one the variety. Humphrey and Westwood write :—"The species varies considerably in the clearness of the pale markings and in the brilliancy of the ground colour of the wings which is sometimes brown (*N. albirena*, Haw.)" ('British Moths,' p. 237).

a. var. *rufescens*, mihi.—Like the type, but the ground colour much redder, and much more variegated with white markings. Almost all our specimens in the South of England are of this form, the dark type being comparatively rare. In some Northern localities in Britain the reverse appears to be the case.

β. var. *albirena*, Haw.—A form with the ground colour of the wings brown is thus described by Haworth from Norfolk specimens :—"*Noctua* alis anticis fuscis, macula strigaque albis." "Alæ anticæ fuscæ, maculâ parvâ pyriformi in loco stigmatis antici, strigâque undatâ posticâ albis. Margo ciliaris fusco punctatus. Posticæ alæ pene ut in præcedente (*myrtilli*, Haw.), at fimbria nigra paulo angustior est" ('Lepidoptera Britannica,' p. 163).

Anarta, Tr., *cordigera*, Thnb.

In this beautiful species there is considerable variation. The rarest form in Britain has the ground colour ashy, not only at the base and on the outer margin, but also between the stigmata and continued downwards towards the inner margin, leaving a black streak between the subterminal and angulated lines (the lines themselves being pale), a black edge to the basal line and a narrow black inner margin. The commonest form is that in which the area between the elbowed and basal lines forms a dark central band, the basal and outer areas ashy, whilst another beautiful form has the whole of the fore wings black except the narrow marginal area outside the subterminal. My finest specimen of this latter form has an ochreous reniform, but this

stigma in all my other specimens is white. The orbicular is generally more or less indistinct, occasionally clear ashy. The border of the hind wings appears to vary but little in breadth, and the base appears never to be suffused. Thunberg's diagnosis of the type is:—"Alis anticis nigris fasciis undatis albis, stigmate albo; posticis flavis margine nigro" ('Mus. Nat.,' p. 72). The "white" (or as I should term them grey) fasciæ point to the banded form as the type and this is certainly the most common form in Scotland.

α. var. *variegata*, mihi.—With the central black band broken by a transverse ashy fascia between the stigmata, giving the insect the appearance of being grey, with a black transverse fascia between the angulated and subterminal lines and another down the basal line.

β. var. *suffusa*, mihi.—A very rare form with the basal area, central band and space between the angulated and subterminal lines continuously black, leaving only the extreme hind margin (outside the subterminal) whitish. As before mentioned I have a specimen of this form with an ochreous, instead of white, reniform. Of this variety Mr. Robson writes:—"Mr. Gregson has two specimens of this species with the whole of the fore wing (except the white stigmata) as dark as the central band" ('Young Naturalist,' vol. viii., pp. 122-123). It appears to occur in the various Scotch localities with the type.

Anarta, Tr., *melanopa*, Thnb.

This species shows a very considerable amount of variation, some specimens being pale grey with darker grey markings, some dark grey, with still darker markings; of course, these latter look much more unicolorous, and one fine variety I have is strongly ochreous. In the hind wings, this species shows more variation than any of its allies, extending from pure white with a black margin and black lunule, to entirely black, with a white lunule just outside the normally black one, there being more or less intermediate forms in a long series. The stigmata in the fore wings vary, especially the orbicular, in size and shape, and there is a tendency to form a dark transverse fascia through the reniform, in some specimens. The grey irrorated form with distinct white hind wings and black marginal band and lunule is the type. Guenée describes the type under the name of *vidua*, Hb., whilst his *melanopa* is var. *rupestralis* ('Noctuelles,' vi., pp. 190-191). Thunberg's original description of the type is:—"Alis deflexis, anticis nigris griseo, irroratis; posticis albis: macula margineque nigris" ('Diss. Ent. sist.' &c., 2nd. pt., p. 42).

α. var. *wiströmi*, Lampa.—The original description of this variety is as follows:—"The fore wings much darker, bordering on yellowish-brown; the black markings rather rough and in places running together. The spot between the reniform and the transverse line has black longitudinal streakings on one specimen, and the underside has a broad black border like the hind wings" ('Entom. Tidskrift,' 1885, p. 81). This would appear to be the var. *brunnea* of Robson, who, writing of the *melanopa* in Mr. Gregson's collection says:—"A browner form with four dark bands, showing the veins lighter, Mr. Gregson calls *brunnea*" ('Young Nat.,' vol. viii., pp. 122-123); whilst of *Anarta melanopa* from the Shetland Isles, Mr. Jenner Weir writes:—"The ground colour of the upper wings is much yellower than that

of the specimens of the insect obtained at Rannoch" ('Entomologist,' vol. xiv., p. 280). My Shetland examples exhibit this peculiar coloration.

β. var. *vidua*, Frey.—This is a form with both darker fore and hind wings figured by Freyer. The ground colour is blackish, with greyish markings. and has a very unicolorous appearance. Guenée writes :—"I believe that the *vidua* of Freyer (iv., pl. 311, fig. 3), is only an accidental variety. The superior wings are entirely blackish, with the terminal space and a costal spot above the reniform of a clear grey. The inferior wings are entirely black in some parts" ('Noctuelles,' vol. vi., p. 190). Of Freyer's *vidua* I made the following notes :—"Fig. 2. Anterior wings greyish, with black basal, elbowed and subterminal lines and black outline to the reniform. Hind wings, with black margin and black lunule. The normal white parts of the hind wings grey. Fig. 3. Anterior wings black from the base to the subterminal line, except a small grey patch around the reniform, extending to the costa ; and of a greyish colour to the outer margin, beyond the subterminal" ('Neuere Beiträge' etc., pl. 311, figs. 2-3). Fig. 2 would appear to be referable to var. *rupestralis*, whilst the only difference between fig. 3 and the following variety appears to be that the fore wings of *vidua* are very dark as well as the hind wings, the fore wings of *rupestralis* being more normal.

γ. var. *rupestralis*, Hb.—This variety generally has the fore wings normal, but the hind wings with the white parts much restricted and suffused. Guenée describes this form as the type, but Staudinger correctly treats it as a variety, and writes :—"Al. post. totis infuscatis" ('Catalog,' p. 128). This is also the *tristis* of Hübner. The description I made of Hübner's figure of *rupestralis* is as follows :—"Anterior wings dark grey with the abbreviated and complete basal lines paler, the space between being black ; the orbicular and reniform black, also the angulated line ; the subterminal line made up of a transverse series of black wedge-shaped marks ; fringes alternately whitish and black. Hind wings dark grey, black outer margin and lunule" ('Sammlung europ. Schmet.,' (Pyralides) fig. 138). The same author's *rupestris* (figs. 644-645) represents the same form.

Heliaca, H.-S., *tenebrata*, Sc.

There appears to be but little variation in this species. Some specimens are a little redder than others, and a tendency to be rather paler in the area between the darker outer transverse margin and central shade, is to be occasionally observed in other specimens. The yellow of the hind wings gets paler when worn, but I have seen no fine specimens naturally so. I have specimens in which the yellow area is reduced to a comparatively small area forming a longitudinal lunule, and others where it encroaches on the basal area. Scopoli's original description is as follows :—"Long. lin. 4½ ; lat. 3. Fuscescentes ; alis anticis subtus macula flava ; posticis utrinque fascia flava." "Seticornis et semigeometra, seu alis semipatulis, nec tamen *Tortrix*. Alæ anticæ lineola alba prope apicem in margine crassiore, binisque similibus in fimbria terminali. Alæ posticæ albida fimbria terminatæ, subtus potissimum anticæ flavæ ; limbo fusco ; superne nigricantes ; fascia flava non attingente marginem inferiorem." "Variat lineolis alarum

super flavescentibus, alisque subtus flavo polline adspersis" ('Ent. Carniolica' &c., p. 230). This type is the *arbuti* of Fabricius and Esper. I have an idea that a form of this species with white hind wings was named var. *albescens* by Mr. Cockerell, but I really cannot find the reference. Of a figure drawn from a similar specimen, Guenée writes:—"This pretty Noctuelle varies little. The figure *c* of Engramelle however, represents a specimen with white inferior wings, which appears to be entirely accidental" ('Noctuelles,' vol. vi., p. 198).

a. var. *jocosa*, Zell.—This is treated by Guenée as a distinct species on the figures of Herrich-Schäffer (figs. 444-445). He writes:—"I have not seen it in nature, but if one may judge from the figures, it is very close to *arbuti* from which it appears to differ principally (1) in the yellow colour of the lower wings, which extends to the costa, (2) in the black at the base being more restricted, and (3) the underside of the superior wings, which is entirely yellow, with an olive border, and a black cellular streak, in contact with a streak of the same colour" ('Noctuelles,' vol. vi., p. 198).

ADDENDUM.

p. 26. Insert in line 5 of the paragraph referring to *Dianthœcia irregularis*:—

Rottemburg's further description of Hufnagel's type is as follows:—"The ground colour of the fore wings is yellowish-brown speckled with white, with the ordinary scalloped and angular transverse lines. Between the second and third of these stand the orbicular and reniform stigmata; the former is quite white, surrounded by a blackish-brown outline, the latter, is also white on the edge, and bordered by a blackish-brown line, the centre of the stigma being brownish. The outer margin of the fore wings is yellowish-brown, marked alternately with whitish. The hind wings are yellowish-brown, darker towards the outer margin and have quite a white border." He also adds:—"Though this moth belongs to the smaller species, as it scarcely equals *fuliginosa* in size, it has a pretty appearance owing to its varied coloration and fine markings" ('Der Naturforscher,' xi., p. 130). I am indebted to Dr. Karsch of Berlin for this description which arrived too late to be inserted in its proper place.

CORRIGENDUM.

p. 91. Lines 8–9. For var. *scotica*, St., read var. *scotica*.

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