TRANSACTIONS

OF THE

ENTOMOLOGICAL SOCIETY

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THE

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EXPLANATION OF THE PLATES.

ERRATA.

Page 28, line 3 from bottom, *for* "figs. 11, 12," *read* "figs. 10, 11."
74, ,, 5 from bottom, *insert* "Expanse of fore-wings, 6-9 lines."
469, lines 1, 5, and 12 from bottom, *for* "Leucothoe" read "Leuconoe."

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I. Trichoptera Britannica; *a Monograph of the British Species of Caddis-flies.* *By* ROBERT M'LACHLAN, F.L.S.

[Read 6th March, 5th June, and 2nd Oct., 1865.]

IT is now five years since I resolved to take up the study of that heterogeneous mass of insects forming the Linnæan order *Neuroptera*, my attention having been directed thereto by the publication of Dr. Hagen's papers on the British species in the "Entomologist's Annual;" and above all others the Caddis-flies appeared to stand in need of diligent examination. I had often, when in pursuit of *Lepidoptera*, captured these insects, either by accident or design, and always looked upon them with interest, and then formed the idea of working out a Monograph of the British Species, which I now beg to bring before this Society. The completion of it has been retarded by various circumstances, not the least of which has been the difficulty of the subject. But I have had to work nearly alone in this country, and with the exception of the assistance kindly rendered by friends who have forwarded to me any specimens they may have captured, I have had to rely almost entirely upon my own exertions. Had it not been, therefore, for the friendship and co-operation of Dr. Hagen, *the* authority *par excellence* on these insects, it is probable that the publication of this Monograph might have been postponed indefinitely. But from the moment that I first announced my intention of under-taking a work of this kind to Dr. Hagen, he has at all times taken the warmest interest in it, and his assistance has been invaluable owing to his power of discriminating the often minute structural characters, so subtle yet so decisive, to be found in the *Trichoptera*, and to the opportunities he has had of investigating the types of the species described by previous authors; it is to be regretted that most of these have ignored the existence of structural specific characters, more difficult to investigate than mere differences of coloration, but far more certain.

With respect to the synonymy,* I have endeavoured to make it as complete as possible, and have indicated by an asterisk in brackets—thus, (*)—all citations that I have been able to verify by an actual examination of type-specimens, a plan that it would be desirable to adopt more frequently in similar works. The types of many of Pictet's species are now lodged in the British Museum, and have been carefully examined both by Dr. Hagen and myself. I have also a considerable number of species named by Dr. Brauer, contained in the Collection of European *Neuroptera* formed by Professor Zeller, which is now in my possession. The Collection of Curtis was inspected by me several times before it was sent to Australia, and that of Stephens has been constantly consulted. The papers by Dr. Hagen, revising the species of Pictet (published in the Stettin "Entomologische Zeitung"), and of Rambur (published in the "Transactions de la Société Entomologique Belge"), have been carefully studied, and I have had at all times the benefit of a constant correspondence with the author on difficult points. Still much remains to be done, and it is possible that many of the citations here given may prove erroneous, when they can be tested by an examination of typical specimens. Many of the species described in the works of Zetterstedt and Kolenati stand greatly in need of identification in this manner.

I will now proceed to compare the number of species described in this Monograph with those noticed by previous authors as occurring in this country. Passing over Stephens' "Catalogue" and Curtis' "Guide" as being mere lists of names, I come to

* Since this was written I have received a copy of Dr. Hagen's "Phryganidarum Synopsis synonymica," just published in the "Verhandlungen der k. k. zoologisch-botanischen Gesellschaft in Wien." This work is a laboriously compiled list of the described *Trichoptera* of the whole world. It will be found that the synonymy of our species agrees very nearly with that given in this Monograph. Some few discrepancies occur, which time and further knowledge will perhaps clear up. Many of the citations from the old authors will always remain uncertain.

Stephens' "Illustrations of British Entomology," as the first work professing to give descriptions of all known native species. In this work, in the sixth volume of the *Mandibulata*, published in 1836—7, I find (excluding two species of *Lepidoptera*, erroneously described as *Trichoptera*) descriptions of 183 so-called species. This has a very pleasing appearance so far as our apparent richness is concerned, and is probably somewhat near the number that really inhabit this country, when all shall have been discovered, but concerning those then known it is altogether illusory, some species being described under as many as six different names, and the two sexes sometimes placed in different genera or in different sections. Moreover, in some cases, Stephens had displaced names used in his Catalogue to give preference to those employed by Curtis in his paper in the Philosophical Magazine, applying these latter to the wrong insects, and thus creating additional confusion.

After Stephens, nothing whatever was done for many years, until, in 1857, Dr. Hagen made a short visit to this country, and jotted down notes on the species in our Collections. After his return home he drew up from these notes a Synopsis of the British Species, which was published in the "Entomologist's Annual" for 1859—61. In this work, which may be looked upon as a masterpiece, considering that the descriptions were drawn up from notes only, made during a hurried visit, the number of species was reduced to 108, which included several not previously recorded. This number I have found it necessary to still further diminish, so far as relates to our knowledge at that period, but there were also some few species then known which were accidentally omitted or misunderstood by Dr. Hagen; the true number known at that time being probably under 100. In the present Monograph I give descriptions of about 126 species (a few being rather doubtful), arranged in 43 genera, thus showing a considerable addition to our Trichopterous Fauna during the past four or five years, and this too the work of very few Entomologists.

I sincerely hope that the publication of this work will induce some of our Entomologists to devote their attention to these much-neglected insects. Most of us in our first essays at ensnaring the finny inhabitants of our lakes and streams, have made personal acquaintance with the larvæ of the Caddis-flies, the "Caddis-worms" as they are commonly called. I would beg then that some of those with entomological proclivities should also turn their attention to the insects produced from these larvæ. I can promise them that the delights to be derived from the study will amply repay them for the labour bestowed upon it; and I feel assured that those who seriously occupy themselves in the study of the *Trichoptera,* will be the most ready to excuse the omissions and imperfections of this Monograph.

Characters of the Order.

Antennæ setaceous, multiarticulate. Ocelli three or none. Mandibles rudimentary (or absent?). Maxillary palpi with the number of the joints varying in the males; always five-jointed in the females. Labial palpi three-jointed. Prothorax very short, forming a collar. Wings four, membranous, deflexed in repose, more or less pilose, with few transverse veins. Legs long; coxæ elongated; tibiæ usually furnished with long spurs; tarsi five-jointed.

Eggs enclosed in a jelly-like substance.

Larvæ generally aquatic* and furnished with external respiratory filaments. Legs six, and two anal crotchets; the first abdominal segment with lateral and median processes. Residing in cases which are either free or fixed.

Pupæ remaining in the cases until shortly before the metamorphosis. Antennæ and legs free. Mandibles strong and often dentate; only used for the purpose of breaking through the case.

It is not my intention to enter into a lengthened examination of the reasons that have induced Entomologists to consider these insects either as forming a distinct Order, or as a part of the *Neuroptera.* Among modern authors, on the one hand rank the names of Kirby, Leach, Curtis, Stephens, Westwood and Kolenati; on the other, Pictet, Rambur, Brauer, Hagen, &c. It is with no disrespect to the opinions of the latter gentlemen that I elect to follow the example of most of my countrymen, and to consider the *Trichoptera* as forming a distinct Order. It appears to me that amongst the *Neuroptera* (in the Linnæan sense) are included two or three Orders, each of co-ordinate value with those that have been universally received as such, and which cannot be retained in such close relationship without outraging the laws of classification both metamorphotic and cibarian.

If the claims of the *Trichoptera* to be considered a separate Order be admitted, the families still remaining in the *Neuroptera* will be scarcely less discordant than before, and it follows that the

* The only well-authenticated exception is *Enoicyla pusilla,* Burm., which is not a British species.

Planipennes of Latreille (excluding the *Perlidæ* and *Termitidæ*) must also be divorced from their former associates. Therefore it seems that either the *Neuroptera* of old must be divided into three distinct Orders, or that one of the plans should be adopted, in which all the families with active pupæ are retained in one Order, and the rest (including the *Trichoptera*) placed in another.* I prefer the triple division.

There are those who are of opinion that it is not prudent to separate the *Trichoptera* from their allies, the *Lepidoptera*, but to this I cannot consent, unless it be on the broad principle which denies the existence of *natural* divisions. There can be no doubt that there exist great analogies, but at the same time the *Trichoptera* possess too many differential characters, both positive and negative. The chief of these are the presence of three ocelli (if any) and of mandibles in the pupa state, and the absence of the basal spur on the costa of the posterior wings and of the flattened striated scales. The form of the palpi and the arrangement of the nervures in some of the *Lepidoptera* are almost precisely similar to what is seen in the *Trichoptera*, and in some genera, as for instance *Mormonia* and *Monocentra* (if this genus be truly Trichopterous), there is an approximation in the clothing to that of Lepidopterous scales. Of all Lepidopterous genera that I have examined *Micropteryx* appears to approach most nearly to the *Trichoptera* in its general characters, and in the pupa of this genus there is to be seen a process in front of the head which might be considered equivalent to the mandibles of the pupa in *Trichoptera*, but in an abortive condition.

It has often been asserted that the imagines of the *Trichoptera* are unable to take nourishment, and from the imperfect state of the oral parts this would appear probable, but experience proves that they imbibe the nectar of flowers and other saccharine matters very readily, though I do not pretend to say by what means. Every Lepidopterist must have observed them on his "sugared" trees, and on the flowers of ivy, &c., and Mr. Nietner has recorded that in Ceylon he has seen some species by myriads on the coffee-trees, when these were covered with the *Aphis*-secretion known as honey-dew.

* Erichson proposes to transfer all the families with active pupæ to the *Orthoptera*, forming them into a section of that order under the term *Pseudo-Neuroptera*. While this would certainly tend to render the *Neuroptera* (in the sense used by him) more homogeneous, it would have the effect of making the families of *Orthoptera* more discordant. Are they not sufficiently so already?

Characters of the Families.

These divisions are most readily separated according to the number of joints in the maxillary palpi *of the males*; thus—

A. Not more than four joints . . . Heteropalpoidea, Kolenati (1848) Inæquipalpidæ, Kolenati (1859).

- *a* Joints four . . . . *Phryganidæ.*
- *aa* Joints three . . . . *Limnephilidæ.*
- *aaa* Joints two or three, differing greatly in structure from those of the females . . . . . . *Sericostomidæ.*
- *aaaa* Joints four. Insects minute and very hairy . . . . *Hydroptilidæ.*

B. Five joints (similar to those of the female) . . . . Isopalpoidea, Kolenati (1848) = Æquipalpidæ, Kolenati (1859).

- *b* Palpi very hairy; terminal joint flexible but simple . . . . . . *Leptoceridæ.*
- *bb* Palpi as a rule slightly hairy; terminal joint very long and multiarticulate . . . . *Hydropsychidæ.*
- *bbb* Palpi usually scarcely hairy; terminal joint cylindrical . . . *Rhyacophilidæ.*

The larvæ of the first five families live in portable cases; those of the other two, either free under stones, or in fixed cases.

For more detailed characters, see those given under each family, remembering that these strictly apply only to British, or at any rate to European, forms.

Generic characters.

There is probably no subject on which more difference of opinion exists than that of genera, owing to these divisions being in reality man's invention for his own convenience, but nevertheless indispensably necessary.

To a beginner in the study of the *Trichoptera* I would beg to offer the following hints on this subject. Being satisfied as to the family to which an insect under examination pertains, first ascertain the number of the tibial spurs, as it is a recognized rule that all the species of a genus should agree in this respect. The form and proportions of the joints of the palpi should be next consulted. Then the arrangement of the nervures of the wings* should be

* See the "Index wings" in Plate III. fig. 5, where the nervural nomenclature is explained. It must be remembered that although, as a rule, the

carefully traced out, as this differs considerably in different genera, but much more so in some families than in others. I have endeavoured to render this latter subject more readily comprehensible by giving outline figures of the neuration of each genus. In the larger forms, the neuration can be readily traced by the aid of an ordinary lens, but in the smaller it is necessary to use a compound microscope with a low power object-glass (a "three-inch" is sufficient for all ordinary purposes), taking care to entirely denude the wing of its hairy clothing, and to place the detached wing on a glass slide, and cover it with a piece of thin microscopic glass, so as to flatten it out. The transverse veins are the most difficult to discriminate, but at the same time furnish most important characters. Lastly, the general shape of the wings and other minor differences must be taken into account.

Specific characters.

The *Trichoptera* have suffered, perhaps more than other insects, from ignorance of the existence of characters whereby most of the species may be separated almost without a possibility of error. Many of them vary greatly in coloration, and as this was at one time the chief character attended to by descriptive writers the number of synonyms is something alarming.

Rambur was the first to point out that in the parts subservient to the procreation of each species there are to be found structural characters of the utmost value, which had been almost entirely overlooked. This step in advance was further greatly extended by Dr. Brauer, and since much more so by Dr. Hagen. Such indeed is the importance of these structural characters, that it is absolutely necessary that all descriptive works on new species should give full details of these parts, and, if possible, figures also.

It is in the males that the anal appendices and generative organs are most prominent and present the most appreciable specific characters. (Rambur erroneously states the contrary.) The arrangement of these appendices, &c., varies so greatly in different genera, and even sometimes in different species of the

arrangement of the nervures in the *Trichoptera* is very little prone to variation in different individuals of the same species, still occasionally specimens are found in which some of the transverse veins are absent, or additional ones inserted, and even the longitudinal veins sometimes depart from the ordinary plan. However these are rare occurrences, and not likely to mislead the student. An extreme instance is figured at Plate IV. fig. 2.

same genus, that it is impossible to give any general description. I may say however that in the males there are three pairs of appendices, properly so-called, some of which are wanting in certain genera. Of these, two pairs are lateral and form the superior and inferior appendices. Between the upper pair, there is usually another pair, thin and pointed, forming the intermediate appendices. Besides these there are generally an upper and under penis-cover, and one or two pairs of sheaths. The form of the penis itself must also be taken into consideration. The upper margin of the last abdominal segment also varies in shape and is often produced in the middle into a lobe, which is either a prolongation of the margin itself, or proceeds from under it; the lower or ventral margin less frequently possesses a lobe. The ventral surface of the last segments often presents processes which are of great specific value.

In the females the discrimination of the various parts is much more difficult. There are usually two pairs of valves closing upon a tubular piece, whence the eggs are protruded. Sometimes there is a long exserted ovipositor.

When possible, it is always advisable to examine living specimens, or those that have been recently killed, for it must be borne in mind that some of the parts are membranous or fleshy, and often undergo great changes of form in drying, and also that the drying of the internal fluids, and the collapsing of the walls of the abdomen, cause even the horny parts to be unnaturally protruded or retracted.

The outline figures of the appendices in the plates are all lithographed from my own drawings, made, when possible, from fresh examples. No doubt in many of the more intricate forms the drawings are susceptible of very great improvement.

Throughout this Monograph the following abbreviations are used: "app. sup." for superior appendices, "app. intermed." for intermediate appendices, and "app. inf." for inferior appendices.

In the examination of these parts I use a simple quarter-inch lens, but a "Stanhope" or "Codrington" will probably be found more suitable to some sights; however, this is very much a matter of habit.

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Fam. PHRYGANIDÆ.

Antennæ stout, about the length of the wings, basal joint thicker than the others, but not much longer; ocelli always present; maxillary palpi very slightly hairy, four-jointed in the males, first joint very short, the three others longer; joints flattish, often concave on the inner or under side, terminal joint ovate;

maxillary palpi of the females five-jointed, basal joint short, the others of nearly equal length; labial palpi with the three joints of about equal length; body robust; wings ample, the hairy clothing very short and slight, sometimes with longer erect hairs on the nervures, neuration strong; anterior wings elongate, obtuse, but usually less so in the females than in the males, discoidal cell alway closed, long and narrow, subcosta united to the costa by a transverse oblique vein placed at about two-thirds of its length from the base (*Agrypnia* excepted), anastomosis complete; posterior wings very broad, rounded at the apex, folded when the insect is in repose; legs strong, tibiæ and tarsi usually spinose, spurs always 2-4-4.*

Larva: Head oval, small, second segment narrowly transverse, third and fourth broad, nearly quadrate, rounded at the sides, fifth very narrow, produced at the sides and in the middle above, sixth to twelfth nearly equal in size, depressed, carrying isolated respiratory filaments, which are usually turned over the back, thirteenth segment smaller than the preceding ones and furnished with two hooks; legs not very long, on the underside, between the two anterior legs, there is a pointed somewhat curved horny prolongation.

Pupa: Stout; mandibles small, not toothed internally; abdomen produced at the sides, which towards the apex are fringed with long hairs; respiratory filaments as in the larva.

Case always a cylindrical tube of nearly equal diameter throughout,† formed of small pieces of vegetable fibres cut in equal lengths and arranged side by side in a spiral manner; sometimes the leaves of water plants are used, and arranged in the same manner. The case is always free when the occupant is in the larva state, but before it changes to a pupa, it fixes the case at one end to water plants, and draws together a few leaves or fibres over the other.

Inhabit standing, or very slowly running, waters.

* Throughout this Monograph the usual plan of abbreviation in numbering the tibial spurs has been adopted:—thus "spurs 2-4-4" means that the anterior tibiæ have two spurs (both apical); the intermediate tibiæ four spurs (one pair apical, the other median); the posterior tibiæ the same as the intermediate: "spurs 1-3-4" means that the anterior tibiæ have one spur, the intermediate tibiæ three spurs, and the posterior tibiæ four spurs; and so on. Care must be taken not to confuse the *spurs* with the *spines* which are so plentiful on the tibiæ of some genera.

† The larvæ have the power of turning themselves in the cases, and present their heads indiscriminately at either end. I have watched a large larva of *Phryganea grandis*, which had been deprived of its case, eject a larva of *Neuronia ruficrus*, but the case of the latter being far too small, it soon rejected it; and after wandering about houseless for a few days, and not having suitable materials at hand for the construction of a new home, it died.

This family may be readily distinguished by the four-jointed maxillary palpi of the males, and by the number of the tibial spurs being always 2-4-4. It comprises some of the largest and most handsome insects in the Order, but is poorly represented in Great Britain. The species, at any rate those that we possess, are heavy-flying nocturnal insects. The handsome continental *Holostomis phalænoides** is migratory, sometimes appearing in large numbers, and then disappearing for years. No insect belonging to this family, or to the *Limnephilidæ,* has yet been found south of the equator, but I think it not impossible, that, when more is known of the insect fauna of the southern parts of South America, there may be found some southern exponents of these families.

The British genera are three in number, and may be tabulated thus:—

A. Wings distinctly clothed with short hairs; tibiæ strongly spinose . . . . *Phryganea.*
B. Wings almost devoid of hairy clothing; tibiæ scarcely spinose.
  a. Apex of anterior wings elliptical . . . . *Neuronia.*
  b. Apex of anterior wings obliquely truncate . *Agrypnia.*

Genus Phryganea, Linné.

Antennæ stout, basal joint short, bulbous. Head broad. Eyes very prominent. Maxillary palpi of the male moderately hairy, with very short basal joint, the rest of nearly equal length, concave on the under surface, terminal joint narrower than the others; of the female, with short basal joint, second and third of equal length, broad, fourth and fifth of equal length, narrow. Labial palpi with the three joints of nearly equal length, terminal joint ovate. Prothorax very hairy. Mesothorax broader than the head. Anterior wings broad, more elongate in the female, apex rounded, hairy covering short but rather dense, neuration strongly marked, radius strongly bent before its termination, discoidal cell long and narrow, first apical cell reaching almost half along the discoidal, truncated at the base, fifth apical cell very acute at the base; in the female the posterior branch of the *ramus thyrifer* (or seventh apical sector) is furcate, whereas in the male it is simple (in *P. minor* it is simple in both sexes). Posterior wings shorter and broader than the anterior,

* This insect has been included in the British list (by Turton), but there is no good evidence that it has really been found in these islands; nevertheless the habit of the species renders its occasional occurrence here not improbable. It is a North-European species, but not exclusively so, Scopoli (*P. speciosa*) having included it in his "Entomologia Carniolica."

discoidal cell short and triangular, first apical sector united to the radius by a transverse vein, fifth apical sector furcate in the female, simple in the male. Legs stout, femora deeply grooved beneath, tibiæ and tarsi with very short spines, the anterior more strongly so than the others, spurs rather long, the pairs nearly equal. Abdomen robust, especially in the female; in the male the terminal segment is strongly fringed with long hairs and furnished with long prominent appendices; in the female the apical segment beneath forms a hollow egg-pouch, with two superior and two lateral valves.

Larva inhabiting standing waters, or very slowly running rivers. (See Pl. II. fig. 10.)

Case composed of vegetable fibres or pieces of leaf, &c., cut into equal lengths, and arranged side by side in a spiral manner toward the left.

This genus, as now restricted, contains the largest species of British Trichopterous insects. They are sluggishly-flying nocturnal creatures, well known to all Entomologists, and possess a strong, but not very disagreeable odour.

According to the neuration, it would perhaps have been better to place *P. minor* in a separate genus. I have, however, seen a female of *P. grandis* in which the seventh apical sector was (aberrantly) not furcate.

We possess five species, as follows:—

A. *Seventh apical sector of the anterior wings furcate in the female.*

1. *Phryganea grandis*, Linné.

(Pl. II. fig. 23, case; Pl. III. fig. 1, neuration and palpi; Pl. IX. fig. 1, appendices.)

Phryganea grandis, Linn. Faun. Suec. n. 1485 (1761), and other authors; *P. atomaria*, Steph. (*) Ill. p. 206, 3 (1837); *Trichostegia grandis*, Kol. Gen. et Spec. Trichop. pt. 1, p. 84, 1.

Antennæ brown, with narrow yellowish annulations. Head dark fuscous, with long cinereous hairs. Palpi fuscous. Prothorax thickly clothed with long cinereous hairs. Mesothorax dark fuscous, darkest at the sides. Anterior wings in the male greyish-brown, clouded and irrorated with dark brown; a somewhat conspicuous elongated ashy spot in the sixth apical cell, and a smaller round one at the base of the third; veins fuscous. Posterior wings dull greyish-brown, palest towards the base; apical veins broadly margined with fuscous. In the female the anterior wings are cinereous, clouded with brown; a rather broad interrupted blackish streak runs from the base to near the apex, terminating at the pale spot in the sixth apical cell. Legs testaceous; anterior femora and the apices of the tarsal joints fuscous. Abdomen brownish above, more ochreous beneath. In the male the terminal abdominal segment is fringed with long reddish hairs; app. sup. long, cylindrical, curved inwards and downwards, with thickened apices and with a short triangular tooth at the base; app. inf. large, hollow, truncated at the extremity and lying close together, the margins turned inwards and toothed; ventral lamina broad, apex produced, obtusely rounded. In the female the lateral valves are acute at the apices.

Expanse of fore-wings, ♂ 21—24 lin.; ♀ 25—26 lin.

Larva dull pale reddish-white. Head with a straight central and two lateral interrupted blackish lines, the latter converging posteriorly. Pronotum with rather broad blackish margins.

A common and well-known insect in lake and marshy districts, appearing in the summer and autumn months. The largest British species of this order. Varies considerably in the intensity of the markings, especially in the female.

2. *Phryganea striata*, Linné. (Pl. IX. fig. 2, app.)

Phryganea striata, Linn. Faun. Suec. n. 1483 (1761), and succeeding works; Hag. (*) Linn. Ent. p. 363; Brauer (*), Neurop. Aust. p. 45, fig. 38, App.; *P. Beckwithii* (Leach, MS.), Steph. (*) Ill. p. 206, 2 (1837); *P. fulvipes*, Burm. Handb. p. 934, 4 (1839).

Antennæ black, with indistinct paler annulations, most distinct towards the apex. Head piceous, clothed with pale brown hairs. Palpi fuscous. Prothorax thickly clothed with brown hairs. Mesothorax piceous. Anterior wings cinereous, irrorated with dark grey or brown, clouded with darker, a somewhat elongate more or less indistinct pale spot in the sixth apical cell, and a small round one at the base of the third; veins fuscous. Posterior wings wholly brownish-grey, apical veins conspicuously dark brown. Legs: anterior and intermediate thighs wholly fuscous, tibiæ and tarsi testaceous, with broad blackish annulations; posterior legs almost wholly testaceous. In the female the anterior wings have a short longitudinal blackish line and shorter blackish dashes. Abdomen piceous, paler beneath. In the male the last abdominal segment is fringed above with long reddish hairs; app. sup. long, cylindrical, nearly parallel, with a rounded lobe at the base, apices thickened and turned slightly upwards and outwards, and furnished with long hairs; app. inf. short, hollow, the margins obliquely rounded; ventral lamina short, broad and rounded. In the female the lateral lobes are broadly rounded.

Expanse of fore-wings, ♂ 17—22 lin.; ♀ 24 lin.

Appears in summer with the preceding species, and is, perhaps, almost as common.

These two species are very generally mixed in collections. To Dr. Hagen is due the credit of having first pointed out the differences (Linnæa Entomologica, Bd. 5, p. 363). *P. striata* is always smaller, darker and more uniform in coloration, and the female has but small traces of the dark band so conspicuous in *P. grandis;* the structural differences in the appendices are most conclusive, but a practised eye can readily separate them without regard to these latter characters.

3. *Phryganea varia*, Fabricius. (Pl. IX. fig. 4, app.)

Phryganea varia, Fab. Ent. Syst. p. 77, 10 (1793); Donov. Brit. Ins. 8, pl. 277, fig. 1; Pict. Recherch. p. 160, 31, pl. 11, fig. 1; Steph. (*) Ill. p. 206, 4; Burm. Handb. p. 934, 2; Zett. Ins. Lapp. col. 1061, 4; Ramb. Hist. Nat. Névrop. p. 471, 2; Brauer (*), Neurop. Aust. p. 45, fig. app. 36; Hag. (*) Ent. Ann. 1859, p. 67, 3; *Trichostegia varia*, Kol. Gen. et Spec. Trichop. pt. 1, p. 86, 2; *P. annularis*, Oliv. Encyc. Méthod. p. 558, 16; *P. variegata*, Humm. Ess. ii. 23, tab. 6, fig. 1 (1822).

Antennæ testaceous, with broad black annulations. Head piceous, with grey hairs. Palpi fuscous. Prothorax thickly clothed with grey and black hairs. Mesothorax piceous, with two median parallel lines of grey hairs. Anterior wings pale grey, thickly clouded and spotted with blackish-brown, large dark and light blotches alternating along the inner margin, two conspicuous white spots, one rather elongate, in the sixth apical cell, and a small round one at the base of the third; veins dark fuscous, sometimes much suffused towards the apex. Posterior wings smoky grey, veins darker. Legs testaceous, the anterior and intermediate tibiæ and tarsi conspicuously, and the posterior indistinctly, annulated with dark fuscous. Abdomen testaceous, somewhat fuscous above, paler beneath. In the male the last abdominal segment and app. sup. are fringed with very long reddish-ochreous hairs, fuscous at the extremities; app. sup. foliaceous, short, broad and rounded; app. inf. long, curved strongly upwards, the tips approximating; penis long and exserted, pale yellow.

Expanse of fore-wings 13—18 lin.

Larva shining greenish, head and pronotum fawn-coloured;

head with a straight median blackish line, and with two lateral black lines uniting anteriorly; pronotum bordered with black anteriorly and posteriorly; mesonotum and metanotum greenish, with paler markings; coxæ with a blackish line.

This prettily marked species is common at the end of summer and in the autumn. It frequents the neighbourhood of ponds, small lakes and marshes, and is frequently found at the saccharine mixture used by Lepidopterists to attract *Noctuæ*, and not infrequently mistaken for a moth by the uninitiated.

4. *Phryganea obsoleta*, Hagen. (Pl. IX. fig. 3, app.)

Phryganea obsoleta, Hag. (*) Stett. Zeit. 1858, p. 114.

Antennæ dark fuscous, with testaceous annulations. Head dark blackish-fuscous, sparingly clothed with grey hairs. Palpi fuscous. Prothorax thickly clothed with greyish hairs. Mesothorax dark reddish or blackish-fuscous. Anterior wings pale grey, with indistinct darker cloudings and reticulations; apical margin spotted with fuscous at the terminations of the apical veins; three small white spots, one at the base of the third apical cell, another rather larger about the middle of the sixth apical cell, and a third in the middle of the wing a little below the thyridium (these markings are generally indistinct); neuration fuscous. Posterior wings very pale grey, subhyaline; neuration pale testaceous, becoming fuscous towards the apex; the extreme apical edge narrowly fuscous. Legs dark testaceous, with a few black spines; anterior and intermediate tibiæ and tarsi with dark fuscous rings; posterior tibiæ and tarsi slightly fuscous at the knees and apices. Abdomen dark blackish-fuscous. In the male the upper margin of the last abdominal segment is furnished with a fringe of long stiff yellow hairs; the app. sup. appear to be wanting; app. inf. long, curved upwards, subcylindrical, the basal portion externally fringed with long yellow hairs, the extreme apex dilated and truncated, and furnished beneath with a long thin slightly bent spine, which is directed downwards.

Expanse of fore-wings 13—15 lin.

A single male example of this species was taken on Skiddaw in July, 1854, by Mr. T. Chapman of Glasgow; this is now in my collection. I have since received a second example from Mr. Bond, who obtained it from the late Mr. Heysham's collection; it was probably taken in the North of England.

On the occasion of Dr. Hagen's last visit to this country he saw this insect, and, without close examination, named it *Agrypnia picta* of Kolenati, and I brought it forward under this name, and noticed it in the Ent. Ann. for 1862, p. 26. I always had a suspicion that the insect was a true *Phryganea*, rather than an *Agrypnia*, and at the last moment I fortunately received from Dr. Hagen types of *P. obsoleta* and *A. picta*, and have no hesitation in declaring my insect to be the former; *A. picta* must, therefore, be erased from our lists for the present, but it is extremely likely to be found in the northern parts of this island. The two species bear very considerable superficial resemblance to each other, but *A. picta* is decidedly narrower-winged, and with the apex more sharply truncated (characteristic of the genus); the head is less transverse; the markings are somewhat the same, but in *A. picta* the small white spots are absent, and there is a dark fuscous spot on each side of the pterostigma, almost encircling it; there is also a fasciate brown band near the apex, which is not defined in *P. obsoleta*. The form of the appendices is altogether different. The published descriptions of both insects are too short to be of much service. *P. obsoleta* might be mistaken for a small and much faded example of *P. varia*, but the wings of the latter are decidedly longer and narrower in proportion; the anal appendices of the males are also dissimilar, especially the app. sup., which are invisible or wanting in *P. obsoleta*.

B. *Seventh apical sector in the anterior wings simple in both sexes.*

5. *Phryganea minor*, Curtis.

Phryganea minor, Curt. (*), Phil. Mag. p. 125, 6 (1834); Brit. Ent. pl. 592; Steph. (*) Ill. 207, 5; Hag. (*) Ent. Ann. 1859, p. 67, 4; *P. mixta*, Burm. Handb. p. 934, 1 (1839); *P. tortriceana*, Ramb. Hist. Nat. Névrop. p. 471, 3 (1842); *Trichostegia minor*, Kol. Gen. et Spec. Trichop. pt. 1, p. 87, 3.

Antennæ testaceous, with fuscous annulations, the few first joints altogether fuscous. Head piceous, with greyish-ochreous hairs. Palpi fuscous. Mesothorax fuscous. Anterior wings fuscous, thickly spotted and irrorated with grey or ochreous grey; on the costa the markings form large blotches, and on the inner margin short oblique streaks, the last of which forms a nearly complete fascia across the wing close to the apex; there are also a few dark, almost black, dashes; apical margin regularly spotted, fuscous and grey alternating; neuration fuscous. Posterior wings smoky-grey, subhyaline; neuration fuscous, somewhat clouded at the apex. Legs testaceous; anterior thighs wholly fuscescent; anterior and intermediate tibiæ with a broad blackish ring at the apex, and the tarsi spotted with fuscous; posterior tarsi slightly fuscescent. Abdomen dark testaceous. In the male the upper margin of the last abdominal segment is fringed with long hairs; app. sup. small, almost entirely concealed; app. inf. long, broad at the base, directed inwards and upwards, brown at the tips, testaceous at the base; app. intermed. (?) long and needle-shaped, curved inwards and upwards. In the female the apex of the abdomen is very obtuse, with the appendices not evident.

Expanse of fore-wings $8\frac{1}{2}$—10 lin. The female rather larger than the male.

Until recently this was a scarce species. In 1863 Mr. Barrett discovered it in abundance near Haslemere, Surrey, and in July in that year I took upwards of forty examples in one day at his locality. They hid themselves in the day-time in the chinks of the bark of oak trees, which they greatly resembled in colour.

Genus Neuronia, Leach, Stephens.

Antennæ stout, basal joint short, bulbous. Head small, transverse. Maxillary palpi of the male slightly hairy, basal joint short, second and third joints broad, the third longer than the second, terminal joint still longer, narrow, the joints thin and compressed; of the female, with short basal joint, second and third joints broad, the third rather the longest, fourth and fifth joints narrow, of nearly equal length. Labial palpi with short broad joints, first joint truncated at the summit, second joint rather narrower, pyriform; terminal joint broadest of all, ovate. Prothorax very narrow, hairy. Mesothorax much broader than the head, smooth and shining. Anterior wings broad, shining, with scarcely any perceptible hairy clothing, apex elliptical; neuration very strongly marked, alike in both sexes, radius sharply bent before its termination, discoidal cell long and narrow, first apical cell reaching to the middle of the discoidal, fifth obliquely truncated at the base. Posterior wings rather shorter than the anterior, with elliptical apex, discoidal cell short and narrow, first apical sector united to the radius. Legs moderately stout, tibiæ and tarsi with few very short spines, spurs short, equal. Abdomen robust, the male with long needle-shaped appendices; terminal segment in the female very broad, with shorter and thicker appendices.

Larva inhabiting standing waters. (See Pl. II. fig. 17.) Case a cylindrical tube, composed of root-fibres and pieces of leaves arranged in a spiral manner.

Of this genus we have in this country only one species, a dull-coloured insect, but some of the Continental and American species are remarkable for the sharpness and contrast of their markings.

Kolenati in the first part of the "Genera et Species Trichopterorum" incorrectly applies the generic term *Anabolia* to these insects, but corrects his error in the second part (p. 284).

1. *Neuronia ruficrus*, Scopoli.

(Pl. II. figs. 1, 17, larva and pupa; Pl. III. fig. 2, neuration and palpi; Pl. IX. fig. 5, app.)

Phryganea ruficrus, Scop. Ent. Carn. 690 (1763); Hag. (*) Stett. Zeit. 15, p. 87; *Neuronia ruficrus*, Brauer (*) Neurop. Aust. p. 44; Hag. (*) Ent. Ann. 1859, p. 68, 5; *N. fusca*, Steph. (*) Ill. p. 234, 1, pl. 24, fig. 2 (1837;) *P. striata*, Burm. Handb. p. 935, 6 (1839); *Oligotricha chloroneura*, Ramb. Hist. Nat. Névrop. p. 473, 3 (1842); *Anabolia analis*, Kol. Gen. et Spec. Trichop. pt. 1, p. 80, 1 (1848).

Antennæ black. Head shining black. Prothorax thickly clothed with reddish-ochreous hairs, most evident beneath, especially in life. Mesothorax shining black. Anterior wings uniform, shining fuscous, the veins piceous and very distinct. Posterior wings paler, but otherwise similarly coloured. Legs fuscous; posterior tibiæ ochreous, fuscous at the base. Abdomen dull, blackish. In the male the upper margin of the last abdominal segment has a fringe of long hairs in the middle, and is furnished with a long triangular process, fringed with very long somewhat ochreous hairs; app. sup. small, not very evident; app. inf. very broad, shining black, furnished at the apex with a long moveable spine-like process directed downwards. In the female there are two short obtuse somewhat converging app. intermed., and two longer curved app. inf., the latter not always visible; the abdomen of the female is broader and more depressed than that of the male.

Expanse of fore-wings ♂ 14—15 lin.; ♀ 17—18 lin.

Larva dull green, with a slight reddish tinge. Head and pronotum yellowish, with two parallel slightly-interrupted black stripes, meeting round the front of the head; these stripes are continued down the meso- and meta-notum, but are less conspicuous there. Respiratory filaments whitish. Legs marked with blackish. Anal crotchets yellowish, marked with blackish at the base.

A not uncommon species in the metropolitan district, frequenting ponds and canals, probably generally distributed. Appears at the beginning of May, and lasts for some weeks.

When it first emerges from the pupa the wings are almost colourless, and the veins not darker. The type of *O. chloroneura* of Rambur was in that condition.

Genus Agrypnia, Curtis.

Antennæ not very robust, basal joint stout. Head transversely quadrate. Eyes very prominent and large. Maxillary palpi in the male compressed, with short rounded basal joint, second third and fourth joints long, the last somewhat ovate. Labial palpi with very broad almost quadrate basal joint, second joint shorter and smaller, third joint longest, narrow. Prothorax hairy. Mesothorax scarcely broader than the head. Anterior wings elongated, rather narrow, dilated before the somewhat obliquely truncated apex, with very short and sparse hairy covering, costa rounded; neuration moderately distinct, not differing in the sexes, radius with a very slight bend (in *A. Pagetana*) before the termination, discoidal cell narrow, first apical cell reaching one-third along the discoidal, fifth acute at the base. Posterior wings subhyaline, with elliptical apex, first apical sector united to the radius by a transverse vein; discoidal cell short, broad and almost triangular. Legs moderately stout, tibiæ and tarsi almost spineless; spurs short, of equal length. Abdomen in the male much dilated towards the extremity, broad and somewhat depressed, terminal segment fringed with long hairs, and furnished with long corneous appendices; penis broad, with needle-shaped sheaths.

Larva inhabits marshes and still waters. Case "consisting of root-fibres of equal length, arranged close together in a spiral turned to the right." (Hagen.)

We have but one species in this country, which has, at first sight, the appearance of belonging to the *Limnephilidæ*.

The typical specimen in the British Museum, from which Curtis' figure was taken, has a remarkably broad and depressed abdomen, and Dr. Hagen seems to think that it has been accidentally pressed flat (Ent. Ann. 1859, p. 71); it would, however, appear that the abdomen has a tendency to assume this flattened appearance, at any rate after death, as I possess several specimens in which the depression is almost as great as in Curtis' type.

I have never seen these insects alive, but they are said to repose with their wings flatter than in other genera.

1. *Agrypnia Pagetana*, Curtis. (Pl. III. fig. 3, neuration.)

Agrypnia Pagetana, Curt. (*) Brit. Ent. pl. 540 (1835); Steph. (*) Ill. p. 229, 1; Kol. Gen. et Spec. Trichop. pt. 1, p. 78, 1; Hag. (*) Ent. Ann. 1859, p. 70, 6; *Phryganea ægrota*, Burm. Handb. p. 935, 5 (1839); *P. lævis*, Zett. Ins. Lapp. col. 1065, 22 (1840); *Oligotricha strigosa*, Ramb. Hist. Nat. Névrop. p. 473, 4 (1842).

Antennæ testaceous. Head testaceous, with pale yellowish hairs. Palpi testaceous. Prothorax thickly clothed with pale yellowish hairs. Mesothorax testaceous. Anterior wings pale straw-colour, sometimes with an appearance of faint greyish reticulations on the membrane towards the apex; veins brown, distinct. Posterior wings hyaline, yellowish at the apex; veins scarcely darker, excepting the apical. Legs testaceous. Abdomen brown, paler beneath. In the male the upper margin of the last abdominal segment has a long fringe of yellow hair; app. sup. not visible; app. inf. curved upwards, from the base arises a long thin piece, curved upwards and inwards, reaching to the upper margin.

Expanse of fore-wings 11—15 lin.

Not uncommon in the fen district of the eastern counties, appearing in May, and probably continuing out all the summer and the early part of the autumn.

The females appear to be rare, for, although I have examined upwards of twenty individuals, only two are of this sex.

A. picta, Kol., has been erroneously included in our lists. (See remarks to *Phryganea obsoleta*, p. 16.)

Fam. LIMNEPHILIDÆ.

Antennæ about the same length as the wings, basal joint always much longer and stronger than the others; ocelli always present; maxillary palpi very slightly hairy, three-jointed in the males, joints nearly cylindrical, basal joint short; maxillary palpi of the females five-jointed; body less robust than in the *Phryganidæ;* anterior wings various in form, usually only slightly clothed with hair, but sometimes with numerous strong erect hairs, neuration not very strong, discoidal cell always closed (in both pairs of wings), long and narrow, subcostal vein not united to the costa by a transverse vein beyond the middle, anastomosis complete; posterior wings broad, folded, discoidal cell similar in form to that of the anterior wings; legs strong, tibiæ more or less spinose, spurs various, but always with one spur on the anterior tibiæ (except in *Chæto-pheryx* ♂).*

Larva: Head usually oval, small, second segment (*pronotum*) rather broadly transverse, almost quadrate, third (*mesonotum*) rounded at the sides, fourth (*metanotum*) almost parallel at the sides, fifth produced at the sides and in the middle above, remaining segments nearly equal in size, furnished with isolated respiratory filaments, hooks on the last segment small; legs long, a horn-like prolongation between the first pair of legs beneath.

Pupa stout, mandibles small, not toothed internally; abdomen very broad, produced at the sides towards the apex and fringed with hairs, terminal segment usually furnished with a pair of long appendices, which however appear to bear no relationship to those of the imago.

Case of various forms and composed of various substances according to the species that makes it, always more or less tubular. In those genera the species of which inhabit standing waters the case is always free whilst the occupant is in the larva state, but in those that inhabit streams it is temporarily fixed by one end to stones, &c.

The genera comprised in this family have been united with the *Phryganidæ* by most authors; the three-jointed maxillary palpi of the males will however readily separate them from that family. The *Limnephilidæ* are usually insects of large size and powerful flight, strictly nocturnal in their habits. They may often be found at a great distance from places where they could have been bred, and are fond of taking refuge in the day-time in trees, and especially in firs, and if disturbed dash out with great velocity; they are most numerous in temperate climates, but some species are found very far north. One species, not yet found in this country, lives out of the water in the larva state, a habit unique in this Order.

The following is an attempt to tabulate the rather numerous genera in this family:—

A. Spurs 1-3-4.

  a. Anterior wings distinctly granulated, short and broad . . . . *Phacopteryx.*

* In two European genera, *Enoicyla*, Rambur, and *Peltostomis*, Kolenati—neither of which is represented in this country—the anterior tibiæ of the males have no spur. *Peltostomis* I know by description only.

b. Anterior wings not distinctly granulated, elongate.	
1. A dark line in apex of posterior wings, apex pointed .	*Grammotaulius.*
2. No dark line; apex not pointed.	
* Apex of anterior wings more or less truncated . . .	*Colpotaulius* and *Limnephilus.*
** Apex of anterior wings parabolic or rounded	*Anabolia* and *Stenophylax.*
B. Spurs 1-3-3	*Halesus.*
C. Spurs 1-2-3	*Ecclisopteryx.*
D. Spurs 1-2-4	*Apatania.*
E. Spurs 0-3-3 (♂); 1-3-3 (♀)	*Chætopteryx.*

Genus Colpotaulius, Kolenati.

Antennæ moderately stout, tapering, basal joint about the length of the head, very slightly curved. Head nearly quadrate. Maxillary palpi of the male with short basal joint, second joint long, third somewhat shorter than the second and slightly compressed; of the female, with short basal joint, second third and terminal joints of nearly equal length, fourth shorter. Labial palpi with broad and compressed basal joint, second joint narrower, terminal joint oval, slightly longer than the others. Prothorax moderately developed, very hairy. Anterior wings narrow, hairy covering rather dense, apical cilia evident; costal margin much rounded, apical margin obliquely truncated, dorsal margin nearly straight, neuration strongly marked, radius with a scarcely perceptible bend before its termination, pterostigma never marked, apical cells all reaching the anastomosis. Posterior wings very deeply excised just below the rounded apex, hyaline, cilia evident. Anterior tibiæ with few spines and one moderately long apical spur; intermediate tibiæ strongly spinose, one long spur in the middle and two at the apex, of which the inner is the longest; posterior tibiæ also strongly spinose, with two long median and two apical spurs, the inner the longest in both pairs.

Larva unknown.

This genus, first formed by Kolenati in the first part of his "Genera et Species Trichopterorum," has been adopted by Brauer, but is considered as forming only a section of *Limnephilus* by Dr. Hagen. The single British species has a general appearance and habits so different from the species of that genus, that I think it best to adopt Kolenati's view and keep it distinct.

1. *Colpotaulius incisus*, Curtis.

(Pl. III. fig. 4, neuration; Pl. IX. fig. 6, app.)

Limnephilus incisus, Curt. (*) Phil. Mag. p. 124, 17 (1834); Steph. (*) Ill. p. 228, 48; Hag. (*) Ent. Ann. 1859, p. 73, 8; *Limnephila striolata*, Ramb. Hist. Nat. Névrop. p. 478, 9 (1842); *Colpotaulius excisus*, Kol. Gen. et Spec. Trichop. pt. 1, p. 48, 1 (1848); *Limnephilus vulsellus*, Walk. (*) Brit. Mus. Cat. Neurop. pt. 1, p. 23, 17 (1852); Kol.?

Antennæ testaceous, with indistinct darker annulations. Head brownish in the middle, bordered with testaceous. Palpi testaceous. Prothorax clothed with brownish hairs. Mesothorax shining, brownish. Anterior wings straw-yellow, darkest towards the dorsal margin, where there are sometimes well-defined brown irrorations; veins testaceous, with black hairs set at regular distances, giving them the appearance of being finely pointed with black. Posterior wings hyaline, sometimes slightly yellowish at the apex; apical veins distinct, somewhat brownish. Legs testaceous, with black spines and testaceous spurs. Abdomen greyish-brown above, ochreous beneath. In the male the upper margin of the last abdominal segment is rounded; app. sup. broad, flat, very obtusely rounded, yellowish and fringed with short hairs; app. intermed. short, divergent, shining brown, scarcely visible; app. inf. nearly obsolete, in their place is a thin tuft of blackish hairs. In the female the extremity of the abdomen is obtuse, with scarcely any appendices; from the middle of the last segment above them arises a short broad triangle, on each side of which is a small hairy valve; lateral valves short, broad and rounded.

Expanse of fore-wings 6—9 lines.

Appears in summer and autumn, frequents the sides of canals and the weedy margins of ponds and marshes, and in the daytime conceals itself under the herbage and dead leaves, &c., running about with great activity, if disturbed. The male seems to be less frequent than the female, at least this is my experience.

Genus Grammotaulius, Kolenati.

Antennæ with long curved basal joint. Head above nearly quadrate. Maxillary palpi of male with short basal joint, two others about equal, long; of the female with short basal joint, fourth joint considerably shorter than the 2nd, 3rd or 5th. Labial palpi compressed, first and second joints broad, terminal joint oval. Prothorax moderately developed, hairy. Anterior wings long, very narrow at the base, much dilated before the acute apex, dorsal margin slightly convex, hairy clothing very slight, cilia scarcely evident; neuration not very strongly marked, radius with a marked bend before its termination, no coloured pterostigma, apical veins all reaching the anastomosis. Posterior wings hyaline, with a slight excision just below the acute apex, a long black apical line following the course of the fourth apical sector. Tibiæ slightly spinose; anterior with one long apical spur; intermediate with one long median spur and two apical, of which the inner is the longest; posterior with two long apical and two median spurs, the inner the longest in both pairs. Anal appendices of the male arranged as follows:—App. sup. large, broad and furcate; app. intermed. large, flat and straight; app. inf. fine, hairy; sheaths furcate, the points approximating; penis with thickened apex. The female has two hairy app. sup., and between these two triangular obtusely pointed valves.

The species on which Kolenati founded this genus appear to me to bear him out in his idea, as they have a peculiar *facies*, altogether different from most of the species of *Limnephilus* with which they have been generally associated, and much resemble each other. They are large insects inhabiting marshy districts.

The blackish apical line in the posterior wings is not constant, as occasionally specimens are found (aberrantly) without any trace of it; these are generally females.

1. *Grammotaulius nitidus*, Müller.

(Pl. IV. fig. 1, neuration; Pl. IX. figs. 7, 8, app.)

Phryganea nitida, Müll. Faun. Fridrichs. p. 65, 569 (1764); Zool. Dan. p. 145, 1673; *Grammotaulius nitidus*, Brauer (*), Neurop. Aust. p. 52, fig. 93, 94, app.; *Limnophilus nitidus*, Hag. (*) Ent. Ann. 1859, p. 74, 10; *P. lineola*, Schrk. Ins. Aust. p. 307, 613 (1781); *G. lineola*, Kol. Gen. et Spec. Trichop. pt. 1, p. 39, 1; *Limnophilus gracilis*, Burm. Handb. p. 932, 12 (1839).

Antennæ pale dull yellowish. Head reddish, with short golden yellow hairs. Palpi dull yellowish. Prothorax very thickly clothed with long pale golden-yellow hairs. Mesothorax pale reddish-brown. Anterior wings with the apex drawn out into an acute point, pale straw-yellow, with a row of small fuscous spots along the dorsal margin, and sometimes, but rarely, with greyish irrorations; veins scarcely darker, but regularly and closely pointed with minute black spots, from each of which springs a hair. Posterior wings subhyaline, sometimes slightly yellowish at the apex, a long black streak along the course of the fourth apical sector. Legs pale testaceous, spines concolorous. Abdomen ochreous. In the male the upper margin of the last abdominal segment is obtusely rounded; app. sup. broad, with a rounded notch dividing them into unequal parts, the upper branch of the fork the broadest, the apices blackish, and fringed with long hairs; app. intermed. straight, about as long as the app. sup., broad, deep black, the apices very obtuse, almost truncated; app. inf. small, finger-shaped, pale yellowish. In the female there are two broad pointed superior valves, and two lateral ones exceeding the superior in length.

Expanse of fore-wings 19—23 lin.

Not a common species; frequents marshes and fenny districts, appearing in summer and autumn.

This and the next were mixed in Stephens's and Curtis's Collections; the shape of the anterior wings will alone readily separate them.

2. *Grammotaulius atomarius*, Fabricius. (Pl. IX. fig. 9, app.)

Phryganea atomaria, Fab. Ent. Syst. p. 78, 15 (1793); *Grammotaulius atomarius*, Kol. Gen. et Spec. Trichop. pt. 1, p. 39, 2; Brauer (*), Neurop. Aust. p. 52, fig. 95, 96, app.; *Limnophilus atomarius*, Hag. (*) Ent. Ann. 1859, p. 74, 10; *Limnephilus strigosus*, Curt. (*) Phil. Mag. p. 122, 3 (1834); *L. lineola*, Steph. (*) Ill. p. 213, 2 (1837); *Limnephila lineola*, Ramb. Hist. Nat. Névrop. p. 474, 1; *Phryganea irrorata*, Zett. Ins. Lapp. col. 1063, 11 (1840).

Antennæ reddish-testaceous, rather darker at the tips. Head dull pale reddish. Palpi reddish. Prothorax with dull testaceous hairs. Mesothorax reddish in the middle, fuscous at the sides. Anterior wings obtusely pointed at the apex which is much dilated, shining brownish-yellow, darker towards the dorsal margin, closely sprinkled with small brown spots (costal and subcostal areas excepted), a whitish spot at the thyridium; varies much in the number of spots, in some examples they are very numerous and confluent, in others wanting altogether. Posterior wings subhyaline, slightly yellowish at the apex; most of the veins conspicuously brownish; a blackish streak follows the course of the fourth apical sector, and sometimes a blackish spot at the base of the third. Legs testaceous, more reddish beneath. Abdomen greyish-fuscous. In the male the upper margin of the last abdominal segment is rounded; app. sup. broad, emarginate almost to the base, the forks widely diverging, testaceous; app. intermed. broad, straight, rather longer than the app. sup., obtuse, black; app. inf. small, slightly curved, yellow, hairy. In the female the superior valves are broadly rounded, the lateral valves longer and very acute.

Expanse of fore-wings 18—19 lin.

Not a common species; frequenting the same localities as the last, and at the same time.

The only other European species pertaining to *Grammotaulius* is *Phryganea interrogationis* of Zetterstedt, which may be merely a strongly marked variety of *G. atomarius.*

Genus Limnephilus, Leach.

Antennæ moderately stout, about as long as the wings; basal joint as long as the head, slightly curved, hairy. Head quadrate, small. Ocelli usually prominent and distinct. Eyes prominent. Maxillary palpi in the males long, slightly hairy, the joints thin and subcylindrical, basal joint short, the two others long and of nearly equal length and thickness; in the females with short basal joint, second, third and terminal joints of nearly equal length, long, fourth shorter and somewhat thicker. Labial palpi with broader joints, first and second of nearly equal length, terminal joint longer, subovate. Prothorax moderately developed, hairy. Mesothorax oval, much broader than the head, very convex, usually with a broad depressed median line above. Anterior wings long and narrow, dilated towards the apex, costa more or less rounded, apical margin usually obliquely truncated, dorsal margin gradually concave from apex to base, hairy clothing short and slight; neuration not very strong; radius slightly bent before the termination, discoidal cell long and narrow, first apical cell rather longer than the three following, all the apical cells reaching the anastomosis (except in *L. vittatus*); usually with longish erect hairs on the veins bordering the cubital cells near the base of the wing; often with a coloured pterostigma. Posterior wings hyaline, very broad, somewhat shorter than the anterior, slightly excised below the apex; anal field very large, discoidal cell similar in shape to that of the anterior wings, fourth apical cell not so broad as the second, first apical sector in the male with frequently a short blackish beard in the middle beneath. Legs strong; tibiæ and tarsi strongly spinose; anterior tibiæ with one rather long apical spur; intermediate tibiæ with one long median and two long apical spurs, of which the inner is rather the longest; posterior tibiæ with two long median and two apical spurs, the inner slightly the longest. Abdomen laterally compressed, robust in the female; in the male the upper margin of the terminal segment is frequently produced; appendices varying much, but the species usually have broad and large superior appendices, two long usually pointed intermediate appendices, and two short somewhat upcurved inferior appendices; penis sheaths curved upwards and approximating, between them lies the somewhat flattened penis; the female is furnished with two pairs of valves, which are sometimes appendiciform.

Larvæ inhabiting standing waters of no great depth, or very slowly running canals, &c. (See Pl. II. fig. 11.) Some species appear to breed in boggy situations in which there is scarcely ever any surface water.

Case always free, composed of a great variety of materials, according to the species and to the conditions under which it is placed.

The species are numerous. They are all strongly-flying insects, and in the day-time may be frequently beaten from trees, often at a great distance from water. Marshy and fenny districts are the most prolific in species of this genus.

As might naturally be expected, the species exhibit considerable diversity of structure, and yet they bear to each other analogies so great that it is impossible to satisfactorily group them into distinct genera. This has been attempted by Kolenati in his Monograph, and I have fallen in with his ideas so far as regards *Colpotaulius* and *Grammotaulius*, but am unable to apply his arrangement to the rest of the species; however I have here considered his genera as forming sections, with some slight modifications.

In many species there is a certain character in the markings very useful in describing them, viz., the existence of two more or less distinct pale spaces, one placed obliquely about the middle of the wing, and termed the *fenestrated spot;* the other enclosing the anastomosing transverse veins, and termed the *anastomosal space.*

A. *Apical margin of anterior wings excised.*

(*Glyphotælius*, Steph., *Glyphidotaulius*, Kol.)

1. *Limnephilus pellucidus*, Olivier.

(Pl. IV. figs. 1*a*, 1*b*, 1*c*, palpi; Pl. IX. figs. 11, 12, app.)

Phryganea pellucida, Oliv. Encyc. Méthod. p. 541, 12; Pict. (*) Recherch. p. 146, 17, pl. 8, fig. 4; P. transparente tachetée, De Geer, Mém. 2, p. 526, t. 12, fig. 1—19; *Limnephila pellucida*, Ramb. Hist. Nat. Névrop. p. 485, 24; *Limnophilus pellucidus*, Hag. (*) Ent. Ann. 1859, p. 72, 7; *Glyphidotaulius pellucidus*, Kol. Gen. et Spec. Trichop. pt. 1, p. 37, 2; *Glyphotælius pellucidus*, Brauer, Neurop. Aust. p. 52; *Limnephilus* (*Glyphotælius*) *pellucidula*, Steph. (*) Ill. p. 211, 1; *L. basalis*, Curt. (*) Phil. Mag. p. 122, 1 (1834); *L. emarginatus*, Curt. (*) Phil. Mag. p. 122, 2.

Antennæ brown, indistinctly annulated. Head brown, paler at the sides. Palpi greyish-brown. Prothorax with greyish hairs. Mesothorax reddish-fuscous. Anterior wings with a deep notch in the apical margin; in the male yellowish-grey, thickly sprinkled with brown spots; pterostigma, two rows of small dots towards the dorsal margin, and large spots on the apical margin, dark fuscous, the apical spots alternating with yellowish ones; fenestrated spot oval, large; anastomosal space also large, often confluent with the fenestrated spot and then forming one large crescentic space; veins fuscous; in the female the anterior wings are paler and more uniform, yellow, very closely irrorated with small confluent brown spots more or less intense, the apical portion entirely brown; pterostigma, and three smaller spots on the apical margin before the notch, fuscous; the fenestrated spot is narrow, often indistinct, the anastomosal space broken up into several smaller spots. Posterior wings hyaline, apex brownish-yellow, with two opposite sometimes confluent fuscous blotches irrorated with paler; in the female the apex is brownish-yellow, without fuscous markings; veins brownish. Legs pale testaceous, with black spines, apices of the tibiæ and tarsi slightly fuscescent. Abdomen dull greenish in life. In the male the upper margin of the last abdominal segment is bisemarginate, somewhat produced in the middle, over each notch is a broad crescentic black spot; app. sup. flat, somewhat truncated at the fuscous tips; app. intermed. broad, black, generally concealed; app. inf. consisting only of a broad base with a few long hairs. In the female the superior valves form two acute diverging tubercles; lateral valves large, broadly emarginate, the lower portion dilated.

Expanse of fore-wings 11—15 lin.

Larva with the head and two first thoracic segments of an uniform brown with black streaks; the metathorax brighter anteriorly, with two black spots, and posteriorly with three triangles formed of small brown spots. The abdomen greenish; the feet brown, without spots. (Pictet.)

Case formed of leaves and other vegetable substances fixed longitudinally, without any particular order.

A very common and generally-distributed species, inhabiting the neighbourhood of ponds and marshes, and appearing in summer and autumn. It is exceedingly variable, but may always be recognised by the excised apical margin of the anterior wings.

B. *Apical margin of anterior wings entire.*

(1.) *Apical margin sharply truncated.*

a. Anterior wings more or less straw-coloured or yellowish ; large species ; the male generally has a tuft of short black hair on the first apical sector of the posterior wings beneath ; fenestrated spot usually large and well defined. (Corresponds very nearly to *Chætotaulius*, Kol.)

2. *Limnephilus rhombicus*, Linné. (Pl. IX. figs. 12, 13, app.)

Phryganea rhombica, Linn. Faun. Suec. n. 1486 (1761), and other authors ; *Limnephilus rhombicus*, Steph. (*) Ill. p. 214, 6 ; *Limnophilus rhombicus*, Burm. Handb. p. 932, 9 ; Brauer, Neurop. Aust. p. 51, fig. 91, 92, app. ; Hag. (*) Ent. Ann. 1859, p. 76, 12 ; id. (*) Neurop. N. Amer. p. 254, 2 ; *Limnephila rhombica*, Ramb. Hist. Nat. Névrop. p. 481, 17 ; *Chætotaulius rhombicus*, Kol. Gen. et Spec. Trichop. pt. 1, p. 45, 7.

Antennæ reddish-testaceous. Head reddish-ochreous. Palpi testaceous. Mesothorax reddish, darker than the head. Anterior wings broad, pale greyish-yellow, the costal margin nearly hyaline, clouded and irrorated with pale brown, darkest towards the dorsal margin ; fenestrated spot large, oval, with a brown dash on either side, anastomosal space sometimes indistinct, filled in with brownish markings; there are also some pale spots about the thyridium ; veins scarcely darker. Posterior wings hyaline, yellowish at the tips, and with yellow veins ; first apical sector in the male with a small blackish beard. Legs pale testaceous, with black spines. Abdomen ochreous, greenish beneath in life. In the male the upper margin of the last abdominal segment is produced in the middle into a broad rounded lobe, margined with black ; app. sup. large, boat-shaped, the lower margin narrowly black, with several minute black teeth ; a large projection or tooth in the middle, also black ; app. intermed. short, triangular ; app. inf. short, with a long tuft of blackish hairs at the apex. In the female a short broad triangle arises from the middle of the upper margin of the last segment; superior valves with the apex produced into a long fine point; lateral valves straight, rounded, darker than the superior and equalling them in length.

Expanse of fore-wings 16—18 lin.

Larva with the head fawn-coloured, marked with three black spots, of which the first is frontal and Y-shaped, and the others lateral, extending from the eyes to the occiput, uniting and forming an X. The two first thoracic segments fawn-coloured, bordered with black and marked posteriorly with small black triangles. Metanotum fawn-coloured, with four scaly black spots. Abdomen fawn-coloured, with numerous rose-coloured respiratory filaments. Feet large, fawn-coloured, spotted with blackish. (Pictet.)

Case composed of fibres, pieces of grass and rushes, &c., cut in equal lengths and arranged close together transversely, sometimes, according to Pictet, of small stones and shells; before the larva is ready to change, the case assumes a nearly oval form, and the occupant then fixes it firmly to some object and closes the orifice with fibres, &c. (See Pictet's "Recherches" for a long and interesting account of these cases, and of the way in which they are constructed.)

A common species by canals, ponds, marshes and all still waters, appearing in summer and autumn. Varies little, chiefly in the intensity of the brown coloration.

3. *Limnephilus pavidus,* Hagen.

(Pl. I. fig. 1; Pl. IX. fig. 14, app.)

Limnophilus pavidus, Hag. (*) Ent. Ann. 1859, p. 77 (not described); *Limnephilus pavidus,* M'Lach. Ent. Ann. 1862, p. 26.

Antennæ reddish-testaceous. Head reddish-fuscous, paler at the sides. Palpi reddish-testaceous. Mesothorax fuscous, slightly reddish in the middle and at the shoulders. Anterior wings narrower than in *L. rhombicus,* shining pale yellow, with brownish markings, most evident along the middle and before the apex, where they form a rather incomplete semilunate spot, the space between which and the apical margin is unspotted; fenestrated spot small, curved; anastomosal space large and distinct; veins fuscous, fourth apical cell obtusely pointed at the base. Posterior wings hyaline, slightly yellowish at the apex. Legs testaceous, with black spines. Abdomen fuscous above, pale beneath. In the male the upper margin of the last abdominal segment forms an obtuse blackish point between the app.; app. sup. long, testaceous, curved upwards, the somewhat acute points directed slightly downwards, a sharp angle near the base of the lower margin, which is furnished with a few small black teeth; app. intermed.

straight, broad, tapering, black, testaceous at the extreme base app. inf. long, almost cylindrical, testaceous, curved slightly upwards and inwards.

Expanse of fore-wings 14 lin.

The single known specimen is a male in the British Museum, supposed to have come from Dr. Leach's Collection. There is nothing in the appearance of the insect against the supposition that it is a native of this country, yet it must be considered rather doubtful until the nativity be confirmed by more examples.

4. *Limnephilus flavicornis*, Fabricius.

(Pl. II. figs. 24, 25, 26, case; Pl. III. fig. 5, neuration; Pl. IX. fig. 15, app.)

Phryganea flavicornis, Fab. Mant. Ins. t. 1, 245, 11 (1787); Ent. Syst. p. 77, 12; Oliv. Encyc. Méthod. p. 541, 13; Pict. (*) Recherch. p. 151, 20, pl. 9, fig. 2; *Limnephilus flavicornis*, Steph. (*) Ill. p. 213, 3; *L. dorsalis*, Steph. (*) Ill. p. 213, 4 (1837); *Limnophilus flavicornis*, Burm. Handb. p. 932, 10; Brauer, Neurop. Aust. p. 50, fig. 88, 89, app.; Hag. (*) Ent. Ann. 1859, p. 77, 14; *Limnephila flavicornis*, Ramb. Hist. Nat. Névrop. p. 484, 23; *Chætotaulius flavicornis*, Kol. Gen. et Spec. Trichop. pt. 1, p. 44, 6.

Antennæ testaceous, with darker annulations. Head reddish. Palpi testaceous. Prothorax clothed with greyish-yellow hairs. Mesothorax fuscous, reddish at the shoulders. Anterior wings almost hyaline, with a faint yellowish tinge, usually most evident in the female, clouded and irrorated with pale grey; a row of fuscous dots along the basal part of the dorsal margin, and also some fuscous dots along the basal part of the middle; pterostigma usually not marked; fenestrated spot large, anastomosal space also large and round, these two spots only evident when the grey markings are numerous; veins testaceous, sometimes streaked with fuscous, the anastomosis usually entirely fuscous, but in some specimens not darker than the other veins; all the apical cells of nearly the same breadth, and all truncated at the base. Posterior wings hyaline, slightly yellowish at the apex in some females; first apical sector with a short and distinct black beard in the males. Legs testaceous, with black spines; apices of tarsi and tibiæ slightly fuscous. Abdomen dull greenish in life, the incisions of the segments paler. In the male the upper margin of the last abdominal segment is nearly straight; app. sup. large, foliaceous, the sides almost parallel, oblique at the apex, which is excised, internally about the middle there is a transverse row of blackish teeth; app.

intermed. straight, nearly as long as the app. sup., fuscous; app. inf. short, with a tuft of fuscous hairs at the apex; penis short, obtuse, testaceous. In the female there is a short triangle from the upper margin of the last segment; superior valves very broad at the base, but produced into long slender hairy points.

Expanse of fore-wings 12—16 lines.

Larva greenish-yellow, with a very fine dark line down each side. Head dark testaceous, with a Y-shaped spot in the middle, and two broad curved streaks meeting behind, fuscous; there are also some minute fuscous irrorations on the side of the head. Pronotum dark testaceous, the upper edge broadly margined with fuscous, the lower margin with a tridentate fuscous band. Mesonotum altogether fuscous above. Metanotum with scattered fuscous spots. Legs testaceous, externally marked with fuscous. Anal segments with a few black hairs. Anal hooks slightly marked with fuscous externally.

Case varying greatly, according to the circumstances under which the larva is placed, and, as it would appear, according to the caprice of the inmate. Thus, it is formed sometimes entirely of pieces of grass-stems or rushes, cut in equal lengths and arranged side by side transversely (when vegetable matters are used they are always arranged in this manner); sometimes wholly of small stones; sometimes of shells of various fresh-water mollusca; or of all these substances mixed heterogeneously. Some cases are formed half of one substance, pieces of grass for instance, and the other half entirely of shells. I possess a case (Pl. III. fig. 25) that I have little doubt belongs to this species, which is made of the minute shells of *Valvata cristata*, arranged in mosaic, to the number of from 150 to 200, and with a few seeds of some water plant placed in the middle, probably to strengthen it.

This is a very common and generally-distributed species, appearing in summer and autumn up to October. Specimens in my collection from Germany are much more strongly marked than is usual in native examples.

5. *Limnephilus nobilis*, Kolenati. (Pl. IX. fig. 16, app.)

Chætotaulius nobilis, Kol. Gen. et Spec. Trichop. pt. 1, p. 43, 3 (1848); *Limnephilus nobilis*, M'Lach. Ent. Ann. 1864, p. 147.

Antennæ testaceous, with slightly paler rings. Head greenish-grey. Palpi testaceous. Prothorax testaceous, clothed with pale yellow silky hairs. Mesothorax greenish-grey. Anterior wings rather narrower than in *L. marmoratus*, hyaline, clouded with very pale grey, the apex dark greyish-fuscous, with numerous small pale spots; pterostigma dark fuscous, placed obliquely and elongate; fenestrated spot broad but indistinct, anastomosal space well marked; veins finely pointed with fuscous. Posterior wings hyaline, with a very indistinct testaceous mark at the pterostigma; veins fuscous. Legs testaceous, with black spines. Abdomen dark blackish-fuscous, the first segment with an elongate testaceous depression in the middle above. In the male the upper margin of the last abdominal segment is produced, somewhat broadly but shallowly emarginate in the middle, with a black protuberance on either side; app. sup. very large, broadly and obtusely spoon-shaped, standing out at a considerable angle from the body; app. intermed. thick, straight, with a somewhat mucronate apex, testaceous at the base; app. inf. thick and straight, obtuse, truncated, with a long tuft of hairs at the apex.

Expanse of fore-wings 15 lines.

I have seen but a single British example of this insect, which was captured in September, 1862, at Ruislip reservoir, Middlesex, by Mr. Wormald, and is now in his collection.

6. *Limnephilus marmoratus*, Curtis. (Pl. IX. figs. 17, 18, app.)

Limnephilus marmoratus, Curt. (*) Phil. Mag. p. 123, 8 (1834); Steph. (*) Ill. p. 214, 17; *Limnophilus marmoratus*, Hag. (*) Ent. Ann. 1859, p. 77, 13; *Limnephilus binotatus*, Curt. (*) Phil. Mag. p. 122, 5 (1834); Steph. (*) Ill. p. 215, 8; *L. discoidalis*, Curt. (*) Phil. Mag. p. 122, 6 (1834); Steph. (*) Ill. p. 214, 5; *Limnephila vitrea*, Ramb. Hist. Nat. Névrop. p. 482, 19 (1842).

Antennæ reddish-testaceous, with very faint darker annulations. Head reddish, fuscous in the centre, sometimes entirely fuscous. Palpi reddish-testaceous. Prothorax reddish, with pale hairs. Mesothorax fuscous, reddish at the shoulders, and usually with two impressed reddish lines in the centre, meeting posteriorly. Anterior wings very pale straw-colour, nearly hyaline, the dorsal half of the wing with strong brown markings; an oblique brown blotch is placed on either side of the fenestrated spot, a large blotch at the anal angle and another in the apex; pterostigma with a somewhat elongated brown spot; these markings are generally irrorated with small spots of the pale ground colour, and are sometimes all confluent, in which case the dorsal half of the wing is almost entirely brown, the two usual pale spots excepted; in other examples the dark spots, and even the dark pterostigma, are almost wanting; fenestrated spot rhombic, large; anastomosal space large; veins fuscous, the anastomosis very dark. Posterior wings hyaline, the apex yellowish, no black beard on the first apical sector. Legs testaceous, with black spines. Abdomen greyish-fuscous above, somewhat greenish beneath, the incisions of the segments paler. In the male the upper margin of the last abdominal segment is rather produced in the middle, and usually scabrous and black; app. sup. not large, somewhat triangular and obtusely pointed, testaceous, the margins fuscous, the lower edge toothed; app. intermed. broad, flat, triangular, blackish; app. inf. short and rounded, testaceous, fringed with long hairs. In the female there is a broad triangular plate proceeding from the upper margin of the last segment; the superior valves are conical and hairy, testaceous.

Expanse of fore-wings 14—15 lines.

This insect has been bred by Mr. Parfitt. The case was composed of vegetable matters, shells and stones mixed heterogeneously, often with a larger stone at one end; probably it is not to be separated from some forms of the case of *L. flavicornis.*

A common and generally-distributed species in summer and autumn, varying much in the number and intensity of the brown markings.

Mr. Parfitt has reared a Dipterous parasite (*Hydrotachina limnephili,* Walker, MSS.) from the larvæ of *L. marmoratus.*

7. *Limnephilus lunatus,* Curtis.

(Pl. II. fig. 28, case; Pl. IX. figs. 19, 20, app.)

Limnephilus lunatus, Curt. (*) Phil. Mag. p. 123, 10 *c* (1834); *L. apicalis,* Curt. (*) Phil. Mag. p. 123, 10 (1834); *L. nebulosus,* Curt. (*) Phil. Mag. p. 123, 9 (1834); Steph. (*) Ill. p. 215, 10; *Phryganea lunaris,* Pict. (*) Recherch. p. 152, 21, pl. ix. fig. 3 (1834); *Limnophilus lunaris,* Burm. Handb. p. 931, 5; *Limnephila lunaris,* Ramb. Hist. Nat. Névrop. p. 481, 18; *Limnephilus affinis,* Steph. (*) Ill. p. 217, 15 (1837), (not of Hagen in Ent. Ann. 1859); *Phryganea vitrata,* Zett. Ins. Lapp. col. 1034, 13 (1840); *Chætotaulius vitratus,* Kol. Gen. et Spec. Trichop. pt. i. p. 42, 1; *Limnophilus vitratus,* Brauer (*), Neurop. Aust. p. 51, fig. 86, app.; Hag. (*) Ent. Ann. 1859, p. 75, 11.

Antennæ reddish-testaceous, with slightly paler annulations. Head reddish. Palpi reddish-brown. Prothorax clothed with reddish hairs. Mesothorax reddish or reddish-fuscous. Anterior wings rather narrow, yellow (or greyish-yellow), with fuscous markings; the dorsal half of the wing is often wholly fuscous, with the exception of small dots of the pale ground-colour: pterostigma fuscous, small; the large oblique fenestrated spot, a large anastomosal space (interrupted by the dark veins of the anastomosis and by brown dots), and a semilunate spot at the apex, all whitish-hyaline (in darkly-marked specimens these spots are very conspicuous, in pale ones sometimes scarcely visible). Posterior wings hyaline, yellowish at the tips; the beard on the first apical sector in the males small and often absent. Legs reddish-testaceous, with black spines. Abdomen greenish-fuscous, paler beneath. In the male the upper margin of the last abdominal segment is rounded and produced in the middle, and bent slightly under, scabrous and blackish; app. sup. rather small and triangular, testaceous; app. intermed. short and nearly straight, black; app. inf. short, testaceous, with long blackish marginal hairs. In the female the superior valves are testaceous, with short, pointed, black tips; lateral valves broad and truncated.

Expanse of fore-wings 10—14 lines.

Larva with the head yellow, with numerous black dots arranged somewhat in a V-shaped mark. Pronotum and mesonotum also yellow, with numerous black dots; on the pronotum many of these are arranged in two parallel rows. Metanotum dirty greyish-ochreous, with a few scattered black dots. Legs yellowish, spotted with black at the base, the tarsi wholly blackish-fuscous. Abdomen dirty greyish-ochreous, with whitish filaments. Anal crotchets yellow, marked with black, and with a few black hairs.

Case a tube composed of small stones, &c., to the outside of which are affixed long twigs, pieces of wood, husks, &c.; these substances are often very much larger than the cases themselves, and give them a peculiar appearance, as the larvæ crawl along the bottom of ditches or ponds.

A very common species in summer and autumn.

With respect to *L. affinis* of Hagen, Ent. Ann. 1859, p. 79, I do not at present feel justified in giving it a place in our Fauna. I have seen types of *L. affinis*, which is certainly a very distinct species, although closely allied to *L. lunatus*. It differs in the anterior wings being entirely of a straw-colour, without any fuscous markings excepting a very distinct pterostigma, in the curved apical line, which is broader than in *L. lunatus*, and in the pale semilunate space between it and the extreme apical margin, which is much narrower, reduced in fact to a mere line; the fenestrated spot and anastomosal space are scarcely present, being indicated only by pale dots. The app. sup. of the male are large and yellow, triangular, with the apices much produced, acute, the lower margin blackish and obsoletely toothed; the penis-sheaths are very long.

The single type of *L. affinis* of Stephens is a female, and though presenting some points of similarity to the Continental specimens, is yet not to be distinguished from pale varieties of *lunatus*, and I do not detect any appreciable difference from the latter in the appendices. I therefore await the capture of both sexes of *affinis*, before I think it prudent to consider it a British species.

In any case the name *affinis* will require to be changed, as it has already been used by Curtis, to indicate *costalis* of Stephens, over which name it has the right of priority (see p. 43).

8. *Limnephilus stigma*, Curtis. (Pl. IX. figs. 21, 22, app.)

Limnephilus stigma, Curt. (*) Phil. Mag. p. 123, 10 *b* (1834); Steph. (*) Ill. p. 216, 12; *Limnophilus stigma*, Hag. (*) Ent. Ann. 1859, p. 78, 15; *Limnephila impura*, Ramb. Hist. Nat. Névrop. p. 476, 5 (1842); *L. fulva*, Ramb. Hist. Nat. Névrop. p. 475, 4 (1842)?; *Goniotaulius stigmaticus*, Kol. Gen. et Spec. Trichop. pt. 1, p. 55, 9 (1848).

Antennæ reddish-testaceous, with faint darker annulations. Head reddish, paler at the sides, and with a few scattered yellowish hairs. Palpi testaceous. Prothorax reddish, with yellowish hairs. Mesothorax reddish-brown. Anterior wings rather broad, yellow or ochreous, thickly sprinkled with brown spots, which are very variable in number and most numerous on the dorsal and apical margins; costal and subcostal areas always unspotted; pterostigma nearly round, piceous; fenestrated spot small, oblique, indistinct; anastomosal space large, sometimes well marked; a small whitish-hyaline spot at the thyridium and another below it; veins testaceous, closely set with short black hairs placed at regular intervals, visible under a strong magnifying power. Posterior wings subhyaline, yellowish at the apex, and sometimes with the apical veins clouded with grey; the male with a small dark brownish beard on the first apical sector below. Legs pale testaceous, with black spines. Abdomen dull greyish-fuscous or greenish-fuscous, evidently green in life. In the male the upper margin of the last abdominal segment is produced in the middle into a long tongue-shaped flap, the apex of which is bent under, scabrous and blackish; app. sup. obtusely rounded, concave, testaceous, the margins turned in, denticulate and black; app. intermed. short, diverging, black; app. inf. obtusely rounded, testaceous, with a few long black hairs on the edges. In the female the lamina from the upper margin of the last segment is of nearly equal breadth, produced into a slight point in the middle; the superior valves short and conical; the lateral valves broad, not quite so long as the superior, slightly emarginate.

Expanse of fore-wings 14—15 lines.

Apparently a very local species, appearing in summer and autumn. Stephens gives the New Forest and neighbourhood of London as localities. It is abundant at Ruislip reservoir, Middlesex, and I have it also from Folkestone and Killarney.

This species is subject to great variation; Curtis' types and most of those of Stephens have yellowish wings without markings, and sometimes without the dark pterostigma, but I have not seen any recent specimen from which this is absent; on the other hand, in some specimens the brown spots are all confluent, and in this case the whole wing is rich brown, excepting the anterior margin and the fenestrated spot and anastomosal space, which then appear very conspicuously paler.

Notwithstanding the doubt expressed by Dr. Hagen as to the identity of *L. fulva* and *impura* of Rambur, I am inclined to think (without having seen the types) that they form only one species. The descriptions of Rambur are good and the details on the appendices of both apply exactly to our insect; it is also to be remarked that of *L. fulva* he had only seen a single specimen, the narrowness of the wings in which might be owing to an accidental deformity.

9. *Limnephilus borealis*, Zetterstedt. (Pl. IX. fig. 23, app.)

Phryganea borealis, Zett. Ins. Lapp. col. 1062, 7 (1840); *Chætotaulius borealis*, Kol. Gen. et Spec. Trichop. pt. 1, p. 42, 2; *Limnophilus borealis*, Brauer, Neurop. Aust. p. 50, fig. 85, app.; M'Lach. Ent. Ann. 1861, p. 57.

Antennæ brown, with paler annulations. Head dark fuscous, paler at the sides. Palpi reddish-testaceous. Prothorax thickly clothed with greyish hairs. Mesothorax fuscous. Anterior wings rather narrow, shining yellow; the costal margin slightly elevated at the pterostigma; the whole wing rather thickly clothed with short dusky pubescence; a rather large fuscous blotch extends obliquely from the base of the sixth apical cell to the anal angle, and there is sometimes a faint fuscous cloud in the apex; pterostigma piceous, very distinct, slightly prolonged; fenestrated spot narrow; anastomosal space most evident on the apical side of the anastomosis, forming one or two detached spots on the inner side; veins pale fuscous, costal and apical edges and anastomosis dark fuscous; long black hairs on the cubital veins. Posterior wings hyaline, the apex yellowish. Legs testaceous, with black spines. Abdomen piceous. In the male the upper margin of the last abdominal segment is truncated; app. sup. yellow, large, broadly and obtusely boat-shaped; app. intermed. very short, the apices hooked and black; app. inf. short and broad, truncated.

Expanse of fore-wings 13—15 lines.

This species was discovered in some abundance by Mr. Winter, in the Fens of Norfolk and Suffolk, appearing in May and continuing for some months. I possess single examples from Killarney and Enniskillen in Ireland, and there was also an old specimen in Curtis' Collection.

10. *Limnephilus politus*, M'Lachlan. (Pl. IX. fig. 24, app.)
Goniotaulius concentricus, Kol. Gen. et Spec. Trichop. pt. 1, p. 55, 10 (1848), not of Zett. (1840); *Stenophylax concentricus*, Hag. (*) Stett. Zeit. 1859, p. 133; M'Lach. Trans. Ent. Soc. 3rd ser. i. 240; *Limnophilus vibex*, Brauer, Neurop. Aust. p. 51 (1857)?, not of Curt. (1834).

Antennæ reddish-testaceous, with faintly darker annulations. Head fuscous. Palpi reddish-testaceous. Prothorax clothed with yellow hairs. Mesothorax dark brown. Anterior wings rather broad, pale shining greyish-yellow, the dorsal and apical portions spotted with grey or greyish-fuscous (varying in different individuals); a conspicuous fuscous line (being in reality a longitudinal vein) near the dorsal margin. Posterior wings hyaline, yellowish at the apex. Legs ochreous, with black spines. Abdomen greyish-fuscous, the terminal segment somewhat testaceous. In the male the upper margin of the last segment is produced in the middle into a short rounded lobe, the margin of which is rolled under, scabrous and black; app. sup. large, broad, spoon-shaped, the greater part of them concealed under the projecting margin of the last segment, testaceous, internally furnished with a transverse row of small black teeth, placed at about the middle; app. inf. broad, straight, acute and divergent, blackish, only visible from below; app. inf. rather long, obtuse, testaceous, with blackish hairs at the tips; penis-sheaths long, suddenly inturned at the tips; penis thin, much exserted, shining brown, issuing from a short tubular piece with truncated margins.

Expanse of fore-wings 12—16 lines. The female somewhat the smaller.

Common in the Norfolk Fens in autumn. I have also seen it from Hartlepool, Willesden, Killarney, &c.

This species, though probably widely distributed, is not contained in the collections of Curtis or Stephens. It is an insect not well understood, and, unless there be a nearly allied species, is liable to great variation in Continental examples, both in size and coloration.

There appears to be little doubt that it is not the true *concentricus* of Zetterstedt, and I have therefore given it a new name.

The position of the insect is also a matter of some uncertainty. Kolenati assigns to it about the same position as I have here given but Dr. Hagen places it at the end of the first section of *Sten phylax*. As I have elsewhere stated (Tr. Ent. Soc. 3rd ser. i. 240), the shape of the wings agrees more with *Limnephilus* than with *Stenophylax*, and the fourth apical cell in the posterior wings is decidedly narrower than the second, whereas in *Stenophylax* (and *Anabolia*) they are of the same breadth. The posterior wings of the male are not furnished with a beard.

11. *Limnephilus elegans*, Curtis. (Pl. IX. fig. 25, app.)

Limnephilus elegans, Curt. (*) Phil. Mag. p. 124, 17 *b* (1834); Brit. Ent. pl. 488; *Limnophilus elegans*, Hag. (*) Ent. Ann. 1859, p. 79, 17; *Phryganea signifer*, Zett. Ins. Lapp. col. 1063, 9 (1840); *Chætotaulius signifer*, Kol. Gen. et Spec. Trichop. pt. 1, p. 46, 8.

Antennæ reddish-ochreous. Head reddish, fuscous in the middle above. Palpi reddish-ochreous. Mesothorax reddish. Anterior wings yellowish-brown, shining, with whitish-hyaline longitudinal streaks, viz., two long ones towards the costal and dorsal margins respectively, a shorter one in the middle of the disc, about five in the apex, occupying the first, second, fourth and fifth apical cells, and an oval one at the base of the sixth; pterostigma yellowish-brown. Posterior wings hyaline, with the tips faintly yellowish. Legs reddish-testaceous, with black spines. Abdomen reddish-ochreous. In the males the upper margin of the last abdominal segment is cut off straight; app. sup. broad, flat, with a deep circular notch on the apical margin, the edges blackish, with long hairs; app. inf. small, yellow, with a few blackish hairs at the apex.

Expanse of fore-wings 12—14 lines.

This species appears to be as rare as it is beautiful; the only recorded localities are the New Forest and Delamere Forest, and I saw (but did not capture) a single specimen at the Black Forest, Rannoch, Perthshire. The figure in Curtis' "British Entomology" is very good.

I saw in the Museum of the Jardin des Plantes at Paris several specimens of a *Limnephilus* from Iceland, which I believe to be identical with *L. elegans*.

b. Anterior wings more or less grey or brown; the male without a black beard on the posterior wings; fenestrated spot smaller. (Corresponds to part of *Goniotaulius*, Kol.)

12. *Limnephilus griseus*, Linné. (Pl. IX. figs. 26, 27, app.)

Phryganea grisea, Linn. Faun. Suec. n. 1484 (1761), and other authors; *Goniotaulius griseus*, Kol. Gen. et Spec. Trichop. pt. 1, p. 53, 8; *Limnophilus griseus*, Brauer, Neurop. Aust. p. 50, fig. 76, 77, app.; Hag. (*) Ent. Ann. 1859, p. 80, 18; Neurop. N. Amer. p. 262, 27; *Limnephilus fenestralis*, Curt. (*) Phil. Mag. p. 123, 12 (1834); Steph. (*) Ill. p. 218, 17; *L. marginalis*, Steph. (*) Ill. p. 218, 16 (1837); *L. bipunctatus*, Steph. (*) Ill. p. 218, 18 (1837); *L. obliquus*, Steph. (*) Ill. p. 219, 20 (1837); *L. signatus*, Steph. (*) Ill. p. 219, 19, part (1837); *L. luniger*, Steph. (*) Ill. p. 219, 21 (1837); *Limnephila variegata*, Ramb. Hist. Nat. Névrop. p. 482, 19 (1842).

Antennæ fuscous, with distinct paler annulations. Head blackish-fuscous, posteriorly reddish. Palpi dull reddish-brown. Prothorax reddish, clothed with long blackish hairs. Mesothorax dark blackish-fuscous. Anterior wings narrow; in the male nearly uniformly brownish-grey, with a few darker spots and clouds in the apex and towards the dorsal margin, with scattered whitish spots; pterostigma brown; fenestrated spot narrow, oblique; anastomosal space forming only two or three pale spots on the apical side of the anastomosis; veins brownish, the anastomosis dark fuscous, long black hairs on the cubital veins. In the female the anterior wings are whitish-grey, with numerous black and fuscous markings, giving the wings a variegated appearance, varying greatly according as the dark spots are more or less coalescent; pterostigma dark fuscous, frequently with paler irrorations; fenestrated spot large and distinct, white; anastomosal space large, white and irregular, generally broken up into several smaller spots; there is usually a distinct pale spot at the termination of the sixth and seventh apical cells, and another about the arculus; some of the veins regularly spotted with black and white. Posterior wings hyaline, apex pale grey; veins testaceous, the ramus discoidalis and ramus subdiscoidalis fork at about the same distance from the base. Legs testaceous, with black spines, the thighs and the apices of the tibiæ and tarsi somewhat fuscous. Abdomen dark fuscous above, ochreous beneath, and with narrow ochreous lateral lines. In the male the upper margin of the last abdominal segment is not produced; app. sup. spoon-shaped, obtuse, yellow; app. intermed. pointed, straight, lying against each other, not diverging; app. inf. large, yellow, concave exteriorly, and with two shining black teeth at the apex. In the female there is in the middle a twice-divided tubular piece springing from a broad base; on each side of this is an appendage very similar in form to the app. sup. of the male, and below these on each side a broad obtusely rounded lateral valve.

Expanse of fore-wings 10—11 lines.

Larva grey, with lateral lines and a depressed dorsal line, brown, the anal segment with long black hairs, respiratory filaments white; head yellowish-brown, with an oblong median spot formed of eight or ten piceous dots, occiput with an oblique line on each side connivent posteriorly (*vitta postice connivente*), formed of piceous dots arranged more or less in rows; pronotum and mesonotum yellow, the posterior and lateral margins with numerous piceous dots; metanotum with four corneous scales; legs yellow, the joints narrowly annulated with piceous. (Kolenati.)

Case sometimes composed of pieces of grass or leaves placed obliquely, sometimes of stones; cylindrical. (Kolenati.)

This very variable and widely-distributed species would appear to be far more common on the Continent than in this country. It appears in May and following months; and most of the specimens that I have taken have been beaten from fir trees in heathy districts; apparently most common in the New Forest.

I have seen an example from Haiti, and possess another from the river Amoor; both of these resemble European specimens in every particular.

13. *Limnephilus bipunctatus*, Curtis. (Pl. X. figs. 1, 2, app.)

Limnephilus bipunctatus, Curt. (*) Phil. Mag. p. 123, 13, part (1834); *Limnophilus bipunctatus*, Hag. (*) Ent. Ann. 1859, p. 82, 19; *Limnephilus griseus*, Steph. (*) Ill. p. 217, 13

(1837); *Limnephila obscura*, Ramb. Hist. Nat. Névrop. p. 483, 21 (1842); *Limnophilus tuberculatus*, Brauer, Neurop. Aust. p. 50, fig. 80, app. (1857)?

Antennæ brown, with paler annulations. Head reddish-brown, blackish anteriorly. Palpi reddish. Prothorax reddish-brown, with long slightly darker hairs. Mesothorax blackish, with two impressed reddish median lines. Anterior wings broader than in *L. griseus*, rusty brown, with numerous small pale dots, a row of fuscous dots in the middle towards the base, and sometimes a few similar dots on the dorsal margin; pterostigma brown; fenestrated spot and the indistinct anastomosal space greyish-yellow, and there is also a greyish-yellow spot, often indistinct, on the inner side of the pterostigma; veins fuscous, with pale dots, the anastomosis conspicuously darker. Posterior wings greyish-hyaline, brownish-grey at the apex; veins brown, the ramus discoidalis forks sooner than the ramus subdiscoidalis. Legs reddish-brown with black spines, the apices of the tibiæ and tarsi slightly fuscous. Abdomen blackish, reddish-ochreous beneath, and with lateral lines of the same colour. In the male the upper margin of the last abdominal segment has a rounded projection in the middle, bent under, black and scabrous, the sides prominent; app. sup. yellow, obtusely triangular; app. intermed. lying close together, broad, triangular, yellow, the superior margins blackish; app. inf. scarcely evident, margined with long blackish hairs. In the female there is a broad obtusely rounded lamina proceeding from the upper margin of the last segment, on each side of which is a long finger-shaped appendage, from beneath which arises a straight deeply cleft tubular piece; the lateral valves are short and broad, almost truncated.

Expanse of fore-wings 12—14 lines.

Not a common species. The recorded localities are the New Forest, neighbourhood of London, and Scotland; I possess it also from the fens of Norfolk and from Torquay.

I have considerable doubt as to the propriety of retaining Curtis' name for this species. In his collection this and *L. griseus* were both present under the name of *bipunctatus*, and his description offers no very evident proof which species he had before him when writing it.

14. *Limnephilus affinis*, Curtis. (Pl. X. fig. 3, app.)

Limnephilus affinis, Curt. (*) Phil. Mag. p. 123, 14 (1834); *L. costalis*, Steph. (*) Ill. p. 217, 14 (1837); *Limnophilus costa-*

lis, Hag. (*) Ent. Ann. 1859, p. 83, 21; *Goniotaulius anastomosis*, Kol. Gen. et Spec. Trichop. pt. 1, p. 52, 5 (1848).

Antennæ fuscous, with paler annulations. Head reddish-fuscous, paler at the sides. Palpi reddish-testaceous. Prothorax reddish-fuscous, with long hairs. Mesothorax fuscous. Anterior wings narrow, grey with an ochreous tinge, clothed with short pale pubescence; there are numerous greyish-fuscous freckles and a row of fuscous dots along the middle of the wing, and a distinct fuscous dot just behind the arculus; pterostigma pitchy brown, often with paler dots; fenestrated spot indistinct, most evident when the wings are closed; anastomosal space still less evident; longitudinal veins pale fuscous, dotted with blackish-fuscous, the anastomosis distinctly blackish-fuscous; the coloration of the anterior wings varies according as the spots are more or less coalescent. Posterior wings greyish-hyaline, the apex slightly darker, and with a brownish-grey pterostigma more or less distinct; the ramus subdiscoidalis forks sooner than the ramus discoidalis. Legs testaceous, with black spines; the anterior tibiæ have exteriorly a row of fuscous dots, the apices of all the tibiæ and tarsi are likewise fuscous. Abdomen dull fuscous above, ochreous beneath, and with ochreous lateral lines. In the male the upper margin of the last abdominal segment is rounded off; app. sup. small, yellow, the apical margin slightly emarginate; app. intermed. curved strongly upward, brown, the tips black; app. inf. short, rounded, with a fringe of black hairs at the base. In the female there is no appearance of the usual valves, but there is a broad inflated ring at the apex, from which proceeds a tubular piece.

Expanse of fore-wings 9—14 lines.

A very common species in woods in the neighbourhood of London, but by no means confined to woods, as I have seen it abundantly in a little marshy spot on the wide sandy expanse known as Dawlish Warren, in Devonshire; probably generally distributed. I have found it as early as the 21st April and as late as the beginning of October.

15. *Limnephilus auricula*, Curtis. (Pl. X. figs. 4, 5, app.)

Limnephilus auricula, Curt. (*) Phil. Mag. p. 124, 11 (1834); Steph. (*) Ill. p. 220, 22; *Limnophilus auricula*, Hag. (*) Ent. Ann. 1859, p. 82, 20; *Limnephilus obscurus*, Curt. (*) Phil. Mag. p. 124, 15 (1834); Steph. (*) Ill. p. 220, 24; *Phryganea nigridorsa*, Pict. (*) Recherch. p. 158, 28, pl. 10, fig. 5 (1834); *Limnephilus geminus*, Steph. (*) Ill. p. 220, 2°

(1837); *L. signatus*, Steph. (*) Ill. p. 219, 19, part (1837); *Limnephila guttata*, Ramb. Hist. Nat. Névrop, p. 485, 25 (1842); *Goniotaulius fenestratus*, Kol. Gen. et Spec. Trichop. pt. 1, p. 52, 6 (1848).

Antennæ fuscous, with slightly paler annulations. Head black. Palpi testaceous. Prothorax fuscous, sometimes reddish. Mesothorax black, with two more or less distinct reddish median lines above. Anterior wings of the male shining greyish-ochreous, rather thickly clothed with short dusky pubescence; pterostigma pale brown; fenestrated spot very indistinct, formed of two smaller spots; anastomosal space only visible as several scarcely evident pale spots at the base of the cells; a distinct pale spot at the thyridium; veins yellowish, many of them with blackish hairs placed at regular intervals. In the female the anterior wings are more tinged with brown, especially towards the apex; the pterostigma less distinct, the fenestrated spot and anastomosal space both larger and much more distinct, and the part of the wing between these spots is usually darker. Posterior wings hyaline, greyish at the apex, and with a pale greyish pterostigma most evident in the male. Legs testaceous with black spines, the terminal tarsal joints darker. Abdomen fuscous above, paler beneath, and with pale lateral lines. In the male the upper margin of the last abdominal segment is broadly produced; app. sup. finger-shaped, testaceous, curved upwards, the tips curved slightly downwards and fringed with long hairs; app. intermed. short, curved downwards, concealed in the cavity of the last segment; app. inf. furcate, the upper branch longest, blackish at the apex, the lower branch bent inwards, and also blackish at the apex. In the female there is a long triangular projection from the upper margin of the last segment, very acute at the apex; this lies closely upon a cylindrical tubular piece, the apex of which is blackish and obsoletely toothed.

Expanse of fore-wings 8—9 lines.

Larva remarkable for its very small head and thorax. Head and pronotum black. Mesonotum with a scaly plate of the same colour. Metanotum with five scaly points. Abdomen fawn-coloured. Feet slender, blackish. (Pictet.)

Case almost cylindrical, composed of fragments of dead leaves cut into equal-sized pieces and joined together at the edges. When the larva is about to change it closes the ends with stones. (Pictet.)

A common species in summer and autumn, probably frequenting both standing and running waters.

c. *Anterior wings straw-colour, yellowish or brownish; small species; the male without a black beard; fenestrated spot not marked, though there is sometimes an approximation to it.* (Corresponds to part of *Goniotaulius*, Kol.)

i. *Fifth apical cell in the anterior wings not reaching the anastomosis, very acute.*

16. *Limnephilus vittatus*, Fabricius.

(Pl. II. fig. 27, case; Pl. III. fig. 6, neuration; Pl. X. figs. 7, 8, app.)

Phryganea vittata, Fab. Ent. Syst. Suppl. p. 201, 16-17 (1798); Pict. (*) Recherch. p. 157, 27, pl. 10, fig. 4; Zett. Ins. Lapp. col. 1064, 16; *Limnephilus vittatus*, Steph. (*) Ill. p. 225, 39; *Limnophilus vittatus*, Brauer, Neurop. Aust. p. 49, fig. 74, 75, app.; Hag. (*) Ent. Ann. 1859, p. 84, 22; *Limnephila vittata*, Ramb. Hist. Nat. Névrop. p. 485, 26; *Goniotaulius vittatus*, Kol. Gen. et Spec. Trichop. pt. 1, p. 49, 1; *Limnephilus consobrinus*, Curt. (*) Phil. Mag. p. 124, 19 (1834); Steph. (*) Ill. p. 224, 35; *Phryganea elegans*, Pict. (*) Recherch. p. 157, 26, pl. 10, fig. 3 (1834); *Limnephila elegans*, Ramb. Hist. Nat. Névrop. p. 486, 27; *Limnephilus notatus*, Steph. (*) Ill. p. 224, 36 (1837); *L. substrigosus*, Steph. (*) Ill. p. 224, 37 (1837); *L. bipartitus*, Steph. (*) Ill. p. 225, 38 (1837); *L. præustus*, Steph. (*) Ill. p. 226, 41 (1837); *Goniotaulius flavus*, Kol. Gen. et Spec. Trichop. pt. 1, p. 50, 2 (1848).

Antennæ testaceous, with very indistinct paler rings. Head reddish-ochreous, sometimes darker in the middle, with two raised tubercles on the posterior margin. Palpi testaceous. Prothorax with long reddish hairs. Mesothorax reddish-ochreous, varying to fuscous. Anterior wings pale yellowish; a fuscous streak runs from near the base to the apex, distinctly interrupted by a whitish spot at the thyridium; the dorsal portion of the wing below this streak is more or less pale fuscous, or freckled with fuscous; this streak is sometimes entirely absent, and numerous intermediate varieties occur; pterostigma pale brownish, sometimes absent; veins pale fuscous. Posterior wings hyaline, with an indistinct brownish pterostigma. Legs testaceous with black spines. Abdomen greyish-fuscous above, ochreous beneath. In the male the upper margin of the last abdominal segment is much produced, and in the middle there is a somewhat truncated projection; app. sup. and app. intermed. not visible; app. inf. rather long with blackish tips. In the female there are small hairy superior valves.

Expanse of fore-wings 8—11 lines.

Larva with the head, pronotum and mesonotum brown with a darker central line; the pronotum with two lateral black points; metanotum fawn-coloured, with four scaly points; abdomen fawn-coloured; feet brown. (Pictet.)

Case long, slightly curved, smaller at the posterior extremity, formed of sand and very small stones. (Pictet.)

A common species in this country, appearing in summer and autumn, and probably frequenting both standing and running waters. I have reason to believe that this and the next frequently breed in spongy bogs.

The varieties are very numerous, and from this cause the number of synonyms is rather astonishing. Stephens, for instance, described it under six different names. The short acute fifth apical cell will at once distinguish it from all other native species; occasionally varieties do occur in which this cell reaches the anastomosis, but it always remains very acute.

ii. *Fifth apical cell in the anterior wings reaching the anastomosis.*

17. *Limnephilus centralis*, Curtis. (Pl. X. figs. 9, 10, app.)

Limnephilus centralis, Curt. (*) Phil. Mag. p. 124, 22 (1834); Steph. (*) Ill. p. 227, 43; *Limnophilus centralis*, Hag. (*) Ent. Ann. 1859, p. 85, 23; *Limnephilus terminalis*, Curt. (*) Phil. Mag. p. 124, 21 (1834); *L. ochraceus*, Curt. (*) Phil. Mag. p. 124, 16 (1834); *Phryganea flava*, Pict. (*) Recherch. p. 156, 25, pl. 10, fig. 2 (1834); *Limnephilus flavus*, Steph. (*) Ill. p. 226, 42; *L. punctatus*, Steph. (*) Ill. p. 226, 44 (1837); *L. elongatus*, Steph. (*) Ill. p. 227, 45 (1837); *L. fuliginosus*, Steph. (*) Ill. p. 227, 46 (1837); *L. ustulatus*, Steph. (*) Ill. p. 228, 48 (1837); *Limnephila nebulosa*, Ramb. Hist. Nat. Névrop. p. 477, 8 (1842).

Antennæ testaceous, with darker annulations. Palpi testaceous. Head, prothorax and mesothorax reddish, the prothorax with long reddish hairs. Anterior wings greyish-yellow with brownish markings, varying very much in number and intensity; there is usually a brownish dash from near the base to the apex, formed of small points united, leaving a pale apical space and often an appearance of the fenestrated spot and anastomosal space; veins fuscous; the fifth apical cell has a truncated base. Posterior wings hyaline, with the apex very pale yellowish. Legs pale ochreous, with black spines. Abdomen ochreous. In the male the upper margin of the last abdominal segment is much produced, with a rounded projection in the middle; app. sup. small, somewhat obtuse, scarcely projecting from under the last segment; app. intermed. diverging, broad at the base, the apices acute and somewhat mucronate, black; app. inf. with the tips approximating and clothed with greyish hairs.

Expanse of fore-wings 9—11 lines.

Larva with the head and thorax brown. Pronotum with darker bands anteriorly and posteriorly; mesonotum with two lateral black points; metanotum with four scaly points. Abdomen fawn-coloured. (Pictet.)

Case similar to that of *L. vittatus* but shorter and less pointed. (Pictet.)

A very common species, found in the same localities and at the same times as *L. vittatus*, to which at first sight it bears considerable resemblance. This is also a very variable insect and suffers under the same burthen of names as the last. Examples are sometimes found in which the anterior wings are almost wholly fuscous (excepting a pale apical blotch), with pale irrorations; these are usually from the North of England or Scotland.

18. *Limnephilus flavescens*, Stephens.

Limnephilus flavescens, Steph. (*) Ill. p. 223, 33 (1837), (not of Hagen in Ent. Ann. 1859).

Antennæ brownish, with paler annulations. Head and thorax reddish-brown. Palpi pale-ochreous. Anterior wings narrow, of a uniform very pale straw-yellow, costal edge brownish; veins brownish, set with blackish hairs; these hairs are much longer towards the dorsal margin; a whitish spot at the thyridium, and another below it at the arculus. Posterior wings hyaline, faintly yellowish at the tips. Legs pale ochreous, with black spines. Abdomen greyish-fuscous, paler beneath. In the male the last abdominal segment is considerably produced, the upper margin cut off regularly; app. sup. small, obtuse, the tips only visible from under the projecting upper margin; app. inf. visible only as a tuft of blackish hairs.

Expanse of fore-wings 12 lines.

The type in Stephens' Collection is the only known example of this species; it is said to have been taken at Ripley, in June.

At present I cannot but consider that it is a little doubtful, yet I am unable to refer the specimen to any other British species. It is to be hoped that further acquaintance with these insects will throw additional light on this matter.

The description in Ent. Ann. 1859, p. 86, belongs to *L. ignavus*, Hag., which is certainly not identical with *flavescens*.

19. *Limnephilus ignavus*, Hagen. (Pl. X. fig. 6, app.)

Limnophilus ignavus, Hag. (*) Stett. Zeit. 1858, p. 116; *L. flavescens*, Hag. (*) Ent. Ann. 1859, p. 86, 24 (not of Steph.)

Antennæ reddish-testaceous, with indistinct paler annulations. Head and thorax reddish-brown. Anterior wings pale reddish-brown, with indistinct paler irrorations most evident along the costal margin and at the apical portion; pterostigma darker; a pale-whitish dot at the thyridium, and another below it. Posterior wings hyaline, pale brown at the apex, and with brownish veins. Legs reddish-testaceous, with black spines; the tips of the tibiæ and of the tarsal joints blackish. Abdomen greyish-ochreous. In the male the upper margin of the last abdominal segment is slightly produced in the middle; app. sup. small and obtusely rounded; app. intermed. short, broad and triangular, black; app. inf. prominent, irregularly and obtusely spoon-shaped, testaceous, with a few long marginal blackish hairs. Sometimes the anterior wings are entirely without paler irrorations.

Expanse of fore-wings 10 lines.

Of this species I know only two British specimens; one in Curtis' Collection, mixed up with *L. luridus;* the other in my own Collection, formerly in that of Mr. Weaver, and probably taken by him in Scotland.

I have yet another species belonging to this group, but unfortunately only a single female specimen, from which I cannot draw up a satisfactory description; it is from the Norfolk fens.

(2.) *Apical margin less sharply truncated, somewhat rounded; hairy clothing more dense.* (Corresponds to *Desmotaulius*, Kolenati.)

20. *Limnephilus extricatus*, M'Lachlan. (Pl. X. figs. 11, 12, app.)

Desmotaulius hirsutus, Kol. Gen. et Spec. Trichop. pt. 1, p. 57, 3 (1848), (not *Ph. hirsuta* of Pict., 1834); *Limnophilus hirsutus*, Hag. (*) Ent. Ann. 1859, p. 87, 25.

Antennæ fuscous, with testaceous annulations. Head reddish-fuscous. Palpi pale fuscous. Prothorax reddish-fuscous, with long hairs. Mesothorax reddish-fuscous. Anterior wings rather broad, grey, with a yellowish tinge, with numerous brown freckles over the whole; a fuscous streak from the middle of the base, and another along the sutural margin; the wings are very uniform in colour, and vary very slightly; veins fuscous, the longitudinal ones with paler points, the anastomosis rather darker; the discoidal cell about the same length as the footstalk. Posterior wings hyaline, slightly grey at the apex; veins yellowish-fuscous, the ramus discoidalis forks rather before the ramus subdiscoidalis. Legs greyish-testaceous, with black spines. Abdomen fuscous above, ochreous beneath. In the male the upper margin of the last abdominal segment is deeply emarginate, bent under, black and scabrous, with a somewhat cylindrical projection on either side; app. sup. yellow, somewhat spoon-shaped, slightly curved; app. intermed. very short, triangular, with black tips; app. inf. large, the tips intensely black and furnished with two teeth. In the female there are short triangular superior valves, covering a short tubular piece.

Expanse of fore-wings 12—13 lines.

Not very uncommon in some localities in the neighbourhood of London, &c., appearing at the end of summer.

This and the two following species demonstrate most forcibly the value of the characters afforded by an examination of the anal appendages in the *Trichoptera*. These three species are at first sight so very similar that an experienced Entomologist might be readily pardoned for considering them identical, yet the appendices prove that they are very distinct, and further examination shews other distinctive characters in the neuration, &c.

21. *Limnephilus hirsutus*, Pictet. (Pl. X. figs. 13, 14, app.)

Phryganea hirsuta, Pict. Recherch. p. 159, 29, pl. ii. fig. 10 (1834); Hag. (*) Stett. Zeit. 1861, p. 117.

In general form and colour almost entirely similar to the last species, but smaller; the anterior wings rather narrower, especially in the male; the discoidal cell much longer and narrower, being nearly twice the length of the footstalk. In the male the upper margin of the last abdominal segment is broadly rounded, with long hairs on the surface of the segment; app. sup. broadly and obtusely spoon-shaped, yellow; app. intermed. almost as long as the app. sup., widely diverging; app. inf. short, yellow, fringed with long hairs. In the female there are two short superior valves.

Expanse of fore-wings 10—11 lines.

Apparently a rare species, frequenting running streams, and appearing in summer. I possess it from the neighbourhood of London, Folkestone, Ringwood, Dublin, and Rannoch.

Dr. Hagen's remarks concerning this species, in his revision of Pictet's *Phryganidæ* in the Stett. Ent. Zeit. 1859, p. 140, should be cancelled, and reference be made to the same Journal for 1861, p. 117.

22. *Limnephilus luridus*, Curtis. (Pl. X. figs. 15, 16, app.)

Limnephilus luridus, Curt. (*) Phil. Mag. p. 124, 26 (1834); *L. irroratus*, Steph. (*) Ill. p. 223, 32 (1837).

In form and colour very similar to the two last species; the anterior wings more rounded at the apex, the colour more ochreous, with fewer freckles, and the veins of the anastomosis conspicuously darker; the discoidal cell scarcely so long as in *L. hirsutus*, but longer than in *L. extricatus*. In the posterior wings the ramus discoidalis forks far before the ramus subdiscoidalis, and thus the discoidal cell is much longer than in the other two species. The coloration of the whole insect is generally redder than in the allied species. In the male the upper margin of the last abdominal segment is truncated; app. sup. very long and thin, curved upwards, slightly dilated at the tips; app. intermed. very long, straight, not diverging, pitchy black, obtuse at the tips; app. inf. scarcely visible; penis-sheaths very large and long, curved strongly upwards, reddish-yellow. In the female there are two long thin greyish appendices, which may be called app. sup.; these are curved inwards; between these proceed two long, straight, needle-shaped, yellowish points (app. intermed.), and below these are two concave appendices drawn out into a fine point, their bases uniting and forming a tube; on each side are two broadly triangular hairy lateral valves (or app. inf.).

Expanse of fore-wings 11—12 lines.

I possess this species from the Norfolk fens, Ringwood, Westmoreland, and Rannoch. Stephens gives the neighbourhood of London as a locality.

In my notes on this species in Ent. Ann. 1862, p. 28, I have erroneously described the penis-sheaths as app. inf., and applied the name *irroratus* to *L. extricatus* (*hirsutus*, Kol.). See Ent. Ann. 1864, p. 148. I know of no other species of this genus in which the female has such complicated and highly-developed anal appendices.

23. *Limnephilus sparsus*, Curtis. (Pl. X. figs. 17, 18, app.)

Limnephilus sparsus, Curt. (*) Phil. Mag. p. 123, 23 (1834); Steph. (*) Ill. p. 223, 31; *Limnophilus sparsus*, Hag. (*) Ent. Ann. 1859, p. 88, 26; *Limnephilus tenebricus*, Curt. (*) Phil. Mag. p. 123, 23 *b* (1834); Steph. (*) Ill. p. 222, 29; *L. vinculum*, Curt. (*) Phil. Mag. p. 124, 25 (1834); Steph. (*) Ill. p. 222, 28; *L. fuscus*, Steph. (*) Ill. p. 221, 25 (1837); *L. punctatissimus*, Steph. (*) Ill. p. 221, 27 (1837); *Limnophilus punctatissimus*, Brauer (*), Neurop. Aust. p. 51, fig. 72, 73; *Limnephilus fuscatus*, Steph. (*) Ill. p. 222, 30 (1837); *Limnephila fuscata*, Ramb. Hist. Nat. Névrop. p. 483, 22; *Desmotaulius Megerlei*, Kol. Gen. et Spec. Trichop. pt. 1, p. 57, 2 (1848).

Antennæ black, with indistinct testaceous annulations. Head and prothorax dull blackish, with grey and black hairs intermingled. Palpi and mesothorax blackish. Anterior wings fuscous, thickly sprinkled with pale yellow dots, most numerous towards the costa; on the dorsal margin, below or enclosing the thyridium, is a large yellow spot, and another less distinct, almost opposite, on the costa; there is also frequently a large yellowish space about the anastomosis; pterostigma indicated by a spot rather darker than the ground colour; a darker streak along the middle towards the base, and the dorsal margin also darker; varies very much according as the yellow spots are more or less confluent; sometimes they are almost entirely absent, excepting the large spot on the dorsal margin; sometimes there is no marked pterostigma. Posterior wings hyaline, the apex fuscescent, with a darker pterostigma; veins fuscous. Legs testaceous, with black spines; anterior and intermediate tibiæ with dark fuscous rings. Abdomen greyish-fuscous, with paler lateral lines. In the male the upper margin of the last abdominal segment is much produced, rounded, with a blackish projection in the centre; app. sup. truncated, hollow; app. intermed. short, concealed in the cavity of the last segment; app. inf. short, black, with a tuft of long hairs at the tips. In the female the lateral valves are united into a tube, deeply notched on either side.

Expanse of fore-wings 8—11 lines.

A common species, frequenting standing waters, and appearing in summer. It is a most variable insect; Curtis described it under three different names; Stephens retained these and added three more.

24. *Limnephilus fumigatus*, Germar.

Phryganea fumigata, Germ. Faun. Ins. Europ. fasc. 13, tab. 21 (1817); *Desmotaulius fumigatus*, Kol. Gen. et Spec. Trichop. pt. 1, p. 58, 4; *Limnophilus fumigatus*, Hag. (*) Ent. Ann. 1859, p. 89, 27; *Limnephila fuscicornis*, Ramb. Hist. Nat. Névrop. p. 486, 28 (1842); *Limnophilus cingulatus*, Brauer (*), Neurop. Aust. p. 51, fig. 70, 71 (1857).

Antennæ dark reddish-fuscous, almost black. Head and prothorax black, with long and thick black hairs. Palpi dark testaceous. Mesothorax dark piceous. Anterior wings broad, entirely smoky fuscous, dorsal margin darker; long black hairs on the cubital veins; a small whitish spot at the thyridium; veins fuscous. Posterior wings smoky subhyaline, darkest at the apices; veins fuscous. Legs dark testaceous, with black spines. Abdomen blackish above, brown beneath. In the male the upper margin of the last abdominal segment is considerably produced but regularly rounded off; app. sup. obtusely triangular or rounded, hairy; app. intermed. short and concealed; app. inf. rounded, blackish and covered with long black hairs. In the female there is a tubular piece, which is notched above and produced into a somewhat curved acute projection on either side.

Expanse of fore-wings 14—15 lines.

Not a common species, frequenting canals and still waters, and appearing at the end of summer and in autumn. London, Exeter, Burton-on-Trent and Hastings are known localities. It is an insect that I have never seen in the day-time; it probably conceals itself at the roots of reeds, &c., not appearing till it is quite dark. Specimens have been taken at sugar by Lepidopterists.

Genus Anabolia, Stephens.

Antennæ stout, basal joint long, thick, nearly straight. Head slightly narrowed in front, hinder part with two raised coloured tubercles. Maxillary palpi of the male with short basal joint, second joint long, nearly cylindrical, terminal joint rather shorter than the second, subcompressed; of the female with short basal joint, other joints longer and of nearly equal length. Labial palpi with very short basal joint, second joint longer, narrow, terminal joint still longer, broader, oval. Prothorax very small, hairy. Anterior wings long, narrow at the base, dilated before the apex which is parabolic, shining; hairy covering very short and slight; neuration strongly marked; radius slightly bent before its termination: all the apical cells reach the anastomosis; pterostigma not marked. Posterior wings subhyaline, with a very slight sinuation below the apex; fourth apical cell as broad as the second. Tibiæ strongly spinose; anterior with one apical spur; intermediate with one median spur and two apical, of which the inner is the longest; posterior with two median and two nearly equal apical spurs. Abdominal appendices varying considerably according to the species. In *A. nervosa* and its allies the app. sup. of the male are very large and concave; app. intermed. broad, finely pointed, straight and divaricating; app. inf. with a fine straight point; the female has large and broad superior valves.

Larvæ inhabiting canals and not very swift streams. Case a tube wider at one end, composed of small stones and sand, to which are affixed longitudinally long pieces of twigs or straws.

This genus is difficult to separate by any very certain characters from *Limnephilus* (section *Desmotaulius*) on the one hand and from *Stenophylax* on the other. Brauer's character of the comparative width of the 2nd and 4th apical cells in the posterior wings seems to be constant, but is nevertheless of slight generic value, yet it may be used with advantage in separating this genus from *Limnephilus*. The dark unicolorous appearance and parabolic apex of the anterior wings of these insects are so different from most of the species of *Limnephilus*, that at first sight it would appear an easy matter to separate them, but *L. fumigatus* (p. 53) has so much the *facies* of an *Anabolia* that it requires no little resolution to retain it in the other genus. With *Stenophylax* the relationship is still nearer; the best character appears to consist in the habit of the larva, which in the latter genus inhabits swiftly running streams and temporarily fixes its case to prevent being swept away. But slight differences of habit should not carry much weight when unaccompanied by any striking structural characters, and I do not feel quite sure that I am right in separating the two genera.

We possess only two species of *Anabolia* in this country, so different that no difficulty can be experienced in distinguishing them, but on the Continent there are several most closely allied.

1. *Anabolia nervosa*, Curtis.

(Pl. II. fig. 2, larva; fig. 29, case; Pl. IV. fig. 3, neuration; Pl. X. figs. 19, 20, app.)

Limnephilus nervosus (Leach, MS.), Curtis (*) Phil. Mag. p. 124, 27 (1834); *Anabolia nervosa*, Steph. (*) Ill. p. 230, 1; Hag. (*) Ent. Ann. 1859, p. 90, 28; *Phryganea fusca*, Pict. (*) Recherch. p. 153, 22, pl. 10, fig. 1 (1834); *Limnephila* *fusca*, Ramb. Hist. Nat. Névrop. p. 487, 29; *Anabolia lurida*, Steph. (*) Ill. p. 230, 2 (1837); *A. nigricornis*, Steph. (*) Ill. p. 232, 6 (1837); *A. destituta*, Hag. (*) Ent. Ann. 1859, p. 20, 29; Kol.?

Antennæ dark uniform blackish-fuscous. Head blackish-fuscous, with two paler tubercles behind. Palpi brownish-testaceous. Prothorax rather thickly clothed with yellowish hairs. Mesothorax dark chesnut-brown, blackish in the middle. Anterior wings uniform dull pale fuscous, with an ochreous tinge; a whitish spot at the thyridium; veins darker than the membrane. Posterior wings subhyaline, apical portion brownish. Legs greyish or brownish-testaceous, with black spines; tibiæ blackish at the apex, and there is also a blackish spot about the median spurs; tarsi somewhat fuscescent. Abdomen blackish, with ochreous lateral lines which often disappear in dead specimens. In the male the upper margin of the last abdominal segment is cut off straight; app. sup. large, obtuse, blackish, concave, with a rather prominent tooth on the lower margin; app. intermed. broad, pointed, diverging, nearly as long as the app. sup.; app. inf. with a large broad base from which proceeds a small obtuse projecting piece. In the female the superior valves are broad, flat, depressed in the centre and almost truncated; two fine spine-like points proceed from the middle of the margin of the last segment, above the superior valves (these points, which may be termed app. intermed., are very liable to be broken off and are generally invisible in dry examples); the lateral valves are somewhat conical and obtuse.

Expanse of fore-wings 12—15 lines.

Larva: Head and pronotum fuscous, corneous; mesonotum also corneous, fuscous, with darker and lighter clouds, and a rather conspicuous short black line on each side posteriorly; metanotum and first abdominal segment paler fuscous; the rest of the abdomen dirty-whitish; anal crotchets tipped with fuscous, with a few black hairs at the base; legs pale reddish-fuscous, black at the joints, slightly hairy. This larva is subject to very considerable variation; sometimes the head and thoracic segments are prettily marbled with fuscous and yellowish, as figured and described by Pictet.

Case composed of vegetable matters and small stones intermixed, with long pieces of twigs attached externally; these are often much longer than the tube and extend far beyond it posteriorly.

An extremely abundant insect, frequenting running streams and also canals, &c., appearing in autumn in immense numbers. It is occasionally found on the blossoms of the ivy.

On the Continent are found other species very closely allied to this, but differing greatly in the structure of the appendices. With respect to *A. destituta*, described by Dr. Hagen in Ent. Ann. 1859, p. 20, I can say with certainty that the type specimen of *A. nigricornis*, Steph., on the authority of which Dr. Hagen introduced *A. destituta* (considering them identical), is only a small and somewhat distorted example of *A. nervosa*. I know *A. destituta* of Kolenati only from description.

2. *Anabolia cœnosa*, Curtis.

Limnephilus cœnosus, Curt. (*) Phil. Mag. p. 123, 24 (1834); *Anabolia cœnosa*, M'Lach. Ent. Ann. 1864, p. 149.

Antennæ black, with very indistinct paler annulations. Head black. Palpi dark fuscous. Prothorax conspicuously ochreous, with yellowish hairs. Mesothorax black, ochreous at the point of articulation with the scutellum. Anterior wings pale shining fuscous, thinly clothed with greyish hairs, and with long black hairs on the cubital veins; a slightly paler spot at the arculus; neuration slightly darker than the membrane; first apical cell longer than the second, obliquely truncated at the base; second and fourth equal in length, straightly truncated at the base; third longer than the second and somewhat acute. Posterior wings subhyaline, iridescent, tinged with pale brownish at the apex; discoidal cell extremely long and narrow. Legs fuscous with black spines. Abdomen fuscous. In the male the upper margin of the last abdominal segment is shallowly emarginate in the middle, with a scabrous black protuberance on either side of the emargination and a pale space between; app. sup. small, rounded and black; app. inf. directed upwards, the apical portion intensely black, the extreme apex obtuse and furnished with obtuse black ridges or teeth; penis bright testaceous.

Expanse of fore-wings 11 lines.

There were three specimens of this insect in Curtis' Collection. He mentions Scotland as the locality, but at the time of publishing his paper in the Philosophical Transactions appears to have known of only one example. A male specimen (from which the above description has been made) is in Mr. Newman's Collection, and was probably captured by him near Leominster.

It differs considerably from the group of *A. nervosa*.

Genus Stenophylax, Kolenati.

Antennæ, head, palpi, legs, &c., with the same characters as in *Anabolia* (p. 53). Anterior wings slightly broader at the apex, rather more hairy, with well-marked paler spots at the thyridium and behind the anastomosis; apex parabolic or circular. Posterior wings as in *Anabolia.* Abdominal appendices in the male varying according to the species; app. intermed. curved, divaricating; app. inf. sometimes well developed; penis-sheaths apparently simple, fine, needle-shaped and curved; penis thin.

Larva inhabiting swiftly running streams. Case a straight cylindrical tube composed of small stones, temporarily fixed at one end to large stones, &c. When about to change to a pupa, the larva closes the case with larger stony fragments, retires to a cavity in a large stone or to some other convenient place, and there fixes it firmly.

As before mentioned (p. 54) this genus is very closely allied to the preceding and differs chiefly in the habits of the larvæ. The anterior wings are, however, decidedly broader than in the species of *Anabolia,* and this character will readily separate the perfect insects of *Stenophylax* from *Limnephilus.* In this respect they resemble the larger species of *Halesus,* and were included in that genus by Stephens. The quadricalcarate posterior tibiæ will readily separate them.

These are large insects of powerful flight; they are very fond of taking refuge in fir trees in woods and are readily beaten from their hiding-places. They also come rather freely to sweet mixtures placed on trees to attract moths.

1. *Stenophylax hieroglyphicus,* Stephens. (Pl. X. fig. 21, app.)

Halesus hieroglyphicus, Steph. (*) Ill. p. 210, 5 (1837); *Anabolia hieroglyphica,* Brauer, Neurop. Aust. p. 48, fig. 58, 59, app.; *Stenophylax hieroglyphicus,* M'Lach. Trans. Ent. Soc. 3rd ser. i. 234; *Halesus vibex,* Steph. (*) Ill. p. 209, 3 (1837); *Stenophylax vibex,* Hag. (*) Ent. Ann. 1859, p. 92, 31; *Limnephila striata,* Ramb. Hist. Nat. Névrop. p. 479, 11 (1842); *Stenophylax striatus,* Kol. Gen. et Spec. Trichop. pt. 1, p. 64, 4.

Antennæ, head and palpi reddish-ochreous. Mesothorax brownish, paler in the middle above. Anterior wings parabolic at the apex, pale reddish-grey, thickly sprinkled with pale yellowish dots, the anterior margin (*area costalis* and *subcostalis*) and dorsal margin (*area suturalis*) entirely pale yellow; the large pale yellow fenestrated spot, generally enclosing the whitish thyridium, is usually connected with a more or less distinct semilunate anastomosal space about the bases of the apical cells; veins brown, those of the anastomosis somewhat darker; upper margin of the discoidal cell rather deeply excised. Posterior wings whitish, subhyaline, yellowish towards the tips. Legs reddish-ochreous, with black spines. Abdomen brownish-ochreous above, paler beneath. In the male the upper margin of the last abdominal segment is cut off nearly straight, with a slight depression in the centre; app. sup. concave internally, base broad, anterior margin deeply excised, the apex curved strongly inwards and very acute, the margins darker-coloured; app. intermed. slightly diverging, blackish towards the tips; app. inf. only evident as a broad obliquely-truncated basal piece, fringed with long hairs; penis-sheaths with the tips slightly converging, piceous.

Expanse of fore-wings 17—21 lines.

The commonest species of the genus, appearing in May, and continuing for some months.

I have not been able to make a comparison of the female appendices of this and the next species from living examples, and have thought it advisable to say nothing about them in the descriptions. Both possess prominent lateral valves and a deeply trifid vulvar scale.

2. *Stenophylax vibex*, Curtis. (Pl. XI. fig. 1, app.)

Limnephilus vibex, Curt. (*) Phil. Mag. p. 125, 30 (1834), and coll. part; *Stenophylax vibex*, M'Lach. Trans. Ent. Soc. ser. 3, i. 233.

Antennæ, head, palpi and thorax similar to the last species. Anterior wings precisely similar in form, and nearly so in coloration, perhaps slightly brighter; the pale anterior margin is much broader and includes the area discoidalis. Posterior wings and legs as in the last species. Abdomen more decidedly ochreous above. In the male the upper margin of the last abdominal segment is cut off nearly straight; app. sup. obtusely spoon-shaped, the lower margin with a not very evident angle; app. intermed. widely diverging; app. inf. with a broad base produced into a rather acute point (when viewed laterally), fringed with long hairs; penis-sheaths as in the last species.

Expanse of fore-wings 18—20 lines.

Apparently less common than the preceding but widely distributed. The place of capture of Curtis' specimen is unknown;

but I have seen specimens from near London, Haslemere, the Isle of Wight, Exeter, Leominster (?), Thorne Moor, Scarborough, and other localities.

This and the preceding are so closely related, that it is impossible for any but a practised eye to separate them without examining the appendices; yet the much broader pale anterior margin of the fore-wings is a constant and good character, and one that will be always confirmed by an examination of the anal parts. Stephens' Collection does not contain this species; the single example in Curtis' Collection was mixed with the next following, but I think it advisable to apply Curtis' name here. This does not appear to be known on the Continent, at least Dr. Hagen did not know it when I sent examples to him, and had not noticed the peculiarities of Curtis' specimen, considering it the same as *S. hieroglyphicus*, to which he applied the name of *vibex*.

3. *Stenophylax striatus*, Pictet. (Pl. XI. fig. 2, app.)

Phryganea striata, Pict. Recherch. p. 132, 1, pl. 6, fig. 1 (1834); *Stenophylax striatus*, Hag. (*) Stett. Zeit. 1859, p. 133, 2; Ent. Ann. 1859, p. 92, 32; M'Lach. Trans. Ent. Soc. ser. 3, i. 235.

In form and coloration very similar to *S. hieroglyphicus*, but smaller. The sides of the mesothorax darker, and the pale space about the anastomosis not evident. In the male the upper margin of the last abdominal segment is produced in the middle into a large triangular flap, which is bent under and densely scabrous and black; app. sup. small and yellow, concave, the apical margin only is visible from above; app. intermed. needle-shaped, shining brown, the tips convergent; app. inf. not produced or pointed, broad, oblique, fringed with long hairs; penis-sheaths nearly parallel, shining brown; penis greatly exserted, about the same length as the sheaths.

Expanse of fore-wings 14—18 lines.

Not a common species. I have examples from various localities, but can only speak with certainty of Leominster and Huddersfield.

4. *Stenophylax lateralis*, Stephens. (Pl. XI. figs. 3, 4, app.)

Halesus lateralis, Steph. (*) Ill. p. 210, 6 (1837); *Stenophylax lateralis*, M'Lach. Trans. Ent. Soc. ser. 3, i. 236; *Halesus latipennis*, Steph. (*) Ill. p. 209, 4 (1837); *Limnephilus tenebrosus*, Curt. (*) Coll.

Antennæ, head and palpi reddish-testaceous. Mesothorax black at the sides. Anterior wings broader and more rounded at the apex than in the three preceding species; brown, thickly sprinkled with small pale dots; the margins scarcely paler, the inner margin most so; a pale spot at the thyridium, and sometimes smaller ones at the base of some of the apical cells; varies in intensity of colour; neuration dark fuscous. Posterior wings subhyaline, the apex yellowish. Legs ochreous, with black spines. Abdomen greyish-ochreous. In the male the upper margin of the last abdominal segment is produced in the middle into a broad lobe, which is bent under, densely scabrous and black (very similar to that in the last species); app. sup. small, scarcely visible from above; app. intermed. short, triangular, slightly divergent, testaceous; app. inf. prolonged upwards, broad and obtuse, yellowish; penis-sheaths parallel, shining brown; penis very short, scarcely apparent. In the female there is a broad dorsal plate, with the apex produced and obtuse, and on each side of this an unequally-triangular acute lateral valve.

Expanse of fore-wings 17—19 lines.

A widely-distributed species, apparently not uncommon. The broad obtusely-rounded apex of the anterior wings, and their generally darker colour, will serve to separate it readily from the three preceding.

The description in Ent. Ann. 1859, p. 93, 33, applies to *pilosa*, Pictet, which has not been found in this country. The present species is No. 6 (from the Righi) in Dr. Hagen's Synopsis of *Stenophylax* in the Stett. Ent. Zeit. 1859, p. 133.

5. *Stenophylax dubius*, Stephens. (Pl. XI. fig. 5, app.)

Anabolia dubia, Steph. (*) Ill. p. 232, 7 (1837); Hag. (*) Ent. Ann. 1859, p. 90, 30.

Antennæ reddish-ochreous, annulated with brown. Head, palpi and thorax reddish-ochreous. Anterior wings short, much dilated and very obtuse at the apex, pale reddish-brown, pubescent, sprinkled with rather numerous small pale dots, especially towards the apex; the pale dot at the thyridium conspicuous; neuration rather darker; first apical cell long, extending about one-third along the upper edge of the discoidal cell. Posterior wings subhyaline, tinged with brown. Legs ochreous, with black spines. Abdomen ochreous. In the male the upper margin of the last abdominal segment is produced in the middle into a broad triangular flap, which is bent down, but not scabrous or black; app. sup. and intermed. hidden under the flap; app. inf. long, directed upwards, coming to a fine point at the apex.

Expanse of fore-wings 12 lines.

The only known specimen is Stephens' type, said to have been taken "in June, in the vicinity of the metropolis."

The short broad wings and the length of the first apical cell readily distinguish this species from its congeners. So far as I am aware there is not any closely-allied European species, but *S. punctatissimus* of Walker from North America is scarcely distinguishable at first sight, and apparently differs only in the app. inf. being blunt and truncated at the tips.

6. *Stenophylax cingulatus*, Stephens. (Pl. XI. fig. 6, app.)

Halesus cingulatus, Steph. (*) Ill. p. 209, 2 (1837); *Stenophylax cingulatus*, M'Lach. Trans. Ent. Soc. ser. 3, i. 237.

Antennæ, head, palpi and mesothorax reddish-ochreous, the last darker at the sides. Anterior wings pale greyish-yellow, immaculate, the extreme costal margin brownish. Posterior wings subhyaline, slightly yellowish at the tips. Legs ochreous, with black spines. Abdomen dark blackish-fuscous above, with broad ochreous rings at the divisions of the segments; beneath wholly ochreous. In the male the upper margin of the last abdominal segment is nearly straight; app. sup. prominent, furcate, the outer fork the longest; app. intermed. short and triangular, black; app. inf. long, directed upwards, rather obtuse at the apex; penis much exserted.

Expanse of fore-wings 18 lines.

A single specimen in Stephens' Collection, said to have been taken in "Devonshire in July."

I have some suspicion that this may be only an old faded example of one of the two succeeding species, in which the app. sup. are protruded more than ordinarily. The pale abdominal rings I do not see, however, in any other.

Stenophylax testaceus of Pictet, described in Ent. Ann. 1859, p. 93, 34, and there given as synonymous with *Halesus cingulatus* of Stephens, has not yet been discovered in this country.

7. *Stenophylax stellatus*, Curtis.

(Pl. IV. fig. 4, neuration and palpi; Pl. XI. figs. 7, 8, app.)

Limnephilus stellatus, Curt. (*) Phil. Mag. p. 125, 32 (1834); *Halesus stellatus*, Steph. (*) Ill. p. 210, 7; *Stenophylax stellatus*, M'Lach. Trans. Ent. Soc. ser. 3, i. 238; *Limnephilus latipennis*, Curt. (*) Phil. Mag. p. 125, 31 (1834); *Stenophy-*

lax latipennis, M'Lach. Trans. Ent. Soc. ser. 3, i. 237; *Phryganea pantherina*, Pict. (*) Recherch. p. 137, 6, pl. 6, fig. 1 (1834); *Stenophylax pantherinus*, Kol. Gen. et Spec. Trichop. pt. 1, p. 67, 8; Hag. (*) Ent. Ann. 1859, p. 94, 35; *Anabolia pantherina*, Brauer, Neurop. Aust. p. 49, fig. 56, app.

Antennæ dark brown, with slightly paler annulations. Head, palpi and thorax dark brown above. Anterior wings pilose, mouse-grey, with elongated pale spots in the cells; a large somewhat bilobed pale spot at the thyridium, and two or three greyish markings at the base towards the dorsal margin. Posterior wings greyish, subhyaline, darker at the tips. Legs greyish-brown, with black spines. Abdomen dark blackish-fuscous above, paler beneath. In the male the upper margin of the last abdominal segment is cut off straight; app. sup. concealed in the last segment, small, apparently divided; app. intermed. acute, divergent, testaceous, the upper half blackish; app. inf. produced into a long cylindrical style, directed upwards, testaceous, black at the apex, which is knobbed, the lower part fringed with long yellowish hairs; penis-sheaths and penis small, scarcely visible. In the female above, there is a large, open, emarginate, tubular piece.

Expanse of fore-wings 14—16 lines.

Larva with the head and thorax brown. The pronotum with several black markings on its posterior portion, which are joined to those on the mesonotum, which is margined by a black line. The metanotum has four scaly points from which arise hairs. Abdomen yellow, very stout, with few respiratory filaments. The feet strong, fawn-coloured. (Pictet.)

Case formed of stony fragments placed in a regular manner, and attached to the underside of stones in running waters. (Pictet.)

A not uncommon species by most swiftly-running streams, appearing in summer and autumn. Scotch specimens are darker than Southern ones.

In Trans. Ent. Soc. ser. 3, i. 237, I separated *latipennis* of Curtis as a distinct species, but am now disposed to think that it belongs here; the types were certainly paler than is usual in *stellatus*, but they may have been faded. The description in Ent. Ann., 1859, p. 94, 36, applies to *areatus* of Kolenati, a species excessively similar in general appearance, but differing in the app. inf., which are produced into a long acute point. This species has not yet been discovered in Britain.

8. *Stenophylax radiatus*, Rambur. (Pl. XI. fig. 9, app.)

Limnephila radiata, Ramb. Hist. Nat. Névrop. p. 479, 12 (1842); *Stenophylax radiatus*, Hag. Stett. Zeit. 1859, p. 136, 3; M'Lach. Trans. Ent. Soc. ser. 3, i. 239.

Very similar in general appearance to the preceding. In the male the app. sup. are decidedly bilobed, the inner lobe shorter than the outer and black with the margins crenulated; this inner lobe appears to be joined to the base of the app. intermed.; app. inf. produced into a long upwards-directed flattened piece, the apex of which is truncated and folded, shining black.

Expense of fore-wings 14—18 lines.

Apparently a very local species. I have taken it at Dawlish, Devon, in September, and have seen examples from other localities.

The different form of the app. inf. is, perhaps, the only decided character by which this can be separated from the preceding. The app. sup. are apparently different, but these parts in this group of *Stenophylax* are so greatly concealed (or retracted) in the last segment, that it is difficult to examine them with any great degree of accuracy. There seem to be several allied European species, which can be separated only by an examination of the appendices, and chiefly of the app. inf.

9. *Stenophylax infumatus*, n. sp.

Antennæ and head dull black. Palpi dark blackish-fuscous. Prothorax reddish-fuscous, with black hairs. Mesothorax black; a deeply impressed longitudinal medial line, with a shorter impressed line on each side. Anterior wings uniformly dark smoky fuscous, with conspicuous blackish veins; a white dot at the thyridium and another below it at the arculus; cubital veins with long black erect hairs. Posterior wings pale smoky fuscous, darker at the apex. Legs fuscous, with black femora; tibiæ and tarsi with black spines. Abdomen black above, brownish beneath. In the male the superior margin of the last abdominal segment is regularly rounded and somewhat testaceous; app. sup. subtriangular, testaceous, the apex slightly produced and black; app. intermed. placed close together, short, broad and triangular, testaceous, the tips obtuse and deep black; app. inf. arising from near the middle of the ventral margin, placed close together, curved upwards, band-shaped, long, obtuse, fuscous, the extreme apex black and scarcely thickened; when viewed from below they are seen to approximate at the base and tips and recede gradually in the middle, owing to the curvature; penis and its sheaths not visible.

Expanse of fore-wings 17—18 lines.

I found this species not uncommonly about some of the moor-streams in the Black Forest at Rannoch, Perthshire, in the beginning of June, 1865, but saw only the male. It is recognizable by its uniform smoky-fuscous coloration, resembling in no small degree *Limnephilus fumigatus*, and by the absence of markings on the wings, save the two pale dots; the form and arrangement of the appendices differ somewhat from the other species of the group, especially the insertion of the app. inf.

The discovery of this insect was made too late for me to give figures of the appendices, which must be reserved for a future occasion.

Genus Halesus, Stephens.

Antennæ moderately stout, basal joint nearly as long as the head. Head somewhat produced in front between the antennæ. Eyes large, prominent. Maxillary palpi in the male long and thin, joints slightly compressed, basal joint short but not much thicker than the others, two succeeding joints long and of nearly equal length; in the female the basal joint is short, the second, third and fifth are long and nearly equal, the fourth a little shorter than the fifth and slightly stouter. Labial palpi with short basal joint, second and third joints longer and nearly equal. Prothorax small but distinct, hairy. Mesothorax large, oval, very convex above, and with a broad median impressed line. Anterior wings slightly hairy, narrow at the base, but expanding very much towards the apex, which is parabolic; dorsal margin gradually curved from base to apex; neuration moderately strong, costal space broad, radius with a slight bend before the termination, discoidal cell long and narrow, all the apical cells reaching the anastomosis. Posterior wings hyaline or subhyaline, scarcely so long as the anterior but much broader, with large anal space; in some species there is a fold following the course of one of the *costulæ*, in which is concealed a pencil-like tuft of long hairs. Legs long, tibiæ and tarsi spinose; anterior tibiæ with one rather long apical spur; intermediate and posterior tibiæ each with one rather short median and two rather long and slightly unequal apical spurs. Abdomen not very robust, laterally compressed; the male is furnished with not very prominent appendices, and sometimes with large serrated penis-sheaths; the extremity of the abdomen in the female is more obtuse, and is apparently furnished with two large valves which close round and form a tube.

Larvæ inhabiting swiftly-running shallow waters. Case composed in some species of imbricated vegetable fragments, in others of small stones, &c.; it is always temporarily fixed.

The British species comprised in this genus are very discordant in size and general appearance, but agree in possessing tricalcarate posterior tibiæ; at the present time only three species have been recorded as native, but very many more are known on the Continent, though they are for the most part undescribed. It is most probable that several others occur among the mountain streams of Scotland and Ireland.

A. *Posterior wings of the male not furnished with a pouch.*

1. *Halesus digitatus*, Schranck. (Pl. IV. fig. 5, neuration.)

Phryganea digitata, Schrk. Ins. Aust. n. 616 (1781); Oliv. Encyc. Méthod. p. 556, 8; Pict. (*) Recherch. p. 138, 7, pl. 7, fig. 2; *Halesus digitatus*, Steph. (*) Ill. p. 208, 1; Kol. Gen. et Spec. Trichop. pt. 1, p. 69, 1; Brauer (*), Neurop. Aust. p. 47; Hag. (*) Ent. Ann. 1859, p. 95, 37; *Limnophilus digitatus*, Burm. Handb. p. 933, 14; *Limnephilus radiatus*, Curt. (*) Phil. Mag. p. 125, 28 (1834); *L. hieroglyphicus*, Curt. (*) Phil. Mag. p. 125, 29 (1834); *Limnephila tessellata*, Ramb. Hist. Névrop. p. 478, 10 (1842).

Antennæ and palpi reddish-testaceous. Head testaceous, somewhat fuscescent. Mesothorax testaceous in the middle, shining blackish-fuscous at the sides. Anterior wings pale greyish-yellow; the veins of the anastomosis, and usually those of the apex, broadly margined with grey; long grey streaks in the apical cells, and between most of the longitudinal veins, sometimes forming large grey blotches; costal margin unmarked. Posterior wings hyaline, yellowish at the apex, and with yellow veins. Legs ochreous, with black spines. Abdomen greyish-fuscous above, paler beneath.

Expanse of fore-wings 18—23 lines.

Larva frequenting running waters. Head and thorax brown, with black markings, forming somewhat regular figures; on the head are a number of small raised black lines. Thorax granulated with black, darker in the middle, and with two stripes posteriorly. Mesothorax with a longitudinal fawn-coloured line; varied with brown and black. Abdomen yellow, with few respiratory filaments. Feet strong and fawn-coloured. (Pictet.)

Case very firm; composed of little twigs and other vegetable *débris*, placed longitudinally. At the posterior part of the case there are often placed longer and stronger twigs, which extend considerably beyond the tube, and form a sort of tail; these are cut off when the larva is about to change. (Pictet.)

A common species in many places in September and October. It varies considerably in the extent to which the wings are marked with grey; some examples are also much yellower than others.

2. *Halesus guttatipennis*, n. sp.
(Pl. I. fig. 2; Pl. XI. fig. 10, app.)

Antennæ and palpi blackish. Head and mesothorax dull blackish. Prothorax with a few yellowish hairs. Anterior wings pale greyish-fuscous, with numerous rather indistinct pale irrorations, most plentiful towards the apex; pterostigma slightly brownish; neuration fuscous; a small whitish hyaline mark at the thyridium; all the apical cells nearly equal in width, none of them acute at the base. Posterior wings whitish-subhyaline, slightly brownish-grey at the apex. Legs testaceous, with black spines; thighs greyish-black, testaceous at the knees; tarsi fuscescent. Abdomen dull-blackish, with reddish-ochreous lateral lines. In the male the upper margin of the last abdominal segment is produced in the middle and bent under like a lip; app. sup. testaceous, obtusely spoon-shaped, scarcely projecting beyond the segmental margin; app. intermed. testaceous, directed upwards, the tips approximating; at the base of the app. intermed. is a horizontal, nearly quadrangular plate, the outer margin of which is excised; app. inf. fuscous, somewhat testaceous, the tips truncated and rather thickened, provided with long hairs; penis apparently unfurnished with sheaths, much exserted, whitish-yellow, the apex slightly notched.

Expanse of fore-wings 12 lines.

Of this I have seen but one specimen (a male) taken by Mr. Edwin Brown, probably near Burton-on-Trent. Several closely-allied species are found on the Continent (some of them yet undescribed), but I cannot find that this has hitherto been noticed.

B. *Posterior wings of the male furnished with a pouch in which is placed a pencil of long hairs.* (This pouch is usually closed and nearly invisible in dead specimens.)

3. *Halesus annulatus*, Stephens. (Pl. XI. figs. 11, 12, app.)

Anabolia annulata, Steph. (*) Ill. p. 231, 4 ♀ (1837); *A. testacea*, Steph. (*) Ill. p. 231, 3 (1837); *A. flavipennis*, Steph. (*) Ill. p. 231, 5 (1837), not of Pictet; *Halesus flavipennis*, Kol. Gen. et Spec. Trichop. pt. 1, p. 71, 5; Hag. (*) Ent. Ann. 1859, p. 95, 38; Brauer, Neurop. Aust. p. 47, fig. 46, app.?

Antennæ brown. Head dark brown, with scattered ochreous hairs. Palpi reddish-ochreous. Prothorax testaceous, with ochreous hairs. Mesothorax dark brown. Anterior wings greyish-yellow, rather thickly clothed with short yellowish pubescence; immaculate, excepting the usual pale dot at the thyridium, and a somewhat browner tinge at the pterostigma; neuration fuscous; first apical sector extending to about one-fourth the length of the discoidal cell. Posterior wings greyish-subhyaline, with fuscous veins; the pencil of hairs in the male yellowish. Legs ochreous with black spines. Abdomen brownish, the margins of the segments paler. In the male the upper margin of the last abdominal segment is truncated, with a space covered with short black setæ in the middle, above which is an oval black swelling; app. sup. yellow, very small and hairy; app. intermed. not visible, but in their place is a short horizontal square plate, with an intensely black outer margin; app. inf. short, directed slightly upwards, testaceous-black at the acute apex; penis short and obtuse. In the female the last abdominal segment above is furnished with long hairs directed forwards; the lateral valves are large and divided at the apical margin, the lower fork longer than the upper.

Expanse of fore-wings 9—11 lines.

A not uncommon insect about swiftly running streams with a rocky bottom, especially in mountainous districts; appearing in summer and autumn. Examples from the North of England and North Wales are darker than southern specimens.

There are several allied continental species; amongst these may be cited *H. flavipennis*, Pictet, and *H. chrysota*, Rambur.

Genus Ecclisopteryx, Kolenati.

Antennæ slender, basal joint stout, scarcely so long as the head. Head subtriangular, produced above between the antennæ, and margined with a row of hairy tubercles. Ocelli very prominent. Maxillary palpi in the male with the first joint short, second and third of nearly equal length; in the female the basal joint is short, second and fourth longer, of nearly equal length, third and terminal joints still longer. Labial palpi with short basal joint, second longer and somewhat clavate, third still longer and cylindrical. Prothorax distinct, slightly hairy. Mesothorax somewhat broader than the head, ovate, with a flattened space above. Anterior wings with very short and sparse hairy covering, shining, very narrow at the base, dilated before the parabolic apex; neuration strong and distinct; radius with a shallow bend before the termination, discoidal cell long and narrow, all the apical cells nearly equal in breadth. Posterior wings rather broader and shorter than the anterior, apex obtusely rounded, anal space moderate, with longer marginal cilia; discoidal cell as in the anterior wings; apical cells all long and narrow; near the base there is a long fold in the male, in which lies a pencil of long hairs. Legs long and slender, tibiæ and tarsi spinose; anterior tibiæ with one apical spur; intermediate tibiæ with two equal apical spurs; posterior tibiæ with one median and two equal apical spurs.

One species occurs in this country; another, *E. Moravica*, Kolenati, (unknown to me), is found in the Moravian Alps.

1. *Ecclisopteryx guttulata*, Pictet.

(Pl. IV. fig. 6, neuration; Pl. XI. figs. 13, 14, app.)

Phryganea guttulata, Pict. (*) Recherch. p. 143, 13, pl. 11, fig. 4 (1834); *Ecclisopteryx Dalecarlica*, Kol. Gen. et Spec. Trichop. pt. 1, p. 75, 1 (1848); Brauer (*) Neurop. Aust. p. 46, fig. 41, app.; *E. guttata*, Hag. (*) Ent. Ann. 1859, p. 97, 41.

Antennæ testaceous. Head fuscous. Palpi testaceous. Prothorax clothed with reddish-brown and blackish hairs. Mesothorax fuscous. Anterior wings pale fuscous, with small indistinct whitish spots; a rather distinct larger whitish spot at the thyridium, and another at the arculus; pterostigma darker than the rest of the membrane; neuration distinct, dark blackish-fuscous. Posterior wings smoky grey, subhyaline; neuration darker; the pouch in the male ochreous. Legs greyish-testaceous, with darker thighs and black spines. Abdomen reddish-fuscous. (I have seen no specimens in sufficiently good condition to enable me to make a description of the anal appendages, and have therefore contented myself with copying Brauer's figures.)

Expanse of fore-wings 8—12 lines.

Found in the North of England; Mr. Beaumont takes it commonly at Huddersfield; and in June of the present year I captured it in some abundance at a stream running into Loch Rannoch, and also at Currie near Edinburgh. Unfortunately I did not make a description of the appendices from fresh specimens. The pale dots on the anterior wings are often absent, excepting those at the thyridium and arculus.

Genus Phacopteryx, Kolenati.

Antennæ very stout towards the base, narrowing gradually; basal joint as long as the head. Head with the angles somewhat rounded, almost smooth, but with a tuft of hairs between the antennæ. Maxillary palpi in the male with short basal joint, second and third of nearly equal length, subcompressed; in the female with short basal joint, second, third and terminal joints of nearly equal length, fourth rather shorter. Labial palpi with short, broad and flattened basal joint, second joint rather longer, thin, terminal joint still longer. Prothorax distinct, hairy. Mesothorax broader than the head, rather angular at the sides, nearly smooth. Anterior wings short, scarcely dilated towards the obliquely rounded apex; apical margin with a shallow sinuation at the termination of each apical sector; the whole of the membrane, with the exception of the costal and dorsal margins, is distinctly granulated, and from each granulation springs a short decumbent hair; the cubitus posticus and its branches have longer somewhat erect hairs; neuration strong, radius with a scarcely perceptible bend, discoidal cell long and narrow, apical cells all broad, but the first and fifth broader than the others. Posterior wings hyaline, slightly broader than the anterior, posterior margin excised, discoidal cell similar in form to that in the anterior wings. Legs rather short, tibiæ and tarsi strongly spinose; anterior tibiæ with one apical spur; intermediate tibiæ with one median and two equal apical spurs; posterior tibiæ with two short median, and two longer equal apical spurs. Abdomen robust, laterally compressed; terminal segment in the male furnished with very large angular superior appendices; intermediate appendices very broad, triangular; inferior appendices small; penis-sheaths hairy; in the female the terminal segment has two superior, and two lateral, rounded valves.

Larva unknown; probably inhabiting standing waters.

At present there is known only one species of this genus. The short distinctly granulated wings, with depressed hairs, are very characteristic.

1. *Phacopteryx brevipennis*, Curtis.

(Pl. I. fig. 3; Pl. IV. fig. 7, neuration; Pl. XI. fig. 15, app.)

Limnephilus brevipennis, Curt. (*) Phil. Mag. p. 125, 33 (1834); *Phacopteryx granulata*, Kol. Gen. et Spec. Trichop. pt. 1, p. 59, 1 (1848).

Antennæ reddish-brown, with slightly darker annulations.

Head, prothorax and mesothorax castaneous, the prothorax with long brown hairs. Anterior wings shining brownish-testaceous, darkest towards the dorsal margin, the apical edge narrowly fuscous, the hairs springing from the granulations black, and there are long black hairs on the veins towards the dorsal margin; veins fuscous; three small whitish spots, one at the base of the third apical cell, one at the thyridium, and the third below it at the arculus. Posterior wings hyaline, testaceous towards the apex, and with brown veins. Legs testaceous, with black spines. Abdomen fuscous above, reddish-ochreous beneath. In the male the app. sup. are very large, foliaceous, angular, cut off very obliquely beneath, testaceous, the lower margin fuscous; app. intermed. short and broad, triangular, concave internally, united at the bases, the apical portion intensely black; app. inf. very short, obtusely pointed. The female appears to be furnished with large obtuse superior valves, and lateral valves of about the same breadth and length.

Expanse of fore-wings 10 lines.

I am only acquainted with four British examples of this singular insect; one in Curtis' Collection, of which I know not the locality; two in my own Collection, taken by Mr. Fereday at Scarborough, in September, 1862; and one taken by Mr. B. Cooke at Bowden, Cheshire.

Genus Chætopteryx, Stephens.

Antennæ slender, basal joint stout, slightly curved, a little longer than the head. Head transversely quadrate, with a few long scattered hairs. Maxillary palpi in the male with short broad basal joint, two succeeding joints of nearly equal length, the second shorter than the third; in the female the basal joint is short and stout, second, third and fourth joints about equal in length and thickness, terminal joint rather longer and thinner. Labial palpi with the three joints of nearly equal length, first and second broad, third narrower. Prothorax distinct, hairs few and long. Mesothorax slightly broader than the head, subrotund, with a broad flat space above. Anterior wings very short, narrow at the base, expanding greatly towards the broadly rounded apex; costa much arched; almost the whole of the membrane is thickly covered with very distinct granulations, from each of which springs a long erect bristle-like hair; marginal cilia rather long, cubital veins with very long erect hairs; neuration very strong, radius not deeply bent before the termination, discoidal cell long and narrow, apical cells short and broad. Posterior wings hyaline, rounded, inferior margin not excised; cilia evident; discoidal cell similar to that in the anterior wings, apical cells narrow. Legs rather long, tibiæ and tarsi strongly spinose; anterior tibiæ in the male without a spur, in the female with one rather long apical spur; intermediate and posterior tibiæ in both sexes with one median and two rather long and nearly equal apical spurs. Abdomen robust, especially in the female; in the male the terminal segment has short and broad superior appendices, upcurved and hook-shaped intermediate appendices, and rather long and very hairy inferior appendices; the penis-sheaths appear to be united into a boat-shaped cover, notched at the extremity, and in which lies the very small penis; in the female the terminal segment has a large convex superior piece, closing round and forming an open tube.

Larva inhabiting clear running water. Case a slightly curved cylindrical tube, composed of vegetable matters and stones intermixed, and temporarily fixed. When the larva is about to change to a pupa, it closes its case with larger stones.

All previous writers have represented that the anterior tibiæ are furnished with a spur in both sexes, a mistake that has evidently arisen from the fact that in the male the anterior tibiæ in dead specimens are always strongly pressed against the thighs, unless the legs have been stretched out whilst drying.

The species are somewhat difficult to separate, and I can only satisfy myself as to the existence of one in this country.

1. *Chætopteryx tuberculosa*, Pictet.

(Pl. IV. fig. 8, neuration and palpi; Pl. XI. figs. 16, 17, app.)

Phryganea tuberculosa, Pict. (*) Recherch. p. 140, 9, pl. 7, fig. 4 (1834); *Chætopteryx tuberculosa*, Kol. Gen. et Spec. Trichop. pt. 1, p. 73, 2; Hag. (*) Ent. Ann. 1859, p. 96, 39; *C. villosa*, Steph. (*) Ill. p. 233, 1 (1837), not of Fab.?, Pict.?, Kol.; *C. brevipennis*, Steph. Ill. p. 233, 2 (1837), not of Curt.; *Limnephilus echinata*, Curtis (*), Coll.

Antennæ reddish-brown. Head dark reddish-brown, a blackish mark towards the base of the antennæ. Palpi reddish-testaceous. Prothorax reddish-brown, with a few long blackish hairs. Mesothorax reddish-brown, darker at the sides. Anterior wings brownish-yellow, clothed with long brown hairs both on the membrane and on the veins; veins yellow; cilia pale yellow; the granulations in the apical cells are usually placed singly towards the base, in two irregular rows in the middle portion, and often three or four together near the margin; first, second, third and fourth apical cells broad and nearly equal, fifth narrower and acute, sometimes scarcely reaching the anastomosis. Posterior wings hyaline, yellowish towards the apex and with testaceous veins. Legs dark testaceous with black spines, the tarsi fuscescent. Abdomen greyish-fuscous. In the male the upper margin of the last abdominal segment is produced in the middle into a short rounded lobe, bent under and covered with short black setæ; app. sup. small and rounded; app. intermed. broad, flat and acute, curved very strongly upwards, the tips shining fuscous; app. inf. curved upwards, rather acute, testaceous, with long hairs. In the female the superior valves appear to be united into a very deeply emarginated tube, the lateral pieces of which are greatly produced and obliquely truncated; the opening of the tube very large.

Expanse of fore-wings 6—12 lines. The females always the largest.

Larva: Head and thorax of a bright fawn-colour, mixed with black spots. Mesonotum with a black line on all sides. Metanotum with four scaly points. Abdomen greyish fawn-coloured, the first segment darker and with fewer respiratory filaments than the others. Feet of a clear brown. (Pictet.)

Case composed of pieces of leaves and wood, disposed longitudinally and irregularly. (Pictet.)

Frequents running streams, and appears in September and October; common in various parts of England, especially in the Lake district.

In the "Entomologist's Annual," 1859, p. 96, Dr. Hagen gives two species as natives of this country, viz., *C. villosa*, Fab., Pict., Kol., and *C. tuberculosa*, Pict. As I have before remarked, I cannot admit that we have two species. In Stephens' Collection there are six males and four females, all labelled *villosa*, whilst there is not a single specimen placed as *brevipennis*, although in the "Illustrations" it is said to be a common species. It would seem probable, therefore, that Stephens discovered afterwards that *brevipennis* of Curtis was a very different insect, and referred his species to *villosa*.

With respect to the other described species of this genus, Dr. Hagen informs me that *C. fusca*, Brauer, differs from all the others in having the app. intermed. forked in the male, and on the ventral surface of the antepenultimate segment in the female there is a transverse row of strong black spines, little visible in the male. In what has been considered as *C. villosa* of Fabr. by Kolenati and Brauer (and perhaps Pictet's species is the same), the app. inf. of the male have a long cylindrical process, and the females are apparently considerably smaller than the males. *C. rugulosa*, Kolenati, is perhaps distinct, differing in the form of the app. inf. *C. irregularis*, Kolenati, is not sufficiently known.

I think the number of rows of dots in the apical cells is not a character of much value, as I have found it to vary considerably in the same individual.

Genus Apatania, Kolenati.

Antennæ slender, basal joint not so long as the head. Head transversely quadrate, hairy. Maxillary palpi in the male with rather short basal joint, two succeeding joints longer, of nearly equal length, cylindrical, terminal joint obtuse; in the female the basal joint is short, second, third and fifth long, nearly equal, the second joint obconical, the fourth much shorter. Labial palpi with the first and second joints nearly equal, terminal joint longer, somewhat club-shaped. Prothorax very small and narrow, slightly hairy. Mesothorax broader than the head, broadly ovate, with few scattered hairs. Anterior wings narrow, thickly clothed with short hairs and with rather long marginal cilia; costal and dorsal margins nearly straight, apex acutely rounded; neuration strong, radius without a sharp bend, a transverse vein unites the radius to the costa at the termination of the subcostal nervure; discoidal cell long and very narrow, most of the apical cells narrow, the fifth scarcely reaching the anastomosis, very acute, the transverse veins forming the lower portion of the anastomosis nearly in a line with the upper. Posterior wings hardly broader than the anterior, scarcely dilated at the anal angle, subhyaline; marginal cilia long; discoidal cell not closed. Legs slender, tibiæ and tarsi with few spines; anterior tibiæ with one apical spur; intermediate tibiæ with two equal apical spurs; posterior tibiæ with two equal median and two apical spurs. Abdomen moderately stout; penis-sheaths broad, penis flattened.

Larva unknown, probably inhabiting lakes and streams.

This genus is easily recognizable by the number of tibial spurs and by the hairy clothing being much more dense than in the other genera in this family, as well as by the neuration being considerably different in character. The nearly straight anastomosis in the anterior wings, the open discoidal cell in the posterior wings, and other minor characteristics, exhibit a divergence from the general type of neuration in this family. The form of the palpi shews, however, that this is the proper place for the genus.

We have at present but one recorded native species; others are known on the Continent. They much resemble each other in outward appearance, but are easily separated by the forms of the anal appendices of the males.

1. *Apatania vestita*, Kolenati.

(Pl. IV. fig. 9, neuration and palpi; Pl. XI. fig. 18, app.)

Apatania vestita, Kol. Gen. et Spec. Trichop. pt. 1, p. 76, 1 (1848); Hag. (*) Ent. Ann. 1859, p. 98, 42.

Antennæ, head and thorax black; the head and prothorax with greyish pubescence. Anterior wings pale greyish-fuscous, thickly clothed with short brownish-grey pubescence, rather darker at the pterostigma; a pale spot at the thyridium and another on the costa just before the pterostigma; veins fuscous; discoidal cell concave on its superior margin; first apical cell narrow at the base; second and fourth of nearly equal breadth throughout, truncated at the base; third much longer than the second, base slightly narrower, two-sided; fifth very acute, scarcely reaching the anastomosis; sixth extending further than all the others, two-sided at the base; the others short and broad. Posterior wings subhyaline, with fine greyish pubescence and long grey cilia. Legs with the thighs fuscous, testaceous towards the knees; tibiæ and tarsi testaceous, with fuscous spines; terminal tarsal joints somewhat fuscous. Abdomen blackish with reddish-brown lateral lines; the three terminal segments fringed with long hairs; app. sup. apparently absent; app. intermed. fine, slightly curved, hairy, united at the base into a broad plate, yellow; between and above the app. intermed. is a long fine needle-shaped yellow spine, exceeding them in length, and directed slightly downwards; app. inf. very long, bisarticulate, curved strongly upwards, the joints of nearly equal length; first joint stout, rather dilated towards the truncated extremity, fuscous and fringed with long fuscous hairs, second joint obtuse at the apex, which has a slight downward curve, yellowish at the base, fuscous at the apex, the whole very thickly clothed with short fuscous hairs; upper penis-sheaths broad, approximating, yellow at the base, fuscous towards the obliquely truncated apex; penis not so long as the upper sheaths, yellow, the apex split; beneath the penis lie two very small needle-shaped fuscous lower sheaths.

An old specimen is in Mr. Newman's Collection. I possess examples from the Lake District, and in June last captured it in abundance on the shores of Loch Rannoch. I found females of an *Apatania* at Arundel which may belong to this species, but until I see the males I cannot speak with certainty.* Mr. Eaton has also taken females near Blandford, which may likewise belong here.

It is not a settled question, whether this be truly Kolenati's species; several closely allied forms are found on the Continent which are readily separable by the appendices of the males, but descriptions in which these parts are omitted are almost useless. One (unnamed) species is found both in the North of Europe and in North America.

Fam. SERICOSTOMIDÆ.

Antennæ about as long as or shorter than the wings, generally rather stout, the first joint usually longer than the head, strongly hairy, the succeeding joints short; ocelli absent; maxillary palpi in the males two- or three-jointed, usually broad, hairy, and curved up over the face, varying very much in form in the different genera; in the females five-jointed, rather hairy, the basal joints thicker than the others, terminal joints nearly cylindrical, straight; anterior wings usually rather short and broad (excepting *Sericostoma*), with a dense hairy clothing; neuration generally indistinct unless the hairs are removed, varying much in the different genera and frequently differing in the sexes; discoidal cell generally closed; posterior wings broad, folded, rather shorter than the anterior; legs not very long or strong, almost without spines, the anterior tibiæ always with two spurs, the number varying on the others. Abdomen short and sometimes rather stout. In the male the appendices vary much in the different genera, and are often of a complicated structure.

Larva frequenting running waters: Head small and transverse. Pronotum and mesonotum rounded at the angles (*Sericostomes*, Pictet), or with the anterior angles greatly produced (*Trichostomes*, Pictet). Abdomen with the sides nearly parallel; the processes on the second segment not strongly developed; respiratory filaments short and few in number. Legs short; anal crotchets very short. Pupa with the mandibles edentate.

Case a cylindrical tube formed of sand, smaller at one end and tapering gradually (*Sericostomes*), or short, broad and flattened, with larger fragments of stones fixed on each side (*Trichostomes*).

Comprises those genera in which the maxillary palpi of the

* In August, 1865, I took upwards of thirty specimens at Arundel; all are females. I am now disposed to consider this form as distinct; it is darker, broader-winged, and more densely pubescent than *A. vestita.* The capture of the male can alone decide the question.

males not only differ in the number of joints from those of the females, but are constructed in quite a different manner.

The following is a tabular arrangement according to the number of the tibial spurs:—

Spurs 2-2-4	*Sericostoma* and *Notidobia*.
Spurs 2-4-4	*Goëra*, *Silo* and *Mormonia*.
Spurs 2-3-3	*Brachycentrus*.

A Continental genus (*Dasystoma*), species of which are very likely to be discovered here, has only 2-2-2 spurs.

Genus Sericostoma, Latreille.

Antennæ shorter than the wings, the basal joint thick, shorter than the head. Maxillary palpi in the male broad, closing together and forming a mask in front of the head, externally clothed with adpressed hairs and internally furnished with long close hairs. Labial palpi long, the three joints of nearly equal length. In the female the maxillary palpi are very long, the basal joint very short; second joint longer than any of the others; third, fourth and fifth joints of nearly equal length; the terminal and penultimate joints are much thinner than the others. Labial palpi of the female much shorter than in the male, the joints scarcely half as long. Prothorax thickly clothed with hair. Mesothorax broad, oval, convex, sulcated in the middle above. Anterior wings long and narrow, the apex elliptical, costal margin nearly straight; hairy clothing thick and short; the radius quite straight; discoidal cell narrow, obliquely truncated; the first apical cell reaches almost to the base of the discoidal; a transverse vein connects the discoidal cell with the radius, an oblique one closes the discoidal cell; nearly in a line with this is one closing the space below the discoidal, and another placed opposite the base of the discoidal closes the long cellula thyridii. Posterior wings considerably shorter than the anterior but slightly broader, also with a very close hairy clothing; the discoidal cell appears to be open; cilia long, especially near the base of the posterior margin. Legs short; tibiæ with few very short spines; anterior and intermediate tibiæ with two equal apical spurs; posterior tibiæ with two equal apical and two similar median spurs. Abdomen robust. In the male the app. sup. are small and obtuse, bandlike; the app. intermed. lie close on each side of the penis and are split at the extremities, the points usually differing in lengths; app. inf. very large, narrow at the base, the apex greatly dilated and notched, very hairy; penis very long and much exserted; penis-sheaths (this term perhaps more properly belongs to what I have called app. intermed.) placed on each side of the ventral margin of the last segment, nearly cylindrical; between them at the base is a triangular plate-like projection.

Larva with the head small and transverse, corneous. Pronotum broader than the head, also transverse and corneous, the superior angles not produced. Meso- and meta-nota scarcely corneous, of about the same consistency as the abdomen. (See Pl. II. figs. 12, 19.) Abdomen nearly cylindrical. Feet short, hairy.

Case a cylindrical tube formed of fine sand, somewhat smaller at the tail-end, and slightly curved.

The extraordinary form of the maxillary palpi in the males will readily separate that sex, and leave no doubt as to the genus to which the insect belongs, but the females are not equally fortunate in this respect, and differ widely from the males in the form of the palpi. Stephens, in his Illustrations, describes as a separate genus *Potomaria*, Leach, MSS.; all the types of his three species of this genus are females of *Sericostoma*, yet he describes the male of *Potomaria.* He also characterizes the anterior tibiæ as without spurs, a statement entirely at variance with the types in his Collection. In his characters of *Sericostoma* he again errs in saying that the anterior wings are without transverse nervures, as any one can see for himself by simply removing the hairy clothing.

1. *Sericostoma Spencii*, Kirby.

(Pl. IV. fig. 10, neuration; Pl. XI. fig. 19, app.)

Prosoponia Spencii, Kirb. & Sp. Int. Ent. ed. 2, vol. 3, p. 488 (1830); *Sericostoma Spencii,* Steph. (*) Ill. p. 184, 1, pl. 33, fig. 2; Hag. (*) Ent. Ann. 1859, p. 100, 43; *S. Latreillii,* Curt. (*) Phil. Mag. p. 214, 1 (1834); *S. collare,* Pict. Recherch. p. 176, 1, pl. 14, 1 (1834); Brauer (*) Neurop. Aust. p. 43, fig. 35, app.; Hag. (*) Stett. Zeit. 1859, p. 147, 1; *Prosoponia collaris,* Kol. Gen. et Spec. Trichop. pt. 1, p. 90, 3; *Potomaria analis,* Steph. (*) Ill. p. 183, 1, pl. 34, fig. 4 (1836); *P. assimilis,* Steph. (*) Ill. p. 183, 2 (1836); *P. hyalina* (*) Steph. Ill. p. 183, 3 (1836).

Antennæ brown, not annulated. Palpi in the male blackish, fuscous externally, internally with long yellowish hairs. Head and prothorax clothed with bright yellow hairs, most evident in the female. Meso- and meta- thorax shining black. Legs with blackish thighs and testaceous tibiæ and tarsi. Anterior wings uniform golden brown; in the female there are frequently greyish blotches at the anal angle and on the opposite costal margin; the blotches are most conspicuous during life ; sometimes the whole of the anterior wings in the female is blotched and spotted with grey. Posterior wings dark fuscous. Abdomen dull blackish, with testaceous appendices. In the male the prongs of the app. intermed. appear to vary slightly in length, sometimes the upper is rather the longer, sometimes the lower, and occasionally they are equal ; the penis-sheaths are thickened and incurved at the tips ; the triangular plate between the sheaths short and obtuse.

Expanse of fore-wings 9—14 lines.

Larva with the head and pronotum chestnut-brown ; the latter with a clearer central line ; meso- and meta-nota and abdomen citron-yellow ; legs fawn-coloured. (Pictet.)

Common everywhere about running streams ; appearing in summer and autumn.

There is a possibility that two species may be here united, and that one of them is the *S. multiguttatum* of Pictet and Hagen, but I have failed to discover any difference by which to separate them, save a very slight variation in the length of the prongs of the app. intermed. Nevertheless I have seen European species in which these sheaths furnish good specific characters.

Genus Notidobia, Stephens.

Antennæ slightly shorter than the wings, the basal joint thick and short. Maxillary palpi in the males small, bent upwards, not forming a mask, without long internal hairs ; labial palpi long, the joints of nearly equal length. In the female the maxillary palpi have a short basal joint ; second much longer and thicker than the others ; fifth very short. Anterior wings narrow at the base, the apex obtusely rounded, hairy covering close, discoidal cell small and closed, the first apical cell reaching almost to its base. Posterior wings shorter than the anterior, and of about the same breadth ; discoidal cell closed ; cilia, especially the basal, long. Legs rather short ; anterior and intermediate tibiæ with two rather long apical spurs ; posterior tibiæ with two pairs of rather long equal spurs. Abdomen subcylindrical in the male, broad and somewhat depressed in the female. Male provided with small superior and large hairy inferior appendices ; in the female the apex of the abdomen forms a large open pouch.

Larva probably similar to that of *Sericostoma*. Case a cylindrical slightly curved tube, composed of sand and very small stones agglutinated together ; closed at each end with vegetable *débris*, when the inmate is in the pupa state.

We possess only one species of this genus.

1. *Notidobia ciliaris*, Linné.

(Pl. V. fig. 1, neuration; Pl. XI. figs. 20, 21, app.)

Phryganea ciliaris, Linn. Faun. Suec. n. 1497 (1761); Müll. Faun. Fridrichs. p. 84, 565; Zett. Ins. Lapp. col. 1070, 41; *Notidobia ciliaris*, Kol. Gen. et Spec. Trichop. pt. 1, p. 91, 1; Brauer (*), Neurop. Aust. p. 43; Hag. (*) Ent. Ann. 1859, p. 101, 44; *Phryganea atrata*, Fab. Ent. Syst. p. 78, 17 (1793); *Sericostoma atratum*, Pict. (*) Recherch. p. 178, 3, pl. 14, fig. 5; Ramb. Hist. Nat. Névrop. p. 497, 7; *Notidobia atrata*, Steph. (*) Ill. p. 186, 1.

Antennæ dark brownish-black. Head and thorax shining black, scarcely hairy. Palpi black, the maxillary (in the males) clothed externally with long hairs. Anterior wings uniform blackish, with a brownish tinge, somewhat shining. Posterior wings rather paler and more transparent. Legs with blackish thighs; anterior and intermediate tibiæ and tarsi slightly testaceous; posterior tibiæ and tarsi decidedly paler. Abdomen dull black. In the male the upper margin of the terminal segment has a submarginal fringe of short black hairs; app. sup. very small and rounded; app. inf. large, testaceous, curved upwards, obtusely rounded and fringed externally with long black hairs; app. intermed. forming a tube above the long exserted penis, which rests between two sheaths, approximated at the base, but diverging at the tips. In the female the terminal segment forms an open mouth-shaped pouch, which is usually filled with a bundle of yellowish eggs; when empty, during life, there may be seen two small appendices on each side of a short testaceous ovipositor.

Expanse of fore-wings 10—11 lines.

A common species in many localities, preferring clear running waters; appearing at the end of spring and in early summer, and is very conspicuous as it sits on the blades of grass bordering the stream.

The character given by Rambur, "ailes supérieures sablées dans leur partie antérieure de petites marques blanchâtres arrondies," is without doubt owing to those wings having been marked by the pressure of the fingers in the capture of the insect.

Genus Goëra, Hoffmansegg.

Antennæ not so long as the wings, rather stout, basal joint thick and straight, longer than the head. Head nearly quadrate, very hairy. Maxillary palpi in the male small, somewhat spoon-shaped, up-curved and thickly clothed on the outside with long thick hairs; labial palpi with a short basal joint, second and third joints equal, long and cylindrical. Maxillary palpi in the female with the two basal joints very short, third and terminal joints long and equal, fourth joint also long but rather shorter than the third; labial palpi smaller than in the male. Prothorax small and hairy. Mesothorax somewhat cordate. Anterior wings rather broad, with the apex obtusely rounded, hairy clothing dense; radius not bent before the termination; discoidal cell long and narrow, closed; just above the anal angle in both sexes there is a small circular space always without hairy clothing, formed by the sudden arching of one of the branches of the ramus thyrifer. Posterior wings shorter than the anterior and less densely clothed; discoidal cell open; a single transverse vein connecting the lower branch of the ramus discoidalis with the ramus subdiscoidalis. Legs short, nearly spineless; anterior tibiæ with two short, nearly equal, apical spurs; intermediate and posterior tibiæ each with two pairs of long equal spurs. Abdomen moderately robust; appendices complicated; in the male there are long finger-shaped app. sup., large app. inf., and fine app. intermed., with a long exserted penis; ventral surface of the antepenultimate segment furnished with a transverse row of spines. In the female there are two long hairy superior valves.

Larvæ inhabiting running streams and canals. The anterior angles of the pro- and meso-nota prolonged in front. (See Pl. II. fig. 13.) Case moveable, broad and flattened beneath, formed of small stones with larger angular fragments placed along either side. During the larva state the tail-end has a membrane closing over the opening, with only a very small central hole allowing a free circulation of the water. Professor Westwood has remarked that cases of this kind are furnished with a grating at each end during the pupa state.

1. *Goëra flavipes*, Curtis.

(Pl. II. fig. 3, larva; fig. 30, case; Pl. V. fig. 2, neuration; Pl. XI. figs. 22, 23, app.)

Silo flavipes, Curt. (*) Ent. Mag. vol. i. p. 189, 4 (1833); *Goëra flavipes*, Curt. (*) Phil. Mag. p. 215, 4; Steph. (*) Ill. p. 197, 2; *Trichostoma capillatum*, Pict. (*) Recherch. p. 173, 1, pl. 13, fig. 8 (1834); Brauer, Neurop. Aust. p. 43; *Spathiodopteryx capillata*, Kol. Gen. et Spec. Trichop. pt. 1, p. 95, 1; *Goëra capillata*, Hag. (*) Ent. Ann. 1859, p. 102, 45; *Trichostoma fuscicorne*, Pict. (*) Recherch. p. 174, 3, pl. 13, fig. 10 (1834), according to the type; *Goëra fusci-*

cornis, Hag. (*) Ent. Ann. 1859, p. 102, 46; *G. pilosa*, Steph. (*) Ill. p. 187, 1 (1836); *Lasiostoma fulvum*, Ramb. Hist. Nat. Névrop. p. 492 (1842).

Antennæ reddish-ochreous, paler in the female. Head, palpi and prothorax ochreous. Mesothorax testaceous. Anterior wings pale silky golden brown or brownish-ochreous, larger and paler in the female; the first apical cell scarcely reaches to the middle of the discoidal. Posterior wings smoky-grey, somewhat iridescent. Legs with the thighs slightly fuscous, tibiæ and tarsi ochreous. Abdomen reddish-brown. In the male the app. sup. are broadly and obtusely finger-shaped; app. intermed. straight, fine, diverging slightly at the tips; app. inf. large, hairy, with the apex produced; penis long, much exserted, cylindrical, with a long flattened apex, apparently with two pairs of fine needle-shaped sheaths, of which the lateral pair are longer than the lower; ventral spines about nine in number, the middle one much longer than the others, the exterior ones very small. The female is provided with two long, hairy, pointed superior valves.

Expanse of fore-wings 9—12 lines.

Larva: Head, thoracic segments, and first abdominal segment yellowish, faintly spotted with darker; two small black spots on the pronotum, and a median paler space. Legs yellowish, with a blackish line at the base externally, and also at the knees and apex. Abdomen dull greyish-yellow, with white respiratory filaments. Anal crotchets marked with black externally, and with a few long black hairs at the base.

A common species in summer about running waters.

There can be no doubt as to the identity of the types of *capillatum*, Pict., and *fuscicorne*, Pict., yet he describes the larvæ of the two as differing considerably. The figure and description of that of *capillatum* agrees very nearly with what I consider to be the larva of this species, and which I have described above. That said to pertain to *fuscicorne* bears far more resemblance to the larva of a *Silo* in the markings, and I cannot but think that some error has occurred.

Genus Silo, Curtis.

Characters very similar to those of *Goëra*, but differing as follows:—The maxillary palpi in the male are longer and more cylindrical, rather widely divaricating. The naked almost circular spot near the anal angle of the anterior wings is absent. In the male there is always a longitudinal fold or pouch near the middle of the posterior wings, running parallel with the costal margin, and extending from the base to about two-thirds the length of the wing; this pouch is beset with coarse clavate hairs. The anal appendices are somewhat similar to those of *Goëra*, but *Silo* appears to possess a more or less developed lobe between the app. intermed. in the male; the ventral surface of the antepenultimate segment in the male is furnished with spine-like teeth.

Larva inhabiting running waters, and similar in form to that of *Goëra*. Case also similar, but smaller.

The larvæ of this genus are particularly subject to the attacks of an ichneumon (*Agrioptypus armatus*), the life-history of which we owe to the researches of Professor Von Siebold. (See "Stettiner Entomologische Zeitung," 1861, p. 59.) It would appear that infested larvæ spin a long appendage to their cases, in the shape of a narrow silken band exceeding in length that of the case; the use of this band is not evident.

Kolenati has misapplied the generic term *Silo* to a very different insect.

The species may be divided into two sections, according to the comparative length of the first apical cell in the anterior wings. Several of both sections occur on the Continent.

A. *First apical cell in the anterior wings not extending beyond the middle of the discoidal.* (Pl. V. fig. 3 *b*.)

1. *Silo pallipes*, Fabricius.

(Pl. V. fig. 3, neuration; Pl. XII. figs. 1, 2, app.)

Phryganea pallipes, Fab. Spec. Ins. 1, p. 388, 6 (1781); *Silo pallipes*, Curt. (*) Phil. Mag. p. 215, 1; Steph. (*) Ill. p. 187, 1; Hag. (*) Stett. Zeit. 1859, p. 145, 1; Ent. Ann. 1859, p. 103, 47; *Trichostoma picicorne*, Pict. (*) Recherch. p. 174, 2, pl. 13, fig. 9 (1834); *Aspatherium picicorne*, Kol. Gen. et Spec. Trichop. pt. 1, p. 97, 2; *Trichostoma nigricorne*, Pict. (*) Recherch. p. 175, 4, pl. 13, fig. 11 (1834); *Goëra vulgata*, Steph. (*) Ill. p. 188, 3 (1836).

Antennæ, head, palpi and thorax blackish-fuscous; the basal joint of antennæ, head and prothorax clothed with light brownish hairs, especially in the female. Anterior wings brownish-black in the male, very dark reddish-brown in the female. Posterior wings smoky-black, with purplish iridescence; cilia grey; the fold in the male conspicuously black. Legs pale testaceous, the thighs fuscescent. Abdomen dark brownish-black, with ochreous-grey lateral lines. In the male there is a straight obtuse shining testaceous lobe between the app. intermed.; app. sup. long, finger-shaped, straight, dilated towards the apices; app. intermed. long and needle-shaped; app. inf. with a broad dilated base ending in two finger-shaped prolongations of equal length; ventral surface of the antepenultimate segment with one long central testaceous spine, and three or four smaller ones on each side; an indication of these spines is also to be found on the penultimate segment in the form of small tubercles. In the female there are two obtuse hairy superior valves.

Expanse of fore-wings 6—9 lines, the females the largest.

Larva: Head, pronotum and mesonotum dark pitchy-brown; three paler spots on the pronotum. Metanotum testaceous, with brown markings. Legs pitchy-brown externally. First abdominal segment testaceous, the others yellowish. Anal crotchets very small, brown.

Very common in summer and early autumn about small rivers and streams.

The types of *picicorne* and *nigricorne*, Pictet, seem to be identical. The larvæ are described as somewhat different, but this may be owing to variation. The figure of that of *nigricorne* accords moderately well with what I take to be the larva of *S. pallipes*.

B. *First apical cell in the anterior wings extending to near the base of the discoidal.* (Pl. V. fig. *3 c*.)

2. *Silo fumipennis*, n. sp. (Pl. XII. figs. 3, 4, app.)

Antennæ, head, palpi and thorax black; in the female the basal joint of antennæ, head and prothorax clothed with pale hairs. Anterior wings in the male smoky-black, somewhat shining; in the female greyish, subhyaline, not thickly clothed with yellowish hairs. Posterior wings pale smoky-black, subhyaline, with grey cilia; the fold in the male not conspicuously darker. Legs dark reddish-brown; thighs somewhat fuscescent, especially the anterior. Abdomen dull blackish, with paler lateral lines, most evident in the female. In the male the lobe is very long and pointed, conspicuously testaceous; app. sup. very small and obtuse; app. intermed. forming two long, narrow, obtuse blades, placed close together, slightly separated at the tips, and acting as an upper cover to the penis; app. inf. somewhat pointed, the apex apparently bifid; ventral surface of the antepenultimate segment with one long central spine, and from two to four smaller ones on each side. In the female the superior valves are longer and more pointed than in the last species.

Expanse of fore-wings $8\frac{1}{2}-10$ lines, the females the largest.

I found this species on the 10th June, 1864, at Sutton-at-Hone by the river Darenth, but not commonly. I have since seen a female taken near Blandford by Mr. Eaton, which may belong here.

This belongs to a section of the genus of which there appear to be several very closely-allied species found in Europe.

According to information with which I have been favoured by Dr. Hagen, *T. picicorne*, Rambur, and species Nos. 8, 9, 10 and 11 (the last, *S. obtusus*, Hagen, and probably identical with *picicorne*), noticed in the Stettin Zeitung for 1859, p. 146, have all similarly formed appendices to *fumipennis*, but all differ in being brownish in colour instead of black. *S. niger*, Hagen, differs in the form of the superior appendices, which are long. *S. auratus*, Hagen, from Corsica, should be sufficiently distinguishable by its paler colour.* I am of opinion that the number of spines on the ventral surface of the antepenultimate abdominal segment does not furnish a character of any specific value, as I find in English specimens of *fumipennis* that they vary from 3 to 4 on each side of the long central one, and in two specimens in my collection from Prussia, which otherwise are precisely similar, there are only two small spines on each side.

The figure of the lateral view of the appendices of the male is copied from Dr. Hagen's drawing, and is, I think, correct, only that the app. inf. do not appear to me to be so deeply bifid as is there represented. Unfortunately at the time I captured my specimens I did not recognize them as being new, and neglected to make an examination while they were yet fresh.

Genus Mormonia, Curtis.

Antennæ thin, slightly longer than the wings, the basal portion sometimes fringed in the male (*Helictomerus*); basal joint very long and hairy, somewhat curved, longer and thinner in the females than in the males. Head small, hairy. Maxillary palpi in the males two-jointed (?), very hairy, club-shaped (*Mormonia*); or long and band-like, coiled round somewhat like a watch-spring (*Helictomerus*). In the females these palpi are very long, the two basal joints short, the first stouter; third joint nearly as long as

* Two species of *Silo* described by Meyer-Dür in the "Mittheilungen der Schweizerische Entomologische Gesellschaft," 1864, p. 223, under the names *Aspatherium frigidum* and *A. medium*, are quite unknown to Dr. Hagen and myself.

the two first united; fourth about as long as the second; fifth nearly as long as the third and fourth united. Labial palpi long; first joint short; second long; third still longer, and thinner than the others. Mesothorax robust, ovate. Anterior wings rather narrow, the apex elliptical; very hairy, sometimes with short clavate hairs in the males, resembling scales (*Mormonia* in part); sometimes the costa in the males is furnished with a long back-curved fringe (*Helictomerus*); apical fringes very long; discoidal cell long and narrow, closed; the female is furnished with two more apical forks than the male. Posterior wings nearly similar in shape to the anterior, but somewhat shorter; fringes very long; discoidal cell closed; neuration varying in the sexes as in the anterior wings. Legs moderately long; anterior tibiæ with two moderately long apical spurs; intermediate and posterior tibiæ each with two pairs of long and equal spurs. Abdomen short and slender. In the males the superior appendices are very small; app. intermed. sometimes long; app. inf. very long, curved round and approximating at the tips; penis exserted and thickened at the apex. In the females the apex of the abdomen is obtuse, with a cleft piece, perhaps representing the valves.

Larva and case similar to those of *Sericostoma*; inhabiting running streams.

In all groups of insects there are some which apparently set at nought the recognized rules of classification, and while the close relationship of the different species is most evident, yet they differ in such a manner, that, if the usual laws of generic distinctions be strictly applied, each individual species should form a separate genus. These vagaries of nature are most curious and interesting, but at the same time they puzzle the would-be classifier, and prove to him the intensely artificial character of all attempts to break the indivisible chain of natural organisms. The genus *Mormonia* is almost an extreme instance of this (as it were) propensity to natural experiment. The different species all present general characters of the greatest resemblance *inter se*, yet the form of the palpi, a character almost universally acknowledged as one of generic value, differs more or less in each, and sometimes to a great extent. I am unwilling to unnecessarily multiply genera, and have therefore divided our three species into two subgenera, *Mormonia* and *Helictomerus*, leaving it to future students to adopt or reject this division as they think fit.

A. *Antennæ not fringed in the male; maxillary palpi in this sex short and clavate (or ovate); costal margin without a* *long in-turned fringe, or this is visible only at the extreme base.* (Mormonia.)

(1.) *Maxillary palpi, and all the wings in the male, clothed with short, black, clavate hairs, resembling scales, easily removable; posterior wings in the male with a long curved longitudinal pouch or fold in the middle, which is free from clavate hairs.*

1. *Mormonia hirta* (Fab. ?), Curtis.

(Pl. V. fig. 4, neuration and palpi; Pl. XII. figs. 5, 6, app.)

Phryganea hirta, Fab. Spec. Ins. 1, p. 391, 19 (1781)?; *Goëra hirta*, Curt. (*) Phil. Mag. p. 214, 6 (1834); *Mormonia hirta*, Steph. (*) Ill. p. 189, 2; Hag. (*) Stett. Zeit. 1859, p. 150, 1; Ent. Ann. 1859, p. 104, 48; *M. gracilicornis*, Curt. (*) Phil. Mag. p. 215, 5 (1834); *M. maculicornis*, Curt. (*) Phil. Mag. p. 215, 3 (1834); *M. nigromaculata*, Steph. (*) Ill. p. 189, 1, pl. 32, fig. 2 (1836); *M. immaculata*, Steph. (*) Ill. p. 189, 3 (1836); *Lepidostoma squamulosum*, Ramb. Hist. Nat. Névrop. p. 493, 1 (1842).

Antennæ dark brown, annulated with pale yellow; basal joint greyish-brown, clothed with long hairs. Head clothed with greyish-brown hairs. Palpi black. Mesothorax brown. Anterior wings greyish, subhyaline, thickly sprinkled with short black clavate hairs; a tuft of in-turned black hairs at the base of the costal margin. Posterior wings similar in colour, but less closely sprinkled with clavate hairs; fringes of all the wings grey. Legs greyish-ochreous. Abdomen above fuscous, the margins of the segments ochreous; beneath wholly ochreous. In the male the upper margin of the last abdominal segment is produced in the middle into a triangular lobe, on each side of which are two straight and pointed app. intermed.; app. inf. long, directed upwards, dilated in the middle, furnished with a fringe of long straight hairs directed downwards; at the base of the app. inf. on each side there is a slender sheath, clubbed at the tip and directed strongly upwards; from beneath may be seen two very short inferior sheaths.

The female is generally paler coloured than the male; the wings greyish-ochreous, with a faint appearance of two darker spots beyond the middle; the hairs simple; the apex of the abdomen obtuse, furnished with a nearly quadrate deeply-cleft plate, which may be considered as the superior valves united.

Expanse of fore-wings 7½—9 lines.

A common species in summer about streams.

It is extremely uncertain if this be the species intended by Fabricius; in fact, there is nothing whatever in his description to indicate that his species really belongs to this genus, or even to this family.

(2.) *Maxillary palpi and wings in the male clothed with ordinary hairs; posterior wings in the male without a longitudinal pouch.*

2. *Mormonia irrorata*, Curtis. (Pl. XII. fig. 7, app.)

Goëra irrorata, Curt. (*) Phil. Mag. p. 214, 2 (1834); *Mormonia irrorata*, Hag. (*) Ent. Ann. 1859, p. 104, 49; *M. minor*, Steph. (*) Ill. p. 189, 4 (1836); Hag. (*) Stett. Zeit. 1859, p. 151, 9.

Antennæ brown, with ochreous annulations; basal joint entirely brown, with brown hairs. Head thickly clothed with golden-yellow hairs. Maxillary palpi in the male small, oval, yellow, clothed with yellowish-grey hairs. Mesothorax brown. Anterior wings greyish, thickly clothed with ochreous hairs; a few blackish hairs on the costal margin near the base; fringes grey. Posterior wings grey, with paler fringes. Legs ochreous. Abdomen fuscous, the appendices yellow. In the male there is a rather long lobe from the upper margin of the last abdominal segment; app. sup. small and obtuse; app. inf. long and slender, coiled round almost upon themselves.

Expanse of fore-wings 5—6 lines.

This little species is widely distributed, but apparently nowhere abundant. It delights in the spray of waterfalls. I have found it frequenting the dribbling springs that escaped from the sides of an old slate-quarry, and it must have bred amongst the damp moss that grew there, as the water formed no stream beneath. I possess it from Freshwater (Isle of Wight), Saltash (Cornwall), various localities in South Devon and North Wales, from Worcester, Huddersfield, Haslemere, &c. Northern examples are darker than those from the south.

B. *Antennæ in the male fringed internally with long hairs on their basal portion; maxillary palpi in the male long, band-like, curved upwards; costal margin in the male furnished with a long in-turned fringe along the greater part of its length.* (Helictomerus.)

3. *Mormonia basalis*, Kolenati.

(Pl. I. fig. 4; Pl. V. fig. 4 *e*, max. palp., fig. 4 *f*, ant.; Pl. XII. fig. 8, app.)

Goëra basalis, Kol. Gen. et Spec. Trichop. pt. 1, p. 98, 1 (1848); *Mormonia basalis*, Hag. (*) Stett. Zeit. 1859, p. 150, 6; M'Lach. Ent. Ann. 1863, p. 133; *Goëra hirta*, Burm. Handb. p. 924, 1.

Antennæ yellow, annulated with brown; fringed with pale grey in the male; basal joint dark brown, clothed with pale yellowish hairs. Palpi clothed with yellowish hairs. Mesothorax brown, thickly clothed with brown hairs. Anterior wings grey; the costal margin furnished with a long in-turned brown or silky fringe almost to the apex; fringes of the apical and dorsal margins grey. Posterior wings grey, somewhat iridescent, with grey fringes. Legs greyish-ochreous. Abdomen greyish-fuscous. In the male there is apparently no trace of either app. sup. or intermed.; app. inf. very long, directed upwards and converging at the tips, semi-cylindrical, sulcate on the inner edge; there is a boat-shaped convex upper penis-cover, beneath which is the thin penis, furnished with two hooks at the tip.

The female is paler coloured than the male and not provided with an in-turned costal fringe; the abdomen clothed with long scattered yellow hairs.

Expanse of fore-wings 9—10 lines.

Frequents streams and appears in summer. Has been taken by Mr. Parfitt near Exeter, by Mr. Newman near Leominster, and by myself near Hythe.

Genus Brachycentrus, Curtis.

Antennæ as long as the wings, thin; the basal joint thick, as long as the head. Head transverse, much broader than long. Maxillary palpi of the males apparently three-jointed, the joints of nearly equal length, but the middle one stouter than the others; slender, curved up in front of the head, with long hairs; in the female the basal joint is very short, succeeding joints longer and cylindrical, the third the longest. Labial palpi with the second and terminal joints equal, the basal shorter. Prothorax indistinct. Mesothorax oval, channelled in the centre above. Anterior wings with rounded costa, the apex elliptical, much produced; hairy clothing very slight; cilia short; neuration strong and conspicuous; radius deeply bent before the termination; discoidal cell short, broad and angular; the seventh apical sector simple in the male, forked in the female. Posterior wings shorter than the anterior, about the same breadth; discoidal cell open; posterior branch of ramus discoidalis simple in the male, forked in the female; anterior branch of ramus subdiscoidalis simple in the male, trifid in the female; thus there are two apical forks in these wings in the male and four in the female. Legs rather long, tibiæ spineless; anterior tibiæ with two short apical spurs; intermediate and posterior tibiæ with one short median and two short apical spurs. Abdomen slender in the male, rather robust in the female; anal appendices not well developed.

Larva unknown to me. It has been suggested that a singular quadrangular case, formed of vegetable matters, may belong here; see Pl. II. fig. 34, and Stett. Ent. Zeit. 1864, pp. 114, 115. This kind of case has been found in Devonshire by Dr. Leach and Mr. Parfitt.

One species only is known to inhabit this country.

It appears to me that Rambur is correct in describing the maxillary palpi of the males as three-jointed, as I fancy I can distinguish the sutures readily; nevertheless the separation of the joints in these palpi in the males of this family is always attended with some uncertainty.

1. *Brachycentrus subnubilus*, Curtis.

(Pl. V. fig. 5, neuration and palpi; Pl. XII. fig. 9, app.)

Brachycentrus subnubilus, Curt. (*) Phil. Mag. p. 215, 3 (1834); Steph. (*) Ill. p. 182, 1; Hag. (*) Ent. Ann. 1859, p. 105, 50; *B. concolor*, Steph. (*) Ill. p. 182, 2 (1836); *B. costalis*, Steph. (*) Ill. p. 182, 3 (1836); *Phryganea tincta*, Zett. Ins. Lapp. col. 1071, 44 (1840); *Pogonostoma vernum*, Ramb. Hist. Nat. Névrop. p. 490 (1842); *Hydronautia maculata*, Kol. Gen. et Spec. Trichop. pt. 1, p. 93, 1 (1848); *H. verna*, Brauer (*), Neurop. Aust. p. 44 (1857).

Antennæ, head, palpi and thorax black. Prothorax with a few grey hairs. Anterior wings greyish-brown, with large yellowish spots on the membrane and smaller spots round the apical margin; these spots are formed of yellowish pubescence, which is generally absent except in very fresh examples; veins fuscous. Posterior wings also greyish-brown, with pale-grey cilia. Legs with the thighs dark-grey, tibiæ and tarsi testaceous. Abdomen blackish. In the male the last segment above is produced into a triangular plate, on each side of which is a large triangular app. sup.; the app. inf. are dilated at the end and clothed with yellowish hairs, and are only visible from beneath. In the female the upper margin of the last segment is fringed with long hairs; the superior valves appear to be united into a cover for the ovipositor, notched in the centre above.

Expanse of fore-wings, ♂ 7—8 lines, ♀ 11—12 lines.

Apparently a local species, appearing in spring; it is said by Stephens to occur in the metropolitan district, but I have never been able to find it there. Found about Exeter, at Pitlochry (Perthshire), and apparently in abundance near Burton-on-Trent.

Kolenati says, with respect to insects of this genus, "Immensa sed præcipue in regionibus septemtrionalibus prodeunt copia, ut nautis sint incommodo."

Fam. HYDROPTILIDÆ.

Antennæ stout, shorter than the wings, moniliform; ocelli present or absent; maxillary palpi in the males four-jointed, the joints somewhat cylindrical and hairy; in the females five-jointed; labial palpi with a thickened apical joint; anterior wings very narrow, exceedingly hairy, neuration not visible unless the hairs be removed; posterior wings rather narrower than the anterior, less hairy, but with very long fringes, not folded; legs rather stout, the anterior pair without tibial spurs; abdomen moderately stout for the size of the insects. All the species are minute.

Larva frequenting both standing and running waters: Head and thoracic segments small; the abdomen much enlarged; external respiratory filaments absent.

Case flat, ovate, membranous.

The species of which this family is composed bear at first sight far more resemblance to *Micro-Lepidoptera* than to *Trichoptera*, and are constantly mistaken for the former. They are of very active habits, so much so as to render their capture difficult, although where they occur, most of them swarm in innumerable numbers. At present very little is known concerning the specific, or even the generic differences, and the accounts given by various authors are very conflicting. The largest known species does not exceed $4\frac{1}{2}$ lines, the smallest 2 lines, in expanse.

We apparently possess only two genera:—

A. Ocelli present. Anterior wings with the costal and dorsal margins nearly parallel; apex somewhat obtuse . . . . *Agraylea.*

B. Ocelli absent. Anterior wings running to an acute point at the apex . . . . . . *Hydroptila.*

Genus Agraylea, Curtis.

Antennæ stout, the basal joint scarcely longer than the others. Head densely hairy. Ocelli present. Maxillary palpi of the males with a short basal joint, the rest long and nearly equal; in the females the joints are nearly equally long, excepting the basal which is very short. Labial palpi with two short basal joints; the third longer and much dilated, conical or rather, perhaps, spoon-shaped, it being concave within. Mesothorax nearly smooth, scarcely so broad as the head. Anterior wings very hairy, with long fringes, narrow, of nearly equal breadth throughout, the costal and dorsal margins straight, the former sloping off rather abruptly before the somewhat obtuse apex; the subcostal nervure and radius short, uniting before their junction with the costa; discoidal cell open (?); the twc branches of the ramus discoidalis ending in long apical forks; the upper branch of the superior fork of the ramus thyrifer ends in a shorter apical fork; thus there are three apical forks in these wings. Posterior wings narrower and shorter than the anterior, less densely hairy, but with very long fringes; neuration very similar. Legs short and moderately stout; all the thighs considerably dilated; the anterior tibiæ not spurred; intermediate tibiæ with a pair of long and very unequal apical spurs, and one short median; posterior tibiæ hairy, two pairs of long and very unequal spurs. Abdomen moderate. In repose the wings are pressed together almost vertically.

Larva unknown. Dr. Hagen suspects that some singular cases found by Bremi may belong to this genus. In these the case of the larva is oblong, somewhat widened in the middle, flat, open at each end and transparent; the case of the pupa is less transparent, with an appendage at each corner by which it is fastened to water plants. The contained larvæ possessed strongly dilated forelegs, and did not resemble *Hydroptila* larvæ. (For a detailed account of these cases, see the Stettin Entomologische Zeitung for 1864, p. 115.)

Agraylea may be separated from *Hydroptila* by the broader and more obtuse anterior wings, the undoubted presence of ocelli, the form of the terminal joint of the labial palpi, &c. They are also less gregarious in their habits.

I have been unable to detect transverse veins in any of the wings; nevertheless I do not feel certain that they are absent, for Kolenati figures and describes the discoidal cell in the anterior pair as being closed by a transverse vein, and indicates another, uniting this cell to the radius or subcosta.

1. *Agraylea multipunctata*, Curtis. (Pl. V. fig. 6, neuration.)

Agraylea multipunctata, Curt. (*) Phil. Mag. p. 217, 2 (1834); Steph. (*) Ill. p. 153, 1; Hag. (*) Ent. Ann. 1859, p. 106, 51; *A. sexmaculata*, Curt. (*) Phil. Mag. p. 217, 1 (1834); Steph. (*) Ill. p. 153, 2; *Hydrorchestria sexmaculata*, Kol. Gen. et Spec. Trichop. pt. 1, p. 103, 1 (1848); *H. argyricola*, Kol. Gen. et Spec. Trichop. pt. 1, p. 104, 2.

Antennæ dark blackish-fuscous. Head blackish, clothed with golden-yellow hairs. Palpi yellow. Mesothorax black. Anterior wings blackish, with numerous golden-yellow spots, some of which are larger than the others; apical cilia blackish, interrupted with yellow. Posterior wings grey; fringes dark grey, those of the apical portion of the costa darker than the rest. Legs greyish or brownish-ochreous. Abdomen greyish-black.

Expanse of fore-wings $3\frac{1}{2}$—$4\frac{1}{2}$ lines.

Occurs in summer and autumn about both standing and running waters, but preferring the latter. Found in various parts of the country, probably nowhere abundant and frequently overlooked.

I examined Curtis' types, and could detect no differences in his two species that I could consider specific. It is liable to considerable variation in the number and size of the golden spots on the anterior wings; I possess an example, in perfect condition, in which these spots are altogether wanting, the wings being uniformly black; this was taken in company with the ordinary form. Probably there may be sexual variations in the adornment, but at present we know too little of the species to speak with certainty on this point. The anal appendages are very minute and highly complicated.

Genus Hydroptila, Dalman.

Antennæ stout. Head densely hairy. Ocelli absent. Maxillary palpi four-jointed in the males. Labial palpi with the terminal joint thickened and cylindrical. Anterior wings densely clothed with long shaggy hair, and with long fringes; very narrow, acutely pointed; neuration very strong, appearing as if dotted under the microscope (these dots are perhaps the tubercles whence spring the hairs), probably varying in the sexes or in the different species. Posterior wings very narrow; fringes very long; apex very acute; costal margin strongly excised from before the middle up to the apex; one transverse vein. Legs rather short; anterior tibiæ without spurs; intermediate tibiæ with one rather long median, and two apical spurs in the male (only the apical spurs in the female); posterior tibiæ with two pairs of rather long spurs. Abdomen slender; stouter in the female, in which sex the apex is acute.

Larva with small head and thoracic segments; abdomen much dilated; no external respiratory filaments. (See Pl. II. fig. 4.) Case oval or reniform, membranous. (See Pl. II. fig. 31.) Inhabiting both standing and running waters.

Such are briefly the only characters that I can give of this most puzzling genus. I confess that I have never been able to satisfy myself, from personal observation, as to the comparative lengths of the joints of the palpi, and scarcely as to the number of these joints.

The characters given by various authors are very discordant. Dr. Hagen has lately sent me specimens (in alcohol) of a minute insect taken in Prussia, which, although it bears a complete superficial resemblance to what he and I consider as *Hydroptila*, is nevertheless very different in structure, so much so in fact, that it cannot even be placed in this family. The maxillary palpi are five-jointed in both sexes, the two basal joints being very short; it possesses large and evident ocelli, and the spurs are 0-3-4 in both sexes; besides these characters the posterior wings do not appear to me to be excised on the costal margin. The existence of this form (which may probably be found in this country) may partially account for the discrepancies in the published characters of *Hydroptila*, but these are no doubt in a great measure due to the extreme minuteness and hairiness of the insects.

That the species I consider as *Hydroptila* really belong to that genus as figured by Dalman, I have little doubt, but Dalman mentions that the anterior tibiæ are spurred at the apex. Neither is Dr. Hagen nor am I aware of the existence of any similar form with this character, but Dr. Hagen informs me that he possesses *Hydroptila*, or at any rate an insect of the same form, in which the spurs are 0-2-4 in both male and female.

The following is a brief *resumé* of the principal characters as given by various authors. Pictet says, "palpes maxillaires à cinq articles dans les deux sexes," but gives nothing whatever about the spurs: unless he had the insect noticed by Dr. Hagen before him, I imagine that he has not rightly defined the number of joints. Zetterstedt omits all description of the parts of the mouth, and gives the number of spurs on the posterior tibiæ only. Burmeister places *Hydroptila* in his first section, "Kiefertaster bei beiden Geschlechtern 5-gliedrig und von gleicher Gestalt;" with respect to the spurs he says, "die vordersten ohne oder mit sehr kleinen Endsporen, die mittleren mit grossen Endsporen." Rambur reproduces Dalman's description, and criticises (with justice) Pictet's assertion, that the terminal joint of the maxillary palpi is ovoid, a mistake that may have arisen through some confusion with the labial palpi. Kolenati, whose description is the most complete, indicates four joints to the maxillary palpi of the males, and five to those of the females: the number of spurs, 0-2-4. Brauer is uncertain as to the number of joints, and indicates 0-2-4 spurs. Stephens says, "maxillary palpi 5-jointed," without any distinction of sex, in his characters of the family *Hydroptilidæ:* in his generic description of *Hydroptila*, he appears to have copied Pictet in saying, that the terminal joint is ovoid; with respect to the spurs he says, "*intermediate* and posterior tibiæ furnished with two pairs of long spurs," in which he is manifestly wrong.

The neuration appears to vary considerably in the number of apical forks, but I am not able to say if this variation be specific or sexual, or both. I have been unable to detect any transverse nervules in the anterior wings, but in a drawing of the neuration of a Madeiran species (*H. atra*) sent to me by Dr. Hagen, he indicates the presence of at least two such nervules. Will this likewise prove a specific character?

With respect to the specific characters founded on the coloration of the antennæ, I feel convinced that these are, in a great part, only sexual; this has, in fact, been proved by Mr. Parfitt, who has taken individuals with spotted and with unicolorous antennæ *in copulâ;* in this case the females had the spotted antennæ, and this quite accords with my own views, deduced from an examition of the species in my collection.

Finally, I will add, that for the successful examination of *Hydroptila* two things are necessary; one, that the observer should carefully study the habits and appearances of the insects, in their own localities; the other, that a number of individuals of both sexes should be placed in alcohol, for it is impossible to discriminate the parts of the mouth, &c. in dry specimens, owing to the dense hairy clothing.

1. *Hydroptila tineöides*, Dalman. (Pl. V. fig. 7, neuration.)

Hydroptila tineöides, Dalm. Analect. Ent. p. 26, tab. 3, fig. 4 (1823); Steph. (*) Ill. p. 152, 1; Kol. Gen. et Spec. Trichop. pt. 1, p. 105, 1 ?; Hag. Ent. Ann. 1859, p. 107, 53; *H. pulchricornis*, Pict. Recherch. p. 224, 1, pl. 20, fig. 10 (1834); *H. brunneicornis*, Steph. (*) Ill. p. 152, 2.

Antennæ testaceous, narrowly annulated with fuscous; in the female there are long fuscous spaces, which do not however appear to be constant either in number, position or length; the male also, apparently, sometimes exhibits traces of similar dark spaces. Head clothed with fuscous hairs. Palpi testaceous. Mesothorax dark blackish-fuscous. Anterior wings rather short, greyish or blackish-fuscous (the female the darkest); there are several whitish spots, some of which form indistinct transverse fasciæ; fringes grey or blackish, with generally a few whitish hairs in the costal portion towards the apex, and others on the dorsal margin. Posterior wings grey, with concolorous fringes. Legs testaceous, sometimes brownish. Abdomen fuscous (greenish in the female), with pale margins.

Expanse of fore-wings, ♂ $2\frac{1}{2}$—3 lines, ♀ 4 lines.

Frequents streams. Extremely abundant in some localities, entering the rooms of houses situated near its breeding-places, and causing the windows and ceilings to appear as if thickly dotted with dark atoms; very nimble and difficult to capture.

It is probable that this is Dalman's species. The types of Stephens' two species are certainly identical. Some of the males appear to have spotted, and others unicolorous, antennæ; but the amount and position of the spots seem to be very variable; hence I conclude that this character has no specific value.

I know nothing of *H. vectis* of Curtis, not having made a sufficient examination of the types. It is given by Dr. Hagen as distinct (in Ent. Ann. 1859).

2. *Hydroptila angustella*, n. sp. (Pl. I. fig. 5.)

Antennæ of the male fuscous, with a pale whitish space near the apex; of the female whitish, very faintly annulated, with three fuscous spaces, one about the middle, the second near the apex, and the third occupying the extreme apex. Head clothed with whitish-yellow hairs. Mesothorax fuscous. Anterior wings very narrow, dark fuscous, with an appearance of darker blackish streaks; the dorsal margin (especially in the female) broadly margined with whitish-yellow, from the base almost to the apex; fringes grey, whitish-yellow on the costa and the pale dorsal margin. Posterior wings pale grey, with paler fringes; a few whitish hairs in the fringes of the costa in the female. Legs very pale whitish-testaceous. Abdomen greyish-fuscous, with silvery whitish margins, most evident in the female.

Expanse of fore-wings, ♂ 3 lines, ♀ 4 lines.

Of this species I possess three examples, two of which (♂ and

♀) were taken at Forest Hill (Kent) and Arundel, in the summer and autumn, in both instances in the vicinity of standing water; the third I found near Kingston-on-Thames in July, 1865. I have been unable to identify them with any described species; the female is a very distinct-looking insect, in consequence of the broad pale dorsal margin. There is a specimen in the Stephensian Collection, mixed up with the types of his *H. sparsa*.

3. *Hydroptila costalis*, Curtis.

Hydroptila costalis, Curt. (*) Phil. Mag. p. 218, 3 (1834); Steph. (*) Ill. p. 153, 5; Hag. Ent. Ann. 1859, p. 108, 55; *H. brunneicornis*, Pict. Recherch. p. 226, 3, pl. 20, fig. 12 (1834)?; Kol. Gen. et Spec. Trichop. pt. 1, p. 106, 3?; *H. sparsa*, Steph. (*) Ill. p. 152, 3 (1836).

Antennæ whitish, finely annulated with fuscous. Head clothed with whitish hairs. Palpi pale testaceous. Mesothorax brown. Anterior wings narrow, greyish-fuscous, with scattered silvery-white spots on the disc; fringes grey, a long, pale whitish space in the costal fringes, and the apical fringes also whitish. Posterior wings pale grey, with paler fringes. Legs testaceous, the tarsi faintly annulated with brown. Abdomen pale brownish, with paler margins.

Expanse of fore-wings ♂ 3½ lines.

I possess examples from Scotland, which I compared with Curtis' types. I have only seen males, and know nothing of the habits of the species.

H. sparsa of Stephens appears to me to be clearly identical with *costalis*. The types of the former are three in number, of which one is the same as my *angustella* (p. 95).

Fam. LEPTOCERIDÆ.

Antennæ as long as or longer than the wings, often several times as long; basal joint generally long and stout, the remaining joints usually long, thin and cylindrical; ocelli absent; maxillary palpi five-jointed in both sexes, very hairy, the basal joint short, some of the succeeding joints very long, terminal joint not very long, flexible, but not multi-articulate; anterior wings long and narrow (in the British genera), generally clothed with a short dense pubescence, neuration often differing in the sexes, discoidal cell generally closed; posterior wings shorter and generally broader than the anterior, usually folded, hairy clothing less dense; legs not very long, spineless, or with few and very short spines; spurs variable in number in the different genera; abdomen short.

Larva with the head very small, oval; pronotum rather broader than the head, the sides rounded, corneous; mesonotum much broader, also corneous; metanotum still broader, not corneous; first abdominal segment produced into a hump in the middle above, and with smaller projections at the sides, the other segments subcylindrical, nearly equal at the sides; the respiratory filaments very short, placed in tufts of three or four on a common base; posterior legs usually very much longer than the others.

Case usually formed of fine sand, and in shape a cylindrical straight or curved tube, generally smaller at one end; sometimes formed partly of vegetable matters, and sometimes entirely of silk, without any apparent addition of extraneous substances.

I have found it impossible to tabulate the genera satisfactorily; they may, however, be placed in two divisions, thus:—

Spurs 2-4-4	*Odontocerus* and *Molanna.*
Spurs 2-2-2, 1-2-2 or 0-2-2	*Leptocerus, Triænodes, Mystacides* and *Setodes.*

For more precise information, I must refer the student to the detailed characters, and to the outline figures of the neuration.

Genus Odontocerus, Leach.

Antennæ moderately stout, longer than the wings, serrated internally; the basal joint stout, as long as the head. Head transverse. Maxillary palpi hairy, the first three joints stout; basal joint short, second somewhat longer, the remaining three joints nearly equal, considerably longer than the second. Labial palpi very small, with short basal joint and elongate terminal joint. Mesothorax ovate. Anterior wings long, considerably dilated towards the apex, which is elliptical; hairy clothing dense; neuration strong and distinct; discoidal cell open; in the female there is one more apical fork than in the male. Posterior wings considerably shorter than the anterior, folded; the anal portion more produced in the male than in the female, in which latter sex there is also an additional apical fork, as in the anterior wings. Legs rather short; anterior tibiæ with two moderately long, equal, apical spurs; intermediate and posterior tibiæ each with two pairs of unequal spurs. Abdomen rather robust; the male with well-developed and complicated appendices; the female furnished with large superior valves.

The female considerably larger than the male.

Larva inhabiting clear running waters; the posterior pair of legs short. Case formed of small stones and sand, cylindrical, curved, smallest at the hinder extremity; when the larva is about to change it closes the larger opening of the case with a single flat stone. These larvæ are subject to the parasitic attacks of *Agriotypus* (see p. 82), and when thus attacked spin a silken band-like appendage.

1. *Odontocerus albicornis*, Scopoli. (Pl. VI. fig. 1, neuration.)

Phryganea albicornis, Scop. Ent. Carn. 1, 689 (1763); Oliv. Encyc. Méthod. 6, p. 155, 2; *Mystacides albicornis*, Pict. (*) Recherch. p. 162, 1, pl. 12, fig. 1; *Odontocerus albicornis*, Steph. (*) Ill. p. 192, 1, pl. 34, fig. 1; Brauer (*), Neurop. Aust. p. 18, 42; Hag. (*) Ent. Ann. 1860, p. 67, 55; *Molanna albicornis*, Kol. Gen. et Spec. Trichop. pt. 2, p. 244, 1, pl. 4, fig. 47; *O. maculipennis*, Curt. (*) Phil. Mag. p. 214, 2 (1834); Steph. (*) Ill. p. 193, 2; *Mystacides cylindrica*, Pict. (*) Recherch. p. 164, 2, pl. 12, fig. 2 (1834).

Antennæ whitish-ochreous. Head and prothorax blackish, clothed with grey hairs. Palpi fuscous. Mesothorax black. Anterior wings ochreous-grey in the male, hoary in the female, with pale fuscous apical blotches, which are often indistinct; transverse veins usually conspicuously fuscous. Posterior wings smoky-grey, with fuscous veins. The anterior pair of legs wholly fuscescent; intermediate and posterior pairs with fuscous thighs and ochreous tibiæ and tarsi. Abdomen dull lurid-fuscous. In the male there is a band-like testaceous lobe, hairy at the tip, proceeding from the middle of the truncated upper margin of the last abdominal segment; app. sup. fuscous, large, flattened and obtuse, rather longer than the lobe; app. intermed. still longer, fine and needle-shaped, approximating at the tips; app. inf. strong, thick and obtuse, curved slightly upwards. In the female the superior valves are large and triangular.

Expanse of fore-wings, ♂ 13—14 lines, ♀ 16—18 lines.

Larva with the head and thorax fawn-coloured, pointed with black. On the head there is a regular frontal spot, and two series of points extending from the eyes to the occiput. The three thoracic rings are narrowly bordered with black, and have several points of the same colour. Abdomen whitish. Feet fawn-coloured. (Pictet.)

Not a very common species, but found about clear and swift streams in most parts of the country; specimens from Scotland are darker.

The question of the identity of *M. albicornis*, Pict., and *M. cylindrica*, Pict., seems difficult to solve. Dr. Hagen mentions that he has examined numerous specimens without being able to arrive at any decision, acknowledging that the types present no seizable characters, an opinion in which I cordially agree with him. These types (now in the British Museum) I have carefully examined, and can discover no difference whatever; yet Pictet describes the larvæ of the two as somewhat different. Till it is proved to be otherwise, I cannot but think that this may be an accidental or ordinary case of variation.

Genus Molanna, Curtis.

Antennæ scarcely longer than the wings, stout, not serrated internally; basal joint thicker, short. Head transversely quadrate. Maxillary palpi very hairy; basal joint short; second rather longer; third longer than the second; fourth and fifth still longer, equal. Labial palpi small; basal joint short, the others longer and equal. Mesothorax robust, ovate. Anterior wings long and narrow, hairy clothing not dense, the costal and dorsal margins almost parallel, apex rounded; neuration distinct; no discoidal cell; the female with an additional forked apical cell. Posterior wings folded, broader than the anterior, the dorsal margin with a small lobe-like projection at the extreme base; in the female there is an additional forked apical cell, or sometimes two more; cilia evident, long at the anal portion. Legs rather long; anterior tibiæ with two short apical spurs; intermediate and posterior tibiæ with two pairs of short equal spurs. Abdomen short, rather robust; anal appendices complicated.

In repose the wings are folded round the body.

Larvæ inhabiting both still and running waters. Head very small, elongated. Pronotum small and transverse, corneous. Mesonotum large, nearly quadrate, the corners rounded. Metanotum still larger. (See Pl. II. fig. 14.) Anterior and intermediate legs with the joints dilated, the first tarsal joint furnished with a very long spur; posterior legs thin, longer than the others, the tarsal joint not spurred. Abdomen subcylindrical; the first segment with a very large, conical, dorsal protuberance, the lateral protuberances nearly obsolete; respiratory filaments in tufts, arranged in two rows; anal crotchets small.

Case composed of fine sand, broad, convex above, flat or slightly concave beneath; the upper surface at the superior end is produced considerably beyond the mouth, and forms a semicircular shield, protecting the larva when it protrudes its anterior segments in search of food, &c. The habit of the larva is to crawl at the bottom, the convex side of the case being always uppermost. These cases are certainly the most curious of all those fabricated by native species of this Order; they were long ago described and figured by De Geer, Mém. ii. pl. xv. figs. 15—17.

1. *Molanna angustata*, Curtis.

(Pl. II. fig. 5, larva; fig. 32, case; Pl. VI. fig. 2, neuration and maxillary palpus; Pl. XII. fig. 10, app.)

Molanna angustata, Curt. (*) Phil. Mag. p. 214, 1 (1834); Steph. (*) Ill. p. 203, 2; Kol. Gen. et Spec. Trichop. pt. 2, p. 246, 2, pl. 4, fig. 46; Hag. (*) Ent. Ann. 1860, p. 68, 56; *M. nigripalpis*, Steph. (*) Ill. p. 203, 1, pl. 33, fig. 3 (1836); *Nais plicata*, Ramb. Hist. Nat. Névrop. p. 504 (1842).

Antennæ testaceous. Head and thorax clothed with yellowish hairs. Palpi reddish-testaceous, sometimes fuscescent. Mesothorax brownish. Anterior wings ochreous-yellow, paler in the female, the veins conspicuously brownish. Posterior wings smoky-grey, with paler fringes. Legs pale testaceous. Abdomen reddish-brown. In the male there is a lobe proceeding from the middle of the upper margin of the last segment, forming a cover to the penis, with a needle-shaped point on either side (probably the app. intermed.); app. sup. rather large, straight, flattened, obtuse, fringed with long hairs; app. inf. long, the tips thin, curved upwards and inwards, the apices approximating or nearly so. In the female the apex of the abdomen is obtuse, with no very evident appendices.

Expanse of fore-wings 10—14 lines; the females the largest.

Larva: Head, pro- and meso-nota shining-testaceous; the head furnished with a conspicuous V-shaped black mark; posterior margin of the pronotum broadly margined with black; some fuscous dots rather thickly placed, forming a blotch-like mark in the middle of the mesonotum. Metanotum and abdominal segments dull dirty brownish-ochreous, the respiratory filaments whitish. Legs testaceous, marked with black at the base.

This curious insect is common in most parts of the country, but especially in the metropolitan district, frequenting both standing and running waters. It is of nocturnal flight, and I have taken it flying steadily at night at long distances from water. During the day it conceals itself among reeds and other water plants, and rests in a peculiar manner, with the wings folded round the body and the legs laterally extended.

Genus Leptocerus, Leach.

Antennæ very long, twice or more than twice the length of the wings, shorter in the females, very thin, the joints long; basal joint as long as the head, bulbous. Head transverse. Maxillary palpi very long and hairy; basal joint short; second and third very long; fourth and fifth shorter, equal. Labial palpi small, with the joints nearly equal, the second stouter. Prothorax very small and densely hairy. Mesothorax rather large and elongate. Anterior wings long and narrow, slightly dilated towards the elliptical apex, costal margin straight, dorsal margin slightly concave; hairy covering dense; neuration usually indistinct; radius scarcely bent before the termination; discoidal cell very long and narrow, closed, connected with the radius by a transverse vein; the anastomosis usually oblique; first apical cell never reaching the anastomosis; in the males the anterior branch of the ramus thyrifer is simply forked, in the females it is twice forked. Posterior wings much shorter than the anterior, folded, subtriangular; discoidal cell open (sometimes aberrantly closed); fringes short. Legs short; all the tibiæ furnished with a pair of apical spurs only, those on the anterior tibiæ very short. Abdomen subcylindrical. In the male the appendices are very complicated; there is generally a bifid lobe from the upper margin of the last segment, beneath which, on either side, are seen the app. sup., which vary considerably in different species, but are usually straight and finger-shaped; the app. inf. are long and curved, usually claw-shaped, and perhaps bisarticulate; the penis probably has always a projecting superior cover and sheaths. In the female the most prominent appendices are two lateral valves.

Female generally smaller than the male.

Larvæ inhabiting standing and running waters. Head small and much elongated. Pronotum small. Mesonotum and metanotum broad. Anterior and intermediate legs rather short, the joints slightly dilated; posterior legs very long. Abdomen subcylindrical, the sides nearly parallel; the first segment with a large median dorsal hump, the lateral humps very small.

Case a cylindrical tube of fine sand, larger at one end, generally more or less curved, and sometimes with vegetable *débris* affixed outside.

The species of the elegant insects which constitute this genus are rather numerous and difficult to separate, owing to the fact that many of them vary considerably in colour and markings. The most certain characters are to be found in the anal appendices of the male, though at the same time these are difficult to discriminate. I find in the app. sup. the most easily seizable characters. The genus is here restricted to those species presenting the sexual differences in the neuration noticed in the generic description; a reference to the outline figures of the neuration in this and the succeeding genera will convey a better idea than could be expressed by words.

The perfect insects are diurnal or crepuscular in their habits; some species dancing over the surface of the water by swarms in the bright sunshine. Where a species occurs, it is usually seen in great abundance.

1. *Leptocerus nervosus*, Fabricius. (Pl. VI. fig. 3, neuration.)

Phryganea nervosa, Fab. Ent. Syst. Suppl. p. 201, 16, 17 (1798); Coquebert, Icon. Ins. Fab. 14, t. 3, fig. 1; *Ceraclea nervosa*, Steph. (*) Ill. p. 194, 1; Kol. Gen. et Spec. Trichop. pt. 2, p. 242, 2, pl. 4, fig. 45; *Leptocerus nervosus*, Hag. (*) Ent. Ann. 1860, p. 68, 57; *Phryganea barbata*, Zett. Ins. Lapp. col. 1071, 47 (1840); *Mystacida venosa*, Ramb. Hist. Nat. Névrop. p. 508, 1 (1842); *Mystacides venosus*, Brauer, Neurop. Aust. p. 41, 5.

Antennæ blackish, beneath annulated with white to beyond the middle, basal joint deep black. Head and palpi deep black, the former sometimes with a few greyish hairs. Mesothorax deep coal-black. Anterior wings yellowish-cinereous, with the veins deep fuscous and very strongly marked; a somewhat paler yellowish anal spot. Posterior wings smoky, with the veins scarcely darker. Legs fuscescent, the tibiæ and tarsi somewhat paler; the thighs with short greyish hairs. Abdomen black. In the male there is a short triangular plate projecting from the middle of the upper margin of the last segment; app. sup. broad and short, the apices very obtuse and directed inwards; app. intermed. two fine needle-shaped points; app. inf. rather small, directed upwards and apparently with a small apical joint; penis short, the sheaths strongly incurved, with the tips thickened.

Expanse of fore-wings 12—14 lines.

Not an uncommon species by rivers in various parts of the country. Near London it is found on the Thames about Kew, &c., and also on the Lea. It has been reported from Killarney, Ireland. Occurs at the end of May and in June, and flies very rapidly over the surface of the water in the bright sunshine in calm weather. It is easily recognizable, having a somewhat different *facies* to the rest of the genus, the thorax being less hairy, and the posterior wings more decidedly triangular.

2. *Leptocerus grossus*, M'Lachlan. (Pl. XII. fig. 11, app.)

Leptocerus grossus, Steph. (*) Cat. p. 320, 3644 (1829); M'Lach. Ent. Ann. 1862, p. 31; *L. cinereus*, Steph. (*) Ill. p. 199, 17 (1836), not of Curtis; Hag. (*) Ent. Ann. 1860, p. 69, 58; *L. notatus*, Hag. (*) Stett. Zeit. 1858, p. 122, not *Mystacida notata*, Ramb.

Antennæ pale brown, annulated with whitish almost to the apex. Head very thickly clothed with browish-ochreous hairs. Palpi brown. Mesothorax dark brown, with two rows of ochreous hairs above. Anterior wings with the apex dilated and obliquely truncated, pale reddish-brown, not thickly clothed, anal spot paler (but scarcely visible in dead examples); neuration distinct, fuscous. Posterior wings subhyaline, greyish, with yellowish anal fringes. Legs ochreous, the apices of the tarsal joints in the four anterior legs brownish. Abdomen dark brown, with pale ochreous lateral lines. A small triangular plate from the middle of the upper margin of the last abdominal segment in the male, on each side of which are placed the very large, broad and acute, somewhat triangular, yellow app. sup.; app. inf. small, curved inwards. (I have not been able to examine fresh specimens.)

Expanse of fore-wings 11—15 lines.

A few specimens have been taken by Mr. Wormald at Ruislip Reservoir, Middlesex, and I also possess it from the Fen District. It is the largest British species. I have adopted Stephens' Catalogue name solely to avoid giving a new one, though Stephens afterwards misapplied Curtis' name *cinereus* to this species. The description of *cinereus* in Ent. Ann. 1860, p. 69, also belongs here.

3. *Leptocerus fulvus*, Rambur. (Pl. XII. fig. 12, app.)

Mystacida fulva, Ramb. Hist. Nat. Névrop. p. 509, 3 (1842); *Leptocerus fulvus*, M'Lach. Ent. Ann. 1862, p. 31; *Mystacides ochraceus*, Kol. Gen. et Spec. Trichop. pt. 2, p. 250, 2, pl. 3, fig. 27 (1859), not of Curtis.

Antennæ pale ochreous, with brownish annulations along two-thirds of their length. Head densely clothed with yellowish-ochreous hairs. Palpi brown. Mesothorax brown, with a few ochreous hairs. Anterior wings brownish-ochreous, the extreme costal margin and an anal spot (indistinct in dead examples) yellowish;

(if the hairs be removed these wings are pale brown); neuration indistinct. Posterior wings subhyaline, dark smoky-grey, with paler fringes. Legs ochreous, the tarsi very faintly annulated with brownish. Abdomen fuscous, with pale lateral lines. The lobe from the middle of the upper margin of the last abdominal segment in the male triangular, entire, the apex much produced; app. sup. large, broadly triangular, fringed with long yellowish hairs; app. inf. small, with the curved tips (or small apical joint?) directed downwards, and with a short, cylindrical, obtuse tooth at the base on the ventral surface; there are also two fine curved needle-shaped sheaths, and what appear to be broad boat-shaped upper and lower penis-covers. The apex of the abdomen in the female is obtuse, without prominent appendices.

Expanse of fore-wings 11—13 lines.

This species was found commonly by Mr. Wormald in August, 1862, at the Ruislip Reservoir, Middlesex; and I have also received it in some numbers from the Fen District. It is not contained in the collections of Curtis or Stephens. *L. annulicornis* of the latter author is distinct; the description under that name in Ent. Ann. 1860, p. 70, pertains to *L. fulvus*.

In the "Synopsis synonymica" Dr. Hagen makes *Phryganea ochrata*, Zett. (Ins. Lapp. col. 1072, 49), synonymous with *L. fulvus*, without however giving the former name the right of priority. This cannot be correct, since *P. ochrata* is said to be of the same size as *P.* (*Mystacides*) 4-*fasciata*, or not much more than half the size of *L. fulvus*. What *P. ochrata* really is, I do not know; possibly *Triænodes bicolor* (p. 111) or *Setodes reducta* (p. 120).

4. *Leptocerus bimaculatus*, Stephens. (Pl. XII. fig. 13, app.)

Leptocerus bimaculatus, Steph. (*) Ill. p. 197, 11 (1836), not of Linn.; Hag. (*) Ent. Ann. 1860, p. 79, 59; *L. alboguttatus*, Hag. (*) Stett. Zeit. 1858, p. 122; *Mystacida albimacula*, Ramb. Hist. Nat. Névrop. p. 509, 2 (1842)?

Antennæ brown, annulated with white to the apex. Head and palpi brown, clothed with grey hairs. Mesothorax brown, darkest at the sides. Anterior wings brown, with a large whitish or ochreous spot at the arculus, most distinct in the female; fringes greyish-brown; neuration indistinct. Posterior wings greyish, subhyaline; fringes grey, except at the apical portion of the costal margin, where they are white. Legs grey, the tips of the tarsal joints and the anterior tibiæ brown. Abdomen greyish-brown (greenish when alive), with white lateral lines. In the male there is a short, obtusely triangular, entire lobe, proceeding from the middle of the upper margin of the last segment; app. sup. short and very broad, obtusely rounded; app. intermed. yellow, straight, cylindrical, the tips dilated and abruptly turned upwards; upper penis-cover apparently absent; app. inf. rather thick, obtuse, blackish at the base, closely adpressed against the lateral margins of the last segment. In the female there are two short truncated lateral valves.

Expanse of fore-wings 11—13 lines.

Apparently a scarce and local species. I possess it from Kew and Ringwood, and have seen specimens from Exeter, Burton-on-Trent, &c.

The large pale spot at the arculus is very conspicuous in living examples.

5. *Leptocerus annulicornis*, Stephens. (Pl. XII. figs. 14, 15, app.)

Leptocerus annulicornis, Steph. (*) Ill. p. 199, 15 (1836); *L. annulatus*, Hag. (*) Ent. Ann. 1860, p. 70, 61 (not of Steph.)

Antennæ dark blackish-brown, distinctly annulated with white for two-thirds of their length. Head fuscous, clothed with white hairs. Palpi greyish-fuscous. Mesothorax dark fuscous, with two lines of white hairs down the middle. Anterior wings brown, slightly darker towards the apex; a yellowish spot at the arculus (indistinct in dead specimens); apical fringes white; neuration indistinct. Posterior wings grey, subhyaline; fringes grey, excepting at the apical portion of the costa, where they are white. Legs whitish. Abdomen greyish (greenish when alive), with pale lateral lines. In the male there is a small lobe from the middle of the upper margin of the last segment; app. sup. short and broad, subtriangular; below the app. sup. is a very large broad, obtusely rounded, yellow upper penis-cover; app. inf. dark brown, cylindrical, directed upwards, perhaps with a very small second (terminal) joint; beneath the cover lies the short, thick and obtuse penis. In the female there are two short, broad, obtusely rounded lateral valves.

Expanse of fore-wings 9—10 lines.

Not a common species; appearing in summer. I possess it from Burton-on-Trent and Kew, and have seen specimens from other localities; Stephens says "near London."

This bears a certain resemblance to the last, but is smaller, and has the anterior wings narrower at the base and more dilated towards the apex. The pale apical fringes, paler legs, and the large upper penis-cover, &c., also distinguish it.

6. *Leptocerus cinereus*, Curtis.

(Pl. VI. fig. 3 *b*, max. palp.; Pl. XII. figs. 16, 17, app.)

Leptocerus cinereus, Curt. (*) Phil. Mag. p. 214, 11 (1834); *L. aureus*, Steph. (*) Ill. p. 197, 8 (1836), not of Pict.; *L. annulatus*, Steph. (*) Ill. p. 197, 9 (1836); *L. seminiger*, Steph. (*) Ill. p. 199, 16 (1836); *Mystacides bifasciatus*, Kol. Gen. et Spec. Trichop. pt. 2, p. 253, 5, tab. 3, fig. 26 (1859).

Antennæ black, annulated with white on the basal half; basal joint and head thickly clothed with cinereous hairs. Palpi fuscous. Mesothorax fuscous, with a few cinereous hairs in the middle. Anterior wings narrow, brownish-cinereous, with pale grey spots on the dorsal margin, and an indistinct pale grey fascia towards the apex, most conspicuous towards the costa and not reaching the inner margin; (these markings are scarcely visible in dry specimens, but are conspicuous during life, especially in the female); fringes cinereous, interrupted with grey at the terminations of the apical veins. Posterior wings smoky-grey; neuration dark fuscous, almost black. Legs silvery-grey, the anterior pair darker; tarsi spotted with fuscous at the joints. Abdomen greyish-fuscous with pale lateral lines. In the male the divisions of the dorsal lobe are dark fuscous, subtriangular; app. sup. very long and thin, nearly straight and very hairy; below these are two long and needle-shaped testaceous app. intermed. (or upper penis-covers?) which appear to be united at the base, but divide into two curved points, the apices of which converge; app. inf. proceeding from a large blackish basal piece, up-directed, elbowed in the middle, the apex acute and testaceous; the penis appears to be bent strongly downwards, the apex dilated into a knob. In the female there is also a bilobed superior plate, broader but somewhat similar to that of the male; below these two lobes are two larger ones, whence proceed two short obtusely-rounded lateral valves.

Expanse of fore-wings, ♂ 9—11 lines, ♀ $8\frac{1}{2}$—9 lines.

A common species about slowly flowing rivers. Along the Thames it appears in the greatest abundance in summer and autumn. It flies in the evening just above the surface of the water, and if we proceed along the river in a boat at that time, the numbers appear so great, that as they diverge on either side from the splash of the sculls, they form two continuous lines, extending for miles. When *in copulâ* they soar to considerable heights, the female alone using her wings, and carrying with her the male hanging helplessly.

I have found, but much less commonly, specimens of slightly larger size, with the wings brown rather than cinereous, and with the markings more distinct and yellower in colour. I am not certain whether these may not prove distinct, but am unable to detect any difference in the arrangement of the appendices.

I strongly suspect that *Mystacides annulata* of Pictet is identical with *L. cinereus*; there is a type in the British Museum, but I cannot speak positively as to its identity.

7. *Leptocerus aterrimus*, Stephens. (Pl. XII. figs. 18, 19, app.)

Leptocerus aterrimus, Steph. (*) Ill. p. 200, 20 (1836); M'Lach. Ent. Ann. 1862, p. 32; *L. ater*, Steph. (*) Ill. p. 196, 5 (1836); *L. caliginosus*, Steph. (*) Ill. p. 201, 9 (1836); *L. niger*, Steph. (*) Ill. p. 196, 6 (1836), part; *Phryganea nigra*, Zett. Ins. Lapp. col. 1072, 53; *Mystacides niger*, Kol. Gen. et Spec. Trichop. pt. 2, p. 257, 10, pl. 3, fig. 31; *Leptocerus perfuscus*, Steph. (*) Ill. p. 196, 7 (1836), var.

Antennæ brownish-black, annulated with white on the basal third. Head and palpi black, clothed with brown hairs. Mesothorax rather shining black. Anterior wings dull dark brownish-black; an ochreous spot at the arculus (little visible in dead specimens). Posterior wings rather paler, and the neuration more distinct. Legs brown, the tarsi with paler rings. Abdomen blackish-brown with pale lateral lines. In the male the app. sup. are short and very broad, obtusely rounded and fringed with long pale hairs; app. inf long and curved upwards, attenuated towards the apex. In the female there is a divided superior lobe, somewhat like that of the male; lateral valves small, obtuse and yellowish.

Expanse of fore-wings 8—10 lines.

Common in summer about ponds and canals, especially in the neighbourhood of London.

With the typical form there are generally to be seen individuals with much paler (reddish-brown) anterior wings; these may be frequently found *in copulâ* with the black specimens, and are simply varieties.

The type of *L. perfuscus* of Stephens appears to be one of these light-coloured specimens, rather paler than usual. I possess several examples from Germany almost precisely similar. It appears probable that this form is *Mystacides tineöides* of Brauer, as a specimen from Professor Zeller's Collection is so labelled.

8. *Leptocerus dissimilis*, Stephens. (Pl. XII. fig. 20, app.)

Leptocerus dissimilis, Steph. (*) Ill. p. 197, 10 (1836); Hag. (*) Ent. Ann. 1860, p. 72, 64; *L. assimilis*, Steph. (*) Ill. p. 198, 14 (1836); *Mystacida vetula*, Ramb. Hist. Nat. Névrop. p. 512, 12 (1842)?; *Mystacides fennicus*, Kol. Gen. et Spec. Trichop. p. 252, 4, pl. 3, fig. 25 (1859)?

Antennæ dark brown, annulated throughout with white. Palpi greyish-brown. Head clothed with pale greyish-white hairs. Mesothorax testaceous. Anterior wings brown, darkest towards the apex; a yellowish spot at the arculus (most conspicuous in the living insect with the wings closed); fringes dark brown, becoming blackish-brown at the anal angle. Posterior wings greyish subhyaline, with grey fringes. Legs white, the tarsi annulated with brown. Abdomen brown, greenish beneath in the female, with whitish lateral lines. From the middle of the upper margin of the last abdominal segment in the male there proceeds a triangular lobe, the apex of which is produced; beneath this lobe on either side are two broad pieces (app. sup.?), much rounded on the external edge and nearly parallel on the internal, their apices produced into a fine point; beneath there is a broadly oval and obtuse upper penis-cover, in which lies the small penis (visible only from beneath); app. inf. large, furcate, the forks widely divaricating, the lower branch longest and thinnest, the upper minutely toothed towards the apex.

Expanse of fore-wings 6—9 lines. The females considerably smaller than the males.

Occurs in summer about slowly-flowing rivers in many places; not uncommon near Kingston-on-Thames; abundant at Ringwood; Killarney, in Ireland.

9. *Leptocerus bifasciatus*, Olivier. (Pl. XII. figs. 21, 22, app.)

Phryganea bifasciata, Oliv. Encyc. Méthod. vol. vi. p. 558, 20 (1791); *Mystacides bifasciata*, Pict. (*) Recherch. p. 166, 5, pl. 12, fig. 3; Brauer, Neurop. Aust. p. 41; *Leptocerus bifasciatus*, Hag. (*) Ent. Ann. 1860, p. 73, 69; *L. affinis*, Steph. (*) Ill. p. 198, 13 (1836); *Mystacides affinis*, Kol. Gen. et Spec. Trichop. pt. 2, p. 258, 11, pl. 3, fig. 30.

Antennæ black, the basal half conspicuously annulated with white. Head, palpi and mesothorax black. Anterior wings black, a white spot near the base towards the dorsal margin, a conspicuous white spot at the arculus and another opposite to it on the costal margin, the two nearly meeting and forming an interrupted fascia; beyond this is an oblique white spot towards the costa near the apex; (these markings are most distinct in the females and are sometimes scarcely visible in the males, especially in dead specimens). Posterior wings black. Legs brownish, the anterior and intermediate tibiæ and tarsi whitish, the tarsi spotted with brown. Abdomen blackish with pale lateral lines. In the male the app. sup. are long, finger-shaped and hairy; beneath them is a long and somewhat pointed upper penis-cover; app. inf. curved upwards, the apex furnished with a small second joint. In the female there are two pointed valves.

Expanse of fore-wings 6½—9 lines.

Larva with the head and thorax pale yellow. On the head is a series of black points, forming an almost complete circle. The divisions of the thorax bordered with black, with hairs of the same colour. Abdomen greenish, with the respiratory filaments short and distant. Feet yellow, with black hairs; the posterior pair very long. (Pictet.)

Case cylindrico-conical, slightly curved, composed of sand and small stones. (Pictet).

An abundant species in many places, frequenting rapid streams and appearing in summer and autumn. It delights to fly in swarms in the bright sunshine, and also in the evening, just above the surface of the water. Particularly abundant about Haslemere in Surrey, and Dawlish in Devonshire.

10. *Leptocerus albifrons*, Linné. (Pl. XII. figs. 23, 24, app.)

Phryganea albifrons, Linn. Faun. Suec. n. 1495 (1761); Syst. Nat. ed. 12, p. 910, 18; Oliv. Encyc. Méthod. vi. p. 517, 36; Zett. Ins. Lapp. col. 1072, 51; *Mystacides albifrons*, Pict. (*) Recherch. p. 168, 8, pl. 13, fig. 5; Brauer, Neurop. Aust. p. 41; Kol. Gen. et Spec. Trichop. pt. 2, p. 259, 12, pl. 3, fig. 29; *Mystacida albifrons*, Ramb. Hist. Nat. Névrop. p. 510, 6; *Leptocerus albifrons*, Hag. (*) Ent. Ann. 1860, p. 73, 68; *Phryganea interrupta*, Don. Brit. Ins. vol. 16, pl. 551 (1813), not of Fabr.; *Leptocerus interruptus*, Steph. (*) Ill. p. 198, 12; *L. bilineatus*, Steph. (*) Ill. p. 200, 21 (1836).

Antennæ black, annulated with white. Vertex and basal joint of antennæ clothed with snow-white hairs. Palpi fuscous. Mesothorax shining black. Anterior wings dark brown ; a snow-white line near the base reaching half across the wing ; a spot on the costa at the pterostigma, another opposite to it on the dorsal margin, and frequently a third between, smaller, all forming an interrupted snow-white fascia ; an oblique white spot on the costal margin near the apex. Posterior wings smoky-greyish, subhyaline and iridescent. Legs greyish, the intermediate legs paler ; tarsi annulated with white. Abdomen blackish, with grey lateral lines.

In the male the app. sup. are short, broad and obtuse, hairy ; beneath the bifid lobe of the last segment proceeds a straight acute upper penis-cover ; below this is the short testaceous penis ; app. inf. curved upwards and inwards, furnished with a small second joint at the tips. In the female there are two short and obtuse lateral valves.

Expanse of fore-wings 8—9 lines.

A common insect about streams, appearing in summer and autumn. Easily recognized by the white vertex and spotted wings.

I have received from Mr. Parfitt specimens of a *Leptocerus* taken near Exeter, which he considers distinct from *L. albifrons.* They are larger and darker than the ordinary form, with the white markings very indistinct, and show scarcely a trace of the white hairs on the vertex. The legs and antennæ are also darker. The appendices are very similar, but I am not sure that the males possess the long upper penis-cover found in *albifrons.* I hope, by a sight of fresh specimens, to be able to decide if it really be distinct.

Genus Triænodes* (new genus).

Antennæ thin, more than twice the length of the wings, basal joint stout and as long as the head. Maxillary palpi very long and hairy ; the first two joints broad, of nearly equal length ; third joint very long ; fourth and terminal joints shorter, nearly equal. Labial palpi small. Mesothorax convex, ovate. Anterior wings narrow, somewhat dilated towards the apex ; costal margin straight ; hairy clothing very dense ; neuration very indistinct, unless the hairs be removed ; discoidal cell long and

* In a "Synonymic List of the British Trichoptera," published in the Entomologist's Annual for 1865, I used the term *Triæna ;* this having been previously employed, I have changed it to *Triænodes.*

narrow, closed; first apical cell short, not reaching the anastomosis; the inferior branch of the ramus discoidalis appears to be twice-forked, the three veins meeting and forming a more or less distinct trident (differing according to the species). Posterior wings rather shorter and broader than the anterior, folded. Costal margin slightly excised before the apex; discoidal cell open; in the male the upper branch of the ramus subdiscoidalis crosses the lower branch of the ramus discoidalis, an arrangement which is somewhat modified (in *T. bicolor*) in the female (see Pl. VI. figs. 4, 4 *a*). Legs not long; the anterior tibiæ furnished with a pair of minute apical spurs; intermediate and posterior tibiæ each with a single pair of longer apical spurs. Abdomen thin in the male, rather robust in the female. App. sup. in the male finger-shaped, placed close together on the middle of the upper margin; app. inf. long and curved; penis very long and exserted. In the female (of *T. bicolor*) there are two enormously developed lateral valves. The female is always larger than the male.

Larva unknown, inhabiting still waters.

I have formed this genus to receive two species, which, from the arrangement of the nervures, &c., cannot be retained in any of the previously described genera. A reference to the figures will give a better idea of those characters in the neuration, so difficult to explain in words.

1. *Triænodes bicolor*, Curtis.

(Pl. VI. fig. 4, neuration, maxillary palpi, antenna; Pl. XII. figs. 25, 26, app.)

Leptocerus bicolor, Curt. (*) Phil. Mag. p. 214, 15 (1834); *L. rufogriseus*, Steph. (*) Ill. p. 201, 24 (1836); *Mystacida ferruginea*, Ramb. Hist. Nat. Névrop, p. 512, 10 (1842); *Phryganea tineoides*, Scop. Ent. Carn. p. 267, 694 (1763)?; *Leptocerus tineoides*, Hag. (*) Ent. Ann. 1860, p. 72, 66.

Antennæ brown, broadly annulated with white to near the apex, basal joint clothed with reddish-brown hairs. Palpi reddish-brown. Head and thorax black, clothed with reddish-brown hairs. Anterior wings very narrow in the male, broader in the female; uniform reddish-brown; the two forks of the lower branch of the ramus discoidalis meet near the transverse vein closing the discoidal cell, with a long transverse vein beneath them (thus the third and fourth apical cells are acute at the base). Posterior wings black. Legs greyish-brown. Abdomen fuscous, with pale lateral lines. In the male there is a short lobe from the middle of the upper margin of the last abdominal segment, on each side of which are placed the long, narrow, finger-shaped hairy app. sup.; beneath the lobe is the very long and narrow upper penis-cover, which is curved strongly downwards; on either side of this cover, and rather below it, is a needle-shaped, upcurved stile, which may be considered as the app. intermed.; app. inf. long and thin, the apex directed slightly downwards; the ventral margin of the last segment thickly fringed with yellow hairs. In the female there are two very large obtuse lateral valves.

Expanse of fore-wings 6½—9 lines.

Occurs in summer about standing waters; not uncommon in the metropolitan district.

It is possible that this may be the *Phryganea tineoides* of Scopoli, and it has been referred to that species by Dr. Hagen. But I think it best to retain Curtis' name, as there must be uncertainty as to what was intended by Scopoli. His diagnosis is simply "*Alæ anticæ fusco-ferrugineæ. Antennæ corpore triplo et ultra longiores, fuscæ, albo-annulatæ.*" Afterwards he says, "*Alæ posticæ fuscæ,*" which gives some probability to the assumption that this was the species described.

2. *Triænodes conspersa*, Rambur. (Pl. VI. fig. 4*d*, neuration.)

Mystacida conspersa, Ramb. Hist. Nat. Névrop. p. 514, 16 (1842); *Setodes conspersa*, Hag. (*) Ent. Ann. 1860, p. 76, 74; *Leptocerus longicornis*, Steph. (*) Ill. p. 201, 23 (1836), not of Linn.; *Mystacides rufogriseus*, Kol. Gen. et Spec. Trichop. pt. 2, p. 261, 14, pl. 4, fig. 40 (1859).

Antennæ whitish, annulated with brown on the basal half. Head clothed with whitish hairs. Palpi fuscous. Anterior wings rather dilated towards the apex, grey, thickly sprinkled with fuscous atoms, a large paler space a little before the apex; fringes pale fuscous, interrupted with whitish; neuration indistinct, the third and fourth apical cells straightly truncated at the base. Posterior wings smoky-grey, with golden and purple iridescence; fringes grey, occasionally interrupted with white. Legs silvery, the tarsi faintly annulated with fuscous. Abdomen brownish-ochreous, with paler lateral lines. In the male the app. sup. are rather short, slender and hairy; app. inf. apparently bisarticulate, the apical joint curved upwards; above the app. inf. on either side there is apparently a nearly quadrate lateral plate, slightly excised at the apex. Female possessing very small lateral valves.

Expanse of fore-wings 6½—10 lines.

A rare insect in this country. It has been taken in summer at Ringwood, Exeter, Hyde Park, &c.

The neuration of the posterior wings does not differ in the sexes of this species. In both, the arrangement of the nervures is as in the female of *T. bicolor*. (See Pl. VI. fig. 4 *a*.)

Genus Mystacides, Latreille.

Antennæ thin, about twice as long as the wings, the basal joint thick and as long as the head. Eyes larger and placed closer together in the male than in the female. Maxillary palpi long and hairy; the basal joint longer than in *Leptocerus;* second and third joints very long, nearly equal and somewhat flattened, the hairs arranged in two rows; fourth and terminal joints shorter and thinner, nearly equal. Labial palpi very small. Mesothorax ovate, very convex. Anterior wings long and narrow, with dense short hairy clothing; in repose the apices are inflexed and approximate; costal margin nearly straight, with a small notch near the apex; neuration alike in both sexes; discoidal cell long and narrow, closed; first apical cell long; anastomosis oblique. Posterior wings rather shorter than the anterior, and about the same breadth, folded; about the middle of the costal margin there is a row of minute hook-shaped bristles, which fit into a narrow fold on the dorsal margin of the anterior wings, and connect the wings when extended (analogous to what is found in the *Hymenoptera*); discoidal cell open; the ramus discoidalis does not appear to reach the radius, but has its origin in the membrane; fringes very long. Legs rather long; the anterior tibiæ appear to have no spurs; intermediate and posterior tibiæ each with one pair of short apical spurs. Abdomen thin. In the male there is a variously-shaped lobe projecting from the upper margin of the last abdominal segment; app. sup. long and finger-shaped; app. intermed. long with fine needle-shaped points; app. inf. curved upwards; there is also a large ventral plate, generally with a forked apex, differing in form according to the species. In the female there are two very large dilated lateral valves.

Larva inhabiting standing and running waters, similar to that of *Leptocerus.* Case a tube composed of fine sand, to the outside of which are affixed pieces of twigs and other vegetable matters.

In the works of most writers on these insects the genus *Mystacides* has included all the long-horned *Leptoceridæ* (Pictet even includes *Odontocerus*), but it was restricted by Hagen (Ent. Ann. 1860) to the three species (all of which inhabit this country) in which the apices of the anterior wings are inflexed in repose. Besides this character, the absence of spurs on the anterior tibiæ, the presence of costal crotchets, the arrangement of the veins and of the anal appendices, all prove this genus (as restricted) one of the most natural in the Order. It is probable that Latreille intended it to comprise the allied species of *Leptocerus*, *Setodes*, &c., but as his typical species belongs here, the name can be very justly retained.

1. *Mystacides atra*, Pictet. (Pl. XII. figs. 27, 28, app.)

Mystacides atra, Pict. (*) Recherch. p. 109, 9, pl. 11, fig. 4 (1834); Hag. (*) Ent. Ann. 1860, p. 75, 71; *M. ater*, Burm. Handb. p. 919, 4; Brauer (*), Neurop. Aust. p. 41; *Leptocerus nigricans*, Steph. (*) Ill. p. 195, 4 (1836).

Antennæ blackish, the basal portion annulated with white, but not conspicuously. Palpi dull black. Head and mesothorax shining black. Anterior wings black, with a metallic lustre; the veins darker. Posterior wings smoky-black, subhyaline, with paler fringes. Legs dark dull-brown. Abdomen blackish-brown. In the male there is a triangular membranous lobe (little evident in dry specimens) from the middle of the upper margin of the last abdominal segment; on either side of this is a needle-shaped app. intermed.; app. sup. long and very fine, slightly hairy; app. inf. broad at the base, the apical portion claw-shaped and curved upwards, dark testaceous; ventral plate produced in the middle into a short slightly forked lobe. In the female there is a superior membranous median lobe, with a semicircular emargination, and with a short straight finger-shaped appendage on either side; lateral valves very large, narrow at the base, the apical portion very greatly dilated.

Expanse of fore-wings 8—9 lines.

Larva slender, of a clear fawn-colour, with black spots forming X-shaped markings on the head and two first thoracic segments. Metanotum with two black points. Abdomen fawn-coloured, with very small respiratory filaments. Legs fawn-coloured, spotted with black. (Pictet.)

Case thin, formed of vegetable remains and grains of sand, with twigs placed longitudinally on the outside. (Pictet.)

Frequent in standing and very slowly running waters, and appears in summer and autumn.

2. *Mystacides nigra*, Linné.

(Pl. II. fig. 6, larva; Pl. VI. fig. 5, neuration and maxillary palpus; Pl. XII. figs. 29, 30, app.)

Phryganea nigra, Linn. Faun. Suec. n. 1490 (1761), and other works; *Mystacides nigra*, Lat. Fam. Nat. p. 437; Pict. (*) Recherch. p. 169, 10, pl. 12, fig. 5; Ramb. Hist. Nat. Névrop. p. 511, 8; Hag. (*) Ent. Ann. 1860, p. 75, 72; *M. niger*, Burm. Handb. p. 919, 5; *Leptocerus niger*, Steph. (*) Ill. p. 196, 6 (part); *Phryganea azurea*, Zett. Ins. Lapp. col. 1072, 52 (1840); *Setodes azurea*, Kol. Gen. et Spec. Trichop. pt. 2, p. 263, 1, pl. 3, fig. 33.

Antennæ black, distinctly annulated with white on the basal half. Head and thorax shining black. Palpi dull black. Eyes dull red in the living insect. Anterior wings narrower than in the last species; metallic bluish-black, with a dull darker central oblique fascia; fringes dark greyish-black. Posterior wings dark smoky-grey, with concolorous fringes. Legs blackish, with a silvery reflexion in certain lights; tarsi annulated with darker. Abdomen dull blackish. In the male the app. sup. are very slender, black and slightly hairy; app. intermed. testaceous, curved, very acute, the points crossing; app. inf. broad at the base, with a short obtusely rounded lobe directed upwards; ventral plate very large, broad and pubescent, produced in the middle into a lobe which is forked at the end, the branches being long and widely divaricating. In the female there is a short membranous median superior lobe, with a semicircular emargination, and on either side a fine straight finger-shaped appendage; lateral valves narrow at the base, the apical portion greatly dilated and somewhat truncated.

Expanse of fore-wings 6½—8 lines.

Larva resembling that of the preceding, but smaller and with the black spots covering to a greater extent the pale ground colour. (Pictet.)

Case similar to that of the last. (Pictet.)

A common and very elegant species, appearing in summer and autumn.

Leptocerus sepulchralis, Walker, from North America, is very closely allied to, or identical with, *M. nigra*. The types are unset and in bad condition; the form of the ventral plate in the male appears to differ slightly, but I am not satisfied that there is any good specific difference.

3. *Mystacides quadrifasciata*, Fabricius. (Pl. XIII. figs. 1, 2, app.)

Phryganea quadrifasciata, Fab. Syst. Ent. p. 308, 17 (1775); Zett. Ins. Lapp. col. 1072, 50; *Leptocerus quadrifasciatus*, Steph. (*) Ill. p. 200, 22; *Mystacida quadrifasciata*, Ramb. Hist. Nat. Névrop. p. 511, 9; *Mystacides quadrifasciata*, Brauer, Neurop. Aust. p. 41; Hag. (*) Ent. Ann. 1860, p. 75, 73; *Setodes quadrifasciata*, Kol. Gen. et Spec. Trichop. pt. 2, p. 265, 2, pl. 3, fig. 3.

Antennæ whitish, annulated with dark fuscous. Head and mesothorax shining blackish-fuscous. Palpi dark fuscous. Anterior wings golden-yellow, with three broad transverse fuscous fasciæ; thus the wings appear to have four golden and three fuscous bands of about equal breadth; fringes fuscous. Posterior wings smoky-fuscous, subhyaline, with grey fringes. Legs ochreous. Abdomen brown, with pale lateral lines. In the male the app. sup. are long and fine, hairy; app. intermed. closely approximating, triangular at the base, running to an acute point, straight; below these is to be seen the testaceous upper penis-cover (or penis?), bent downwards at the tip; app. inf. short, directed upwards; ventral plate produced in the middle into a short, straight, truncated lobe. In the female the lateral valves are scarcely narrower at the base, afterwards curved strongly downwards; above them on each side is a short hairy finger-shaped appendage.

Expanse of fore-wings 8—9 lines.

A common species in summer about standing waters and the shallow expansions of the margins of slowly flowing rivers.

Varies greatly in colour; in strongly marked individuals the dark bands predominate; in others there is not a trace of these, the wings being entirely golden-yellow.

Genus Setodes, Rambur.

Antennæ very long and thin, more than twice as long as the wings; basal joint stout, as long as the head. Maxillary palpi long and hairy; first joint rather long; second and third joints very long; fourth and terminal joints shorter (perhaps these palpi vary according to the species). Labial palpi very small. Mesothorax robust, convex and ovate. Anterior wings very long and narrow, but slightly dilated before the apex; hairy clothing dense, sometimes very long; discoidal cell closed; first apical cell long; anastomosis usually straight. Posterior wings usually not folded, narrow; the costal margin generally somewhat convex in the middle; discoidal cell open; fringes very long. Legs rather short; anterior tibiæ with one apical spur (two in some species); intermediate and posterior tibiæ each with one pair of apical spurs. Abdomen thin. Appendices complicated, varying greatly according to the species. The female generally larger than the male.

Larva similar to that of *Leptocerus*, inhabiting standing and running waters. Case a cylindrical tube, smaller at one end, composed of fine sand or entirely of silk.

This genus probably stands in need of subdivision, as some of the species are rather discordant.

According to the neuration, we may divide it into two sections, and again I must ask the student to refer to the figures. (See Pl. VI. fig. 6; Pl. VII. fig. 1.)

A. *Upper branch of the ramus thyrifer in the anterior wings simple.*

1. *Setodes ochracea*, Curtis.

(Pl. VI. fig. 6, neuration and maxillary palpus.)

Leptocerus ochraceus, Curt. (*) Brit. Ent. vol. 2, fol. 57 (1825); Steph. (*) Ill. p. 195, 1; *Phryganea hectica*, Zett. Ins. Lapp. col. 1072, 48 (1840); *Mystacides hecticus*, Kol. Gen. et Spec. Trichop. pt. 2, p. 251, 3, pl. 5, fig. 54; *Mystacida obsoleta*, Ramb. Hist. Nat. Névrop. p. 509, 4 (1842); *Phryganea pilosa*, Müll. Zool. Dan. p. 145, 1761 (1776)?; *Mystacides pilosus*, Brauer, Neurop. Aust. p. 41; *Leptocerus pilosus*, Hag. (*) Ent. Ann. 1860, p. 74, 70.

Antennæ pale ochreous, the articulations marked above with brown at the sutures. Palpi greyish-ochreous. Head and thorax testaceous. Anterior wings ochreous, the cilia at the anal angle greyish; neuration prominent, the three transverse veins forming the anastomosis placed in a slightly oblique line. Posterior wings whitish, subhyaline. Legs pale ochreous; the anterior tibiæ with one very minute apical spur. Abdomen testaceous.

Expanse of fore-wings 10—13 lines.

Occurs not uncommonly in summer about ponds and other standing waters, such as those in the parks of London. It is an elegant species and cannot well be confounded with any other.

The figure in Curtis' British Entomology is good but rather too darkly coloured.

2. *Setodes intaminata*, n. sp.

Antennæ whitish-ochreous. Head dark brown, clothed with ochreous pubescence. Eyes intensely black. Palpi greyish-ochreous. Mesothorax brown. Anterior wings somewhat dilated towards the obtuse apex, uniform pale greyish-ochreous without markings; fringes ochreous; neuration indistinct, scarcely darker than the membrane; the three transverse veins forming the anastomosis irregular; that closing the discoidal cell very strongly curved; that uniting that cell to the cellula thyridii very oblique, placed rather nearer the base than the former; that closing this cell placed still nearer the base and oblique, but in an opposite direction to the one above it. Posterior wings pale grey; fringes greyish-ochreous. Legs whitish-ochreous. Abdomen greyish-brown. The last abdominal segment in the female is furnished with two somewhat triangular diverging valves; beneath them appears to be a large concave egg-pouch.

Expanse of fore-wings 10 lines.

I have seen but one example of this—a female—which is in my own collection. It was taken by Mr. Winter in the Norfolk Fens. We must await the capture of more specimens, and especially of males, before a complete description can be given. It certainly does not appear to have been previously described. The size is greater than that of any other European species strictly pertaining to *Setodes* (in the sense in which I understand that genus), excepting *S. ochracea*, with which it agrees in its uniform coloration, though otherwise abundantly distinct; the arrangement of the transverse veins forming the anastomosis is peculiar and characteristic.

3. *Setodes lacustris*, Pictet. (Pl. XIII. fig. 3, app.)

Mystacides lacustris, Pict. (*) Recherch. p. 171, 13, pl. 13, fig. 7 (1834); *Setodes testaceus*, Hag. (*) Ent. Ann. 1860, p. 77, 77 (not of Curtis).

Antennæ greyish-ochreous, with fine and distant darker annulations, most evident in the female. Head clothed with ochreous hairs. Palpi grey. Mesothorax ochreous, with a few hairs of the same colour. Anterior wings greyish-ochreous (paler in the female), with dark grey spots; some of these uniting form a line along the anastomosing transverse veins, and the apical margin is regularly dotted with grey; fringes grey; the three transverse veins of the anastomosis are straight, that closing the discoidal cell placed rather nearer the apex than the others. Posterior wings greyish, subhyaline, with grey fringes. Legs pale greyish-ochreous, the anterior tibiæ with apparently two very minute apical spurs. Abdomen dark dull greenish, with whitish lateral lines. In the male the upper margin of the last abdominal segment is produced in the middle into a short triangular lobe, on each side of which are placed the broad, obtuse and very hairy app. sup.; app. inf. sharply elbowed, the apical portion directed strongly upwards; above the app. inf. there appears to be a large triangular upper penis-cover. (In dry specimens the parts are confused and not easy to discriminate, excepting the app. inf.)

Expanse of fore-wings, ♂ 6—7 lines, ♀ 7½—8 lines.

Not an uncommon species about still waters in summer; flying on calm evenings just above the surface.

I am not certain if this be really Pictet's species; the type in the British Museum is much rubbed, and has lost its abdomen; Dr. Hagen informs me that he thinks there may be two closely allied species, one smaller than that here described, and probably the true *lacustris* of Pictet.

I think it probable that the three varieties figured by Kolenat (Gen. et Spec. Trichop. pt. 2, pl. 3, figs. 35, 36, and pl. 4, fig. 37), are distinct species; fig. 36, perhaps, representing our *lacustris*.

S. notata, which I erroneously recorded in the Ent. Ann. for 1862, p. 33, is the male of this species. Rambur's *notata* is allied, but different.

4. *Setodes testacea*, Curtis. (Pl. XIII. fig. 4, app.)

Leptocerus testaceus, Curt. (*) Phil. Mag. p. 213, 13 (1834), not of Steph. or Hag.

Antennæ ochreous, marked with blackish at the sutures of the articulations above. Head, palpi and thorax ochreous. Anterior wings densely hairy, dark ochreous, slightly brownish, the fringes greyish at the anal angle; the three transverse veins forming the anastomosis rather conspicuously darker than the others, placed nearly in a straight line. Posterior wings hyaline, with long grey fringes. Legs ochreous. Abdomen greenish; the three or four last segments in the male have on each side above a large oval space of a different texture, minutely and thickly punctuated; a broad plate, obtusely rounded in front, covers the whole of the terminal segment above, and extends far beyond it; this plate is of a similar texture to the spaces above mentioned, and is punctuated in the same manner; app. sup. small, finger-shaped, with a lobe between them, beneath which is a large boat-shaped testaceous piece, which may be considered as the upper penis-cover; app. inf. very large, with an oval base; the apical portion branched, the forks widely divergent, the lower the longest. In the female the abdominal spaces are wanting, and there is not a vestige of the broad cover over the last segment; the lateral valves are rather large, dilated, and testaceous.

Expanse of fore-wings $7\frac{1}{2}$ lines.

This singular species seems to be rare. I have seen but few examples, and only one female. Mr. Parfitt finds it near Exeter; and I have taken it in June by the River Mole near Box Hill, also at Ringwood in Hampshire, and possess it from Kingston-on-Thames and Killarney. The curious abdominal spaces and the cover over the last segment render the identification of the male easy.

B. *Upper branch of the ramus thyrifer in the anterior wings forked.*

5. *Setodes reducta*, M'Lachlan.

(Pl. VII. fig. 1, neuration; Pl. XIII. fig. 5, app.)

Leptocerus bicolor, Steph. (*) Ill. p. 201, 25 (1836), not of Curtis; Hag. (*) Ent. Ann. 1860, p. 73, 67.

Antennæ whitish, unspotted. Palpi fuscous. Head and thorax thickly clothed with reddish-brown hairs. Anterior wings very pubescent, brownish-ochreous, slightly paler about the anastomosis; an appearance of a faint blackish line round the apex, and the apical cilia towards the anal angle also blackish-grey; the three transverse veins forming the anastomosis placed in an oblique line. (The pubescence must be removed before the neuration can be seen.) Posterior wings purplish-black. Legs greyish; anterior tibiæ with one distinct apical spur. Abdomen greyish (greenish when alive), with pale lateral lines. In the male the app. sup. are small, broad and rounded; app. inf. coming to an obtuse point; (the parts are not prominent, and difficult to discriminate exactly).

Expanse of fore-wings 6 lines.

Widely distributed about small rivers and streams, especially in the south, but scarcely known in collections. Abundant in June and July at Haslemere, in Surrey; also in Devonshire, the New Forest, near Darenth, North Wales, &c.

6. *Setodes tineiformis*, Curtis.

(Pl. II. fig. 33, case; Pl. XIII. fig. 6, app.)

Leptocerus tineiformis, Curt. (*) Phil. Mag. p. 214, 16 (1834); *L. elongatus*, Steph. (*) Ill. p. 201, 261 (1836); *Setodes elon-*

gata, Hag. (*) Ent. Ann. 1860, p. 76, 75; *S. aspersella*, Ramb. Hist. Nat. Névrop. p. 516, 3 (1842)?

Antennæ dark fuscous, annulated with white on the basal half. Head clothed with cinereous hairs. Palpi fuscous. Mesothorax fuscous. Anterior wings long and very narrow, pointed at the apex; cinereous, the longitudinal veins regularly dotted with blackish; fringes greyish-ochreous; the three transverse veins forming the anastomosis placed successively rather behind one another, that closing the discoidal cell being nearest the apex. Posterior wings grey, subhyaline, with grey fringes. Legs greyish-ochreous. Abdomen greyish, with pale lateral lines. In the male there are two needle-shaped styles, which I consider app. intermed., but apparently no trace of app. sup.; app. inf. very large, dilated at the apex and notched, hairy, very similar in shape to those of the genus *Sericostoma;* below the app. intermed. is a large upper penis-cover (or perhaps the penis itself?)

Expanse of fore-wings 6—8½ lines.

Has been bred by Mr. Parfitt of Exeter, but I have no description of the larva. Case a straight tube, 6½ lines long, tapering almost to a point at the smaller end; constructed of silk, without any extraneous substance attached to the outside; the mouth nearly circular and dilated.

A delicate species, frequenting slowly-flowing rivers, and appearing in summer; not common.

In Curtis' Collection two species were placed under the label *tineiformis*, but the description shews that this was intended to bear the name. In Stephens' Collection three species are included under the one label, but here also his description shows that this was intended. The types of *attenuatus*, Stephens, I believe to be examples of this, in which the hairy clothing of the wings has been rubbed off.

7. *Setodes interrupta*, Fabricius.

(Pl. I. fig. 6; Pl. XIII. fig. 7, app.)

Phryganea interrupta, Fab. Syst. Ent. p. 307, 13 (1775); *Mystacides interruptus*, Burm. Handb. p. 919, 6; *Setodes interrupta*, Brauer, Neurop. Aust. p. 41; Kol. Gen. et Spec. Trichop. pt. 2, p. 268, 6, pl. 3, fig. 34; M'Lach. Ent. Ann. 1862, p. 33.

Antennæ dark brownish-black, annulated with white on the basal third. Head black. Palpi clothed with silvery-white hairs. Mesothorax shining black. Anterior wings black, with white markings, viz., a broad band at the extreme base, reaching nearly across the wing; a narrower band before the middle, also reaching nearly across the wing; two large triangular opposite spots, one on the costa and one on the dorsal margin, a little beyond the middle; and about eight small spots round the apical margin; neuration indistinct, the three transverse veins forming the anastomosis placed in an oblique interrupted line. Posterior wings grey, with grey fringes. Legs somewhat fuscescent, with a silvery lustre. Abdomen black with pale lateral lines. In the male there are two long needle-shaped and curved app. intermed., the left hand one being nearly twice the length of the right (I have examined five males, and in every one I find that the app. intermed. are thus unequal; this in a single specimen I should have considered accidental); between these app. intermed. is an enormously long and slender needle-shaped upper penis-cover; app. inf. very long and slender, hairy, the points turned upwards. In the female there are two slender superior valves, and two broad and obtuse lateral valves.

Expanse of fore-wings $6\frac{1}{2}$—$7\frac{1}{2}$ lines.

This elegant species was described by Fabricius from an English specimen in 1775, but was not re-discovered in this country until the year 1859, when a single example was taken at the canal at Taunton by Mr. Parfitt, the only native specimen that I have seen. I possess a fine series of the insect from Prussia.

The name *interruptus* was erroneously applied by Donovan and Stephens to *Leptocerus albifrons*, Linn.

Fam. HYDROPSYCHIDÆ.

Antennæ fine with long joints and longer than the wings, or stouter with short joints and shorter than the wings; ocelli generally absent; maxillary palpi alike in both sexes, long, scarcely hairy, the terminal joint longer than the others, flexible and multiarticulate, or appearing to be made up of a number of very small joints, the sutures of which are readily seen in some genera, but are indistinct in others; labial palpi also with the terminal joint multiarticulate; anterior wings generally dilated towards the apex, usually thinly clothed with hair, but sometimes with long and thick hair; discoidal cell closed; posterior wings folded, usually shorter and broader than the anterior; legs spineless, with the spurs variable in number, the posterior tibiæ always (in British genera) with two pairs of spurs.

Larvæ elongate, tapering at the extremities, especially posteriorly; in some the head and three thoracic segments are all corneous, in others the metanotum is not corneous; mandibles strongly dentate; legs short; terminal abdominal segment with long anal crotchets; respiratory filaments arranged in tufts, or not visible externally.

Pupa rather stout, lying free within the case; mandibles internally dentate; abdomen not fringed, sometimes with external respiratory filaments.

Case a fixed heap of small stones, or sometimes a channel is formed of sand on the surface of a large stone. The larvæ sometimes live free beneath stones and only form cases when about to metamorphose.

Most of the genera inhabit running waters, but some frequent ponds and canals.

As the genera in this family are in most instances founded on characters afforded by the neuration, especially of the apical portion of the wing, the following scheme for numbering the apical forks (suggested by Dr. Hagen) will be found very serviceable, and I only regret that I could not see my way clear to the intelligible adoption of it in the other families.

Taking the genus *Hydropsyche* as the most complete example, we find in the anterior wings that the two branches of the ramus discoidalis fork at the ends, forming a cell; these we call forks Nos. 1 and 2. Again, both the branches of the upper or anterior branch of the ramus thyrifer fork at their extremities; these furcations we call forks Nos. 3 and 4. Finally, the lower branch of the ramus thyrifer (the ramus clavalis of Kolenati) forks at the end, and forms fork No. 5.

In the posterior wings a similar arrangement may be seen. Thus the two branches of the ramus discoidalis fork and form Nos. 1 and 2; the upper branch of the anterior branch of the ramus subdiscoidalis forks and forms No. 3; and the lower branch of the ramus subdiscoidalis forks and forms No. 5; fork No. 4 is never present in these wings.

A reference to the figures of the neuration of these genera (Plates VII., VIII.), in which all the forks are numbered, will render this arrangement easily understood.

The genera may be arranged according to the presence of the forks in the anterior wings, thus:—

Forks 1, 2, 3, 4, 5 . . .	*Hydropsyche*, *Diplectrona*, *Philopotamus*, *Plectrocnemia*, *Polycentropus*, *Ecnomus*, and *Neureclipsis*.
Forks 1, 2, 3, 5 . . .	*Wormaldia*.
Forks 2, 3, 4, 5 . . .	*Tinodes*, *Psychomia*, and *Cyrnus*.

Or the usual tabular arrangement according to the number of spurs may be used, thus :—

Spurs 3-4-4 . . . *Plectrocnemia, Polycentropus, Cyrnus, Ecnomus*, and *Neureclipsis.*

Spurs 2-4-4 . . . *Hydropsyche, Tinodes, Diplectrona, Philopotamus, Wormaldia*, and *Psychomia.*

Genus Hydropsyche, Pictet.

Antennæ thin, usually longer than the wings and with the joints long, each joint, excepting the apical ones, having a dark oblique raised band; basal joint very short, thicker than the others. Head transverse, hairy. Ocelli absent. Maxillary palpi long; basal joint short; second, long and thick; third and fourth joints shorter; fifth as long as the others united. Labial palpi with two short basal joints and a long and thin terminal one. Mesothorax robust, broadly ovate. Anterior wings narrow at the base, much dilated at the obliquely truncated apex; hairy clothing short and thin; discoidal cell short and closed; a transverse vein on both the upper and under sides of the discoidal cell, another closing the cellula thyridii, another below this cell, and two others towards the base of the wing; forks 1, 2, 3, 4 and 5 all present, fork 1 short. Posterior wings folded, shorter and broader than the anterior, the apical portion of the costal margin shallowly excised; anal portion strongly developed; fringes very short; discoidal cell closed; one transverse vein above, and two or three below it; forks 1, 2, 3 and 5 present. Legs long; intermediate legs of the females dilated; anterior tibiæ with two short (sometimes scarcely evident) equal spurs; intermediate aud posterior tibiæ each with two pairs of long and rather unequal spurs. Abdomen slender in the male, robust in the female. In the male there is a narrow horny lobe from the upper margin of the last abdominal segment, connected with a broad membranous dorsal plate, beneath which, and perhaps united to it, is an emarginate piece which may be considered the penis-cover; what I consider to be the app. sup. are two small pieces on the lateral margins a little above the app. inf.; the app. inf. are very long and bisarticulate, the first joint long and nearly straight, the second shorter and curved inwards, so that the tips of the two appendices approximate; the penis is long and extensile, and apparently without sheaths; at the apex it is swollen and cleft, and often with subapical protuberances. In the female the apex of the abdomen is obtuse, and is furnished with a retractile piece which is corneous above; beneath this, and connected with it, is a fleshy semicircular apparatus, the margins of which are furnished with fleshy papillæ, which usually disappear in dried specimens;* inside this is the opening whence the eggs are protruded.

Larva with the head small and nearly quadrate, truncated anteriorly, and furnished with short and broad internally-dentate mandibles; pronotum transverse, shorter than the head, corneous; mesonotum broadly transverse, also corneous; metanotum broadly ovate, with a large corneous plate above. (See Pl. II. fig. 15.) Legs short, the posterior the longest, slightly hairy. Abdomen subcylindrical; on the ventral surface of each segment there is a dense tuft of respiratory filaments on each side; these are even found on the under-side of the thoracic segments; anal segment furnished with two long processes surmounted by horny hooks and long hairs. Case an irregular fixed heap of stones, in which the pupa (Pl. II. fig. 20) lies free. Inhabits running streams.

Considering that most of them are of moderately large size, the species of this genus are perhaps the most difficult of all to satisfactorily separate. The anal appendices, so certain and evident in their characters in most genera, here present very few differences in the various species; besides, as many of the parts are membranous or fleshy in their nature, they dry up into very different forms in dead individuals of one species; however, these usually all-important characters are not to be despised even here, and an attentive examination of living specimens may yet help to clear up much of the uncertainty surrounding this perplexing genus.

A. *Third joint of the maxillary palpi longer than the fourth. Antennæ scarcely so long as the wings; the joints not marked with oblique dark lines.* (Small species.)

1. *Hydropsyche albipunctata*, Stephens.
(Pl. VII. fig. 2 *e*, maxillary palpus.)

Tinodes albipunctatus, Steph. (*) Ill. p. 164, 7 (1836); *Hydropsyche angustata*, Pict. Recherch. p. 208, 10, pl. 19, fig. 6 (1834)?; Steph. Ill. p. 174, 9; *H. ventralis*, Curt. (*) Brit. Ent. pl. 601 (1836)?; *H. lepida*, Hag. Ent. Ann. 1861, p. 13, 105 (not of Pictet).

Antennæ brown, the basal portion annulated with yellow. Head and prothorax thickly clothed with yellow hairs. Palpi

* It is probable that the number and position of these papillæ may be a means of specific diagnosis; but from the fact of their disappearing in drying, the application of the character becomes almost impossible.

greyish-ochreous. Mesothorax dark blackish-fuscous. Anterior wings greyish-yellow, faintly clouded and reticulated with pale greyish-fuscous; a large yellow elongate spot on the dorsal margin just before the anal angle, and the apical margin is regularly spotted with yellow and greyish-fuscous alternately; these markings are most distinct in the female. Posterior wings grey, subhyaline, iridescent; fringes grey. Legs greyish-ochreous. Abdomen fuscous, paler beneath; greenish in the female during life. In the male the upper margin of the last abdominal segment is fringed with long yellow hairs; app. inf. with a long and straight up-directed basal joint, pale yellow, with an oblique brown line at the apex, where there is a tuft of brownish-yellow hairs, terminal joint very small; penis long and slender, cylindrical, yellow, the apex much thickened and directed abruptly downwards, brown. In the female there is a broad fuscous lobe proceeding from the upper margin of the last segment, with a small semicircular notch on the middle of its anterior edge; lateral valves large, nearly quadrate, yellow, the margin excised.

Expanse of fore-wings 6—7½ lines.

Very common in autumn along the Thames about Kingston; occurs at Ringwood and Exeter; also in North Wales, Ireland (Loch Derg), &c., but apparently not generally distributed.

After having compared specimens of this insect with types of *H. angustata* and *H. lepida*, Pictet, Dr. Hagen informs me that he is doubtful if our species be identical with either, but adds that it is certainly the *lepida* of his synopsis in the Ent. Ann.

B. *Third joint of the maxillary palpi shorter than the fourth. Antennæ as long as or longer than the wings, the joints of the basal portion marked with oblique dark lines.* (Large or middle-sized species.)

a. *Eyes small. Vertex transverse, much broader than long.*

2. *Hydropsyche pellucidula*, Curtis.

(Pl. VII. fig. 2, neuration, palpi, leg, antenna; Pl. XIII. figs. 8, 9, app.)

Philopotamus pellucidulus, Curt. (*) Phil. Mag. p. 213, 8 (1834); *Hydropsyche pellucidula*, Steph. (*) Ill. p. 172, 4; *Philopotamus lanceolatus*, Curt. (*) Phil. Mag. p. 213, 10 (1834)?; *Hydropsyche tenuicornis*, Steph. (*) Ill. p. 171, 2 (1836); Kol. Gen. et Spec. Trichop. pt. 2, p. 234, 5?; *H. hibernica*, Steph. (*) Ill. p. 173, 5 (1836)?; *H. maxima*, Brauer, Neurop. Aust. p. 40 (1857).

Antennæ brown. Head fuscous, thickly clothed with yellowish-white silky pubescence. Palpi fuscous. Mesothorax dark blackish-fuscous, clothed with whitish pubescence in the middle. Anterior wings broad, grey, thickly irrorated with pale yellow spots, with a larger elongate spot behind the anal angle; these spots are distinct in the living insect, but fade and become very indistinct in dry specimens. Posterior wings pale grey, subhyaline, the fringes dark grey. Legs uniform greyish-brown. Abdomen blackish-fuscous, brownish-ochreous beneath, and with pale lateral lines. In the male the superior horny lobe (see the generic description, p. 124) is narrow, blackish and pointed, the membranous parts beneath it are yellow; app. sup. blackish, triangular; app. inf. with the basal joint very long, entirely yellowish, apical joint scarcely half the length of the basal, slightly dilated at the tip; penis shining dark testaceous, the apex deeply divided, with a very conspicuous angular subapical projection on either side.

Expanse of fore-wings 12—14 lines.

Not an uncommon species in summer about streams. The largest of the British (perhaps also of the European) species, and, unless there be others closely allied, distinguishable by its size, combined with the prominent lateral projections below the apex of the penis. The types of *H. hibernica* are probably individuals just emerged from the pupa, and which consequently had not acquired their full measure of coloration.

3. *Hydropsyche lanceolata*, Stephens.

(Pl. I. fig. 7; Pl. XIII. figs. 10, 11, app.)

Hydropsyche lanceolata, Steph. (*) Ill. p. 173, 6 (1836); *H. atomaria*, Steph. (*) Ill. p. 171, 1 (not of Pict.); *H. guttata*, Steph. Ill. p. 172, 3 (1836)?; *Philopotamus instabilis*, Curt. Phil. Mag. p. 213, 7 (1834)?; *Hydropsyche Danubii*, Brauer, Neurop. Aust. p. 40, (1857)?.

Antennæ yellow, brown towards the apex; the oblique dark lines very conspicuous. Head thickly clothed with whitish-yellow pubescence. Palpi brown. Mesothorax pitchy-black. Anterior wings rather narrow; grey, thickly spotted with yellow, some of the spots on the dorsal margin and near the apex larger than the others; several short black lines placed on the longitudinal veins of the dorsal half of the wing. Posterior wings pale greyish, subhyaline, the fringes darker. Legs testaceous.

Abdomen blackish, with whitish lateral lines. In the male the superior horny lobe is short, narrow and black, the membranous parts beneath it yellow; app. sup. short, subrotund, yellowish; app. inf. yellow, the basal joint cylindrical, dilated towards the apex, the upper side marked with brown and furnished with long hairs, apical joint short, yellow, obtuse, scarcely dilated; penis cylindrical, testaceous, darkest at the tip, which is deeply cleft, with a scarcely-perceptible lateral subapical projection.

Expanse of fore-wings 10—12 lines.

A widely-distributed species. Smaller and with narrower wings than the last, and more sharply marked. It varies exceedingly in coloration; examples from the north are much darker than those from the south. The almost entire absence of subapical projections on the penis will serve to distinguish it from allied native species, but I am uncertain whether it has been found and named on the Continent; I have never seen a continental example.

This is certainly not the *H. atomaria* of Pictet. Dr. Hagen informs me that a type of *H. Danubii* of Brauer, in his collection, agrees with *lanceolata* in coloration; a specimen of *Danubii* in my collection (from Zeller), named by Dr. Brauer, does not at all resemble this, and in colour is scarcely distinguishable from *angustipennis* of Curtis.

4. *Hydropsyche angustipennis*, Curtis.

(Pl. II. fig. 8, larva and pupa.)

Philopotamus angustipennis, Curt. (*) Phil. Mag. p. 213, 9 (1834); *Hydropsyche angustipennis*, Steph. (*) Ill. p. 173, 7; *Philopotamus fulvipes*, Curt. (*) Phil. Mag. p. 213, 9*b* (1834)?; *Hydropsyche fulvipes*, Curt. (*) Brit. Ent. pl. 601?; Steph. (*) Ill. p. 174, 8; Hag. (*) Ent. Ann. 1861, p. 15, 107.

Antennæ brown, the oblique dark lines not conspicuous. Head thickly clothed with yellowish pubescence. Palpi brown. Mesothorax dark blackish-fuscous. Anterior wings golden-brown, faintly irrorated with paler spots (when alive); a pale elongate spot on the dorsal margin (conspicuous when alive); fringes paler than the ground colour. Posterior wings smoky, with pale fringes. Legs pale brownish-ochreous. Abdomen dark blackish-fuscous, with whitish lateral lines. In the male the superior horny lobe is short, black and obtuse, the membranous parts beneath it bright yellow; app. sup. blackish, obtusely triangular;

app. inf. blackish, the first joint slightly dilated at the apex, the apical joint of nearly uniform thickness; penis shining blackish, slightly contracted behind the thickened divided apex.

Expanse of fore-wings 9—12 lines.

Larva: Head and two first thoracic segments dark fuscous; a pale ring encircling the eyes, and two pale oblique spots on the disc of the head; lateral and posterior margins of the mesonotum bordered with black, the posterior margin three-lobed, the middle lobe the smallest. Metanotum dirty-whitish, with a broad nearly quadrate brown corneous plate, the posterior edge of which is concave. Legs yellowish, marked with black at the joints. Abdominal segments dull brown, the three terminal segments paler, the peduncles bearing the anal crotchets pale ochreous, with a tuft of long black hairs at the base of the crotchets.

Not an uncommon species about streams, appearing from May to October. Especially abundant along the little river Ravensbourne, about Lewisham, &c.

The types of *H. fulvipes* of Curtis are two females, which are more distinctly irrorated than is usual in this species; nevertheless I have little doubt that they belong here.

5. *Hydropsyche contubernalis*, n. sp. (Pl. XIII. fig. 12, app.)

Antennæ whitish, brown towards the apex, the oblique black streaks very conspicuous on the basal portion. Head thickly clothed with silky whitish pubescence. Palpi brown. Mesothorax black, with a median line of whitish pubescence. Anterior wings brown, thickly irrorated with whitish spots; a large whitish spot on the dorsal margin towards the apex, preceded by a long brown space; apical fringes greyish-brown, interrupted with whitish. Posterior wings grey, with grey fringes, the neuration hardly darker. Legs pale fulvous. Abdomen black, with broad reddish or whitish lateral lines. In the male the superior horny lobe is short and black, the membranous parts beneath it yellowish; app. sup. very small, obtuse and blackish; app. inf. with the first joint thin and cylindrical, much dilated towards the apex, testaceous, the apical portion blackish-brown externally, apical joint cylindrical, hardly dilated, pale yellow; penis shining deep brownish-testaceous, cylindrical, the apex scarcely thickened and slightly cleft, without any apparent lateral subapical projections.

Expanse of fore-wings 8—9½ lines.

I have found this species commonly in summer and autumn along the Thames, between Kew and Richmond, and am unable to identify it with any described species. It varies in the number of the pale spots and very slightly in size; the only British species agreeing with it in this respect is *H. ophthalmica.* It may possibly be the *H. guttata* of Pictet.

b. *Eyes (of the male only?) large. Vertex nearly quadrate, slightly longer than broad.*

6. *Hydropsyche ophthalmica*, Rambur.

Hydropsyche opthalmica, Ramb. Hist. Nat. Névrop. p. 505, 2 (1842); M'Lach. Ent. Ann. 1864, p. 152.

Antennæ whitish, with very distinct oblique black lines. Head thickly clothed with whitish pubescence. Palpi whitish-grey. Mesothorax blackish. Anterior wings whitish, reticulated with grey, with blackish spots towards the dorsal margin; apical margin grey and whitish alternately. Posterior wings pale whitish-subhyaline. Legs pale whitish-ochreous; the apex of the terminal joint of the anterior and intermediate tarsi blackish. Abdomen brownish above, ochreous beneath. In the male the superior horny lobe is very short and brown, the membranous parts beneath it yellow; app. inf. greyish-white, the basal joint much dilated in its apical portion and externally marked with black, apical joint much incurved and scarcely dilated at the tip; penis testaceous, much swollen below the apex, which is darker than the other parts.

Expanse of fore-wings 8½—9 lines.

Occurs along the Thames about Kingston, Kew, &c. in autumn.

The peculiar structure of the eyes will readily distinguish this species from all others.

I am inclined to think that the male only possesses the enlarged eyes. This insect is very common in August along the Seine at Paris, frequenting the river-walls and the interiors of the baths, as I observed in August, 1864. The only female *Hydropsyche* that I saw there had eyes of the ordinary size, and, as I found the male of no other species of this genus, I think it may pertain to *ophthalmica*.

Genus Tinodes, Leach.

Antennæ moderately stout, shorter than the wings, obsoletely dentate internally; basal joint short, not much thicker than the others. Head convex above, hairy. Ocelli absent. Maxillary palpi long and thin; basal joint short; second longer; third as long as the two first united; fourth as long as the second; fifth longer than the third, and thinner. Labial palpi very small, with two short basal joints and a longer terminal one. Mesothorax robust. Anterior wings long and narrow, with an elliptical somewhat-dilated apex; hairy clothing short, rather dense, varying according to the species; a naked circular space in both sexes near the base, at the point where the ramus discoidalis parts from the radius; discoidal cell closed, short and broad; forks 2, 3, 4 and 5 present; two transverse veins, besides the one closing the discoidal cell, towards the apex, and two others towards the base. Posterior wings shorter than the anterior, considerably dilated before the apex, which is obliquely rounded; discoidal cell open; forks 2, 3 and 5 present; fringes long. Legs long; intermediate tibiæ and tarsi not dilated in the female; anterior tibiæ with two short apical spurs; intermediate and posterior tibiæ each with two pairs of short unequal spurs. Abdomen slender. In the male a short pointed lobe proceeds from the upper margin of the last segment; beneath this is a large horny cover of the penis, and on each side of this, two needle-shaped app. intermed.; app. sup. long, finger-shaped and hairy; app. inf. large, bisarticulate, the terminal joint usually cleft. In the female the apex of the abdomen ends in a short and rather pointed ovipositor.

Larva inhabiting running waters; long and slender, with short feet; without external respiratory filaments.

Case sometimes merely a silken serpentine tube on the surface of stones, closed with *débris* when the larva changes to a pupa; or composed of small stones, similar to that of most of the other genera in this family.

The species are difficult to separate, but the appendices furnish the best characters. I can satisfactorily determine only three native species, but it is probable that we have several others.

1. *Tinodes lurida*, Curtis.

(Pl. VII. fig. 3, neuration and max. palp.; Pl. XIII. figs. 13, 14, app.)

Tinodes luridus, Curt. (*) Phil. Mag. p. 216, 5 (1834); Steph. (*) Ill. p. 163, 4; Hag. (*) Ent. Ann. 1861, p. 10, 99; *T. pallescens*, Steph. (*) Ill. p. 162, 1 (1836); *T. flaviceps*, Steph. (*) Ill. p. 162, 2 (1833); *T. xanthoceras*, Steph. (*) Ill. p. 163, 3 (1836); *T. pallipes*, Steph. (*) Ill. p. 163, 5 (1836); *T. annulicornis*, Steph. (*) Ill. p. 163, 6 (1836); Hag. (*) Stett. Zeit. 1860, p. 283, 3; *Philopotamus longipennis*, Ramb. Hist. Nat. Névrop. p. 504, 6 (1842); *Tinodes Waenerii*, Kol. Gen.

et Spec. Trichop. pt. 2, p. 223, 3 (1859)?; *T. flavipes*, Hag. (*) Stett. Zeit. 1860, p. 282, 1.

Antennæ yellowish, closely annulated with fuscous. Head and mesothorax clothed with golden-yellow hairs. Palpi fuscous. Anterior wings greyish, subhyaline, clothed with very short yellowish pubescence; fringes greyish-yellow; neuration distinct, fuscous. Posterior wings paler, with longer yellowish-grey fringes. Legs yellowish. Abdomen conspicuously ochreous when alive, brown after death. In the male there is a short fleshy lobe from the middle of the upper margin of the last segment; on each side of this lobe are the needle-shaped testaceous app. intermed.; app. sup. long, finger-shaped, curved and hairy, yellow; app. inf. bisarticulate, the basal joint large, ovate, with a sharp spine on the upper margin, apical joint smaller, deeply bifid, the two divisions acute at the apex; in dead examples the spine on the first and the two forks of the apical joint are seldom visible, the latter being usually pressed closely together and apparently inseparable. In the female the abdomen terminates in a short triangular ovipositor.

Expanse of fore-wings 7—9 lines.

Common in summer and early autumn about streams.

I cannot separate the various species named by Stephens, and consider them all to belong to one. *T. annulicornis*, given by Dr. Hagen as distinct, seems to be only a small female of this.

The species of this genus shew the necessity of making careful examinations of living specimens, as the parts of the appendices are far less distinguishable after death.

2. *Tinodes pusilla*, M'Lachlan. (Pl. XIII. fig. 15, app.)

Tinodes pusillus, Curt. (*) Phil. Mag. p. 216, 4 (1834, not described); M'Lach. Ent. Ann. 1862, p. 37.

Antennæ fuscous, indistinctly annulated with yellow. Head thickly clothed with yellow hairs. Palpi fuscous. Mesothorax dark fuscous, with a few brownish-yellow hairs. Anterior wings broader at the apex than in the last species; hairy clothing much denser, greyish-yellow, with concolorous fringes; neuration very indistinct. Posterior wings subhyaline, iridescent, with yellowish fringes. Legs greyish-yellow. Abdomen brown (in dead examples). In the male there is a long fleshy lobe from the middle of the upper margin of the last segment, beneath which lie the needle-shaped app. intermed., the points only being visible; app. sup. very long, finger-shaped, slightly dilated at the base, very hairy; app. inf. with an oval basal joint and a forked terminal one, the upper prong very long and curved, the lower bristle-like; below the app. intermed. is a long, curved upper penis-cover.*

Expanse of fore-wings 6—6½ lines.

I have taken this in summer by a small streamlet in the Warren at Folkestone, but do not know for certain of other localities.

The description of the appendices is made from dead examples, but will probably be found pretty correct.

This and the next may be readily separated from the group to which *lurida* belongs, by the more obtuse and more densely hairy anterior wings; and the palpi appear to be proportionably longer.

3. *Tinodes assimilis*, n. sp. (Pl. XIII. fig. 16, app.)

In size and form almost entirely similar to the last; differs in the structure of the appendices. The lobe from the upper margin of the last abdominal segment is very similar but shorter; the app. intermed. the same; app. sup. much more dilated at the base; the basal joint of the app. inf. broad, obovate; the terminal joint thin and bristle-like; from the lower side of the base of the app. inf. (perhaps united to it) proceeds a long, curved, cylindrical process, the apex of which is directed inwards and downwards.

I have seen but few specimens; I possess it from Haslemere, and from a locality now unknown to me.

The differences in the structure of the appendices seem to indicate with certainty that the species is good.

It is right to mention that at the time I examined Curtis' Collection I was not aware of the existence of this species, but I think nevertheless that I rightly determined his *pusillus*.

Genus Psychomia, Latreille.

Antennæ short and thick, about half the length of the wings; the two first joints stouter than the rest. Head small and hairy. Ocelli absent. Maxillary palpi not very long; basal joint short, each of the three following about twice the length of the first, dilated and flattened; the fifth thinner, scarcely so long as the two preceding joints united. Mesothorax moderately robust,

* *T. cinerea*, Hagen, from Madeira, is very closely allied to this, and perhaps may not be specifically distinct. In the types of that species I do not, however, see the lower bristle-like branch of the inferior appendices; but the specimens are gummed on card, and difficult to examine satisfactorily. See "Entomologist's Monthly Magazine," vol. ii. pp. 78, 79.

short. Anterior wings long and narrow, somewhat dilated towards the elliptical apex; hairy clothing long and dense; fringes long; radius not bent; discoidal cell short and triangular, closed by an oblique transverse vein; a transverse vein uniting the upper margin of the discoidal cell to the radius, and two others placed below that cell (perhaps another more towards the base); forks 2, 3, 4 and 5 present. Posterior wings not folded, much shorter than the anterior and very narrow; the costal margin suddenly and acutely elevated about the middle; beyond this elevation the margin is slightly excised to the apex; fringes very long; no discoidal cell; perhaps one or two transverse veins; forks 2, 3 and 5 present. Legs moderately long, the intermediate tibiæ and tarsi dilated in the female; anterior tibiæ with two minute apical spurs; intermediate and posterior tibiæ each with two pairs of rather long and unequal spurs. Abdomen slender. In the male, there is sometimes a pointed lobe from the middle of the upper margin of the last segment; app. sup. and inf. sometimes both present, or the app. inf. are absent. In the female the apex of the abdomen is furnished either with a very short ovipositor, or with a very long upcurved one.

Larva unknown; frequenting slowly-flowing rivers.

The species are small, unicolorous, and difficult to separate, but the two here described cannot possibly be confounded.

1. *Psychomia gracilipes*, Curtis.

(Pl. VII. fig. 4, neuration; Pl. XIII. fig. 17, app.)

Anticyra gracilipes, Curt. (*) Phil. Mag. p. 216, 1 (1834); *A. latipes*, Curt. (*) Phil. Mag. p. 216, 2 (1834); *A. subochracea*, Steph. (*) Ill. p. 160, 3 (1836); *A. ciliaris*, Steph. (*) Ill. p. 160, 4 (1836); Hag. (*) Ent. Ann. 1861, p. 12, 103; *Psychomia annulicornis*, Pict. Recherch. p. 222, 1, pl. 20, fig. 7 (1834) ?; Ramb. Hist. Nat. Névrop. p. 500.

Antennæ whitish, annulated with dark fuscous. Head covered with dense yellowish pubescence. Palpi brownish. Mesothorax reddish-brown. Anterior wings rather acute at the apex; pale greyish-ochreous with long yellowish fringes. Legs pale-ochreous. Abdomen reddish-brown. In the male the only apparent appendices are the app sup., which are long and crooked with curved tips. In the female the abdomen ends in a short, nearly triangular, upturned ovipositor.

Expanse of fore-wings 4—5½ lines; the females the largest.

An extremely abundant species about some slowly flowing rivers, appearing in summer. Along the Thames about Kew and Richmond it is found in myriads, taking refuge in the herbage on the banks.

2. *Psychomia phæopa*, Stephens. (Pl. XIII. figs. 18, 19, app.)
Anticyra phæopa, Steph. (*) Ill. p. 159, 1 (1836); *A. gracilipes*, Steph. (*) Ill. p. 159, 2 (1836); *Tinodes pusillus*, Kol. Gen. et Spec. Trichop. pt. 2, p. 226, 10 (1859); *Psychomia pusilla*, Hag. (*) Stett. Zeit. 1860, p. 290, 5; *P.* (*Homoecerus*) *derelicta*, M'Lach. Proc. Ent. Soc. 1863, p. 152.

Antennæ blackish-brown, faintly annulated. Head and palpi blackish-brown. Anterior wings obtusely rounded at the apex, black with a brownish tinge; fringes concolorous. Posterior wings blackish, subhyaline, with blackish fringes. Legs brownish-testaceous, the tibiæ and tarsi darker. Abdomen blackish, paler beneath, with testaceous appendices. In the male there proceeds a short, acute, somewhat curved lobe from the middle of the upper margin of the last abdominal segment; app. sup. long and narrow, directed upwards, dilated towards the tips and somewhat hairy; app. inf. nearly as long as the app. sup., directed upwards, apparently bisarticulate, the basal joint being short, the terminal joint long and obtuse; from between the app. inf. projects the obtuse and truncated apex of the penis (or upper penis-cover?). In the female the apex of the abdomen is furnished with a long and thin ovipositor, which is dilated and somewhat flattened at the base, the apical portion being directed strongly upwards.

Expanse of fore-wings 5—6 lines. The females the largest.

In this country not nearly so common as the last species, occurring about rivers in summer and autumn.

Genus Diplectrona, Westwood.

Antennæ slender, scarcely so long as the wings, distinctly serrated on the inner side; basal joint short, rather thicker than the rest. Head broad and hairy. Ocelli absent. Maxillary palpi long; the four first joints of nearly equal length, the basal joint the shortest; terminal joint thinner, nearly as long as the others united. Mesothorax short and robust. Anterior wings short, narrow at the base, but greatly dilated before the broadly elliptical apex; hairy clothing short and not very dense; discoidal cell short, closed; radius considerably bent before its termination; about four transverse veins towards the apex, and two others more towards the base; forks 1, 2, 3, 4 and 5 all present.

Posterior wings shorter than the anterior and about the same breadth; discoidal cell closed; forks 1, 2, 3 and 5 present; fringes short. Legs short; intermediate tibiæ not dilated in the female; anterior tibiæ with two unequal apical spurs; intermediate and posterior tibiæ each with two pairs of long and nearly equal spurs. Abdomen short and slender, more robust in the female. In the male there is a long filamentous process on each side of the abdomen, placed between the fourth and fifth segments; a rather prominent lobe proceeds from the upper margin of the last segment, beneath which is the short penis, thickened at the slightly notched apex; app. sup. apparently wanting; app. inf. long and bisarticulate.

Larva unknown, frequenting streams.

Diplectrona, Westwood=*Aphelocheira*,* Stephens.

The serrated antennæ and short broad form will readily enable the student to identify this genus. The lateral abdominal filaments in the male are very curious, and unique in the Order; they are present in *A. flavomaculata*, Steph., and *A. meridionalis*, Hagen (from Corsica), but are wanting in *A. Ladogensis*, Kol. (from Russia), and in *A. obesa*, Hag. MSS. (from Lapland). The two latter species are much larger and differ in general habit, perhaps forming a new genus.

1. *Diplectrona flavomaculata*, Stephens.

(Pl. VII. fig. 5, neuration; Pl. XIII. fig. 20, app.)

Aphelocheira flavomaculata, Steph. (*) Ill. p. 179, 1 (1836); *ib.* pl. 32, fig. 3 (var.?); M'Lach. Ent. Ann. 1862, p. 36.

Antennæ brown, slightly annulated, the serrations darker. Head thickly clothed with golden-brown hairs. Palpi brown. Mesothorax dark-brown, with brown hairs. Anterior wings greyish-brown, obscurely spotted with yellowish; three rather large dark brown spots towards the anal angle; fork 1 not reaching the transverse vein closing the discoidal cell; fork 2

* The generic name *Aphelocheira*, employed by Stephens, cannot be retained, it having been used by Westwood to designate a genus of *Hemiptera*, in the Magazine of Natural History for 1833, three years prior to the publication of the sixth volume of Stephens' Illustrations (Mandibulata). In his "Generic Synopsis," Westwood changed *Aphelocheira* to *Diplectrona*, and this is the next oldest name. This, however, is not equivalent to *Diplectrona* of Brauer (*Potamaria*, Kolenati), which is allied to—if indeed it be really separable from—*Tinodes*. I cannot admit Kolenati's objection to *Diplectrona*—viz., that the same name had been previously employed in Ornithology

very long, extending to near the middle of the cell; fork 3 short. Posterior wings greyish-black. Legs pale-brownish ochreous. Abdomen fuscous. In the male the lobe from the upper margin of the last segment is somewhat emarginate at the apex; app. inf. with the basal joint long and nearly straight, thickened at the tips, the second joint shorter and thinner, curved inwards and upwards, the tips approximating; penis with a dark shining-brown apex.

Expanse of fore-wings 6—7 lines.

A local insect, appearing in summer and the beginning of autumn. Occurs near Plymouth and Corwood in Devonshire, Hastings and Scarborough; common in Hawthornden, near Roslyn, N. B.

Pictet's name was applied to this insect by Stephens with a mark of interrogation; the *flavomaculatus* of the former author is a *Polycentropus;* it is not probable that the two genera, as now characterized, can be confounded, and it is better to retain Stephens' name than to increase the number of synonyms.

Genus Philopotamus, Leach.

Antennæ stout, slightly shorter than the wings; basal joint swollen, much shorter than the head; the remaining joints short. Head large, convex above, very hairy. Eyes prominent. Ocelli present. Maxillary palpi long; two basal joints short and stout, scarcely longer than broad; third joint longer than the two first together, somewhat flattened; fourth somewhat shorter than the third; fifth nearly as long as the others united. Labial palpi much smaller, two basal joints moderately long, the third nearly as long as the other two united. Mesothorax about as broad as the head, scarcely hairy. Anterior wings short and rather broad, with the tips elliptical, the costal and dorsal margins slightly rounded; hairy clothing short and dense; a transverse vein unites the costa and subcosta before the middle; discoidal cell short, closed; apical forks 1, 2, 3, 4 and 5 all present, 1, 3 and 4 short; an oblique transverse vein unites the upper edge of the discoidal cell to the radius; a straight one unites the lower branch of the inferior fork of the ramus discoidalis to the upper branch of the superior branch of the ramus thyrifer; another closes the cellula thyridii, and two others are placed further towards the base of the wing. Posterior wings almost as long as and nearly similar in form to the anterior; forks 1, 2, 3 and 5 present; discoidal cell closed. Legs long; intermediate tibiæ and tarsi not dilated in the female; anterior tibiæ with two rather long and equal apical spurs; intermediate tibiæ with two pairs of long and unequal spurs; posterior tibiæ with two pairs of long and equal spurs. Abdomen short and stout, especially in the female. From beneath the upper margin of the last segment in the male proceeds a beak-shaped plate, placed over another smaller plate; app. sup. small and almost square; app. inf. very long and bisarticulate, the second joint furcate, with a large upper fork curved at the apex, and a thinner nearly straight lower fork; penis cylindrical, directed downwards. The apex of the abdomen in the female is very obtuse, with two small rounded lateral valves.

Larva inhabiting streams. Head elongate, the sides nearly parallel, somewhat truncated in front. Pronotum short, small, nearly quadrate; this and the head corneous. Meso- and metanota broader, of the same consistency as the abdomen. Legs moderately long. Abdomen tapering behind, without external respiratory filaments; anal crotchets moderately long.

Pupa elongate, the mandibles strongly dentate at the tips (Pl. II. fig. 21); apex of the abdomen furnished with long appendices.

Case an irregular heap of stony fragments.

The pretty insects comprised in this genus attract the attention of the least observant. They are found in great numbers about swiftly-running streams, preferring those of small size with rocky bottoms, such as are found in mountainous districts.

1. *Philopotamus scopulorum*, Stephens.

(Pl. VII. fig. 6, neuration, maxillary palpus, antenna; Pl. XIII. fig. 21, app.)

Philopotamus scopulorum, (Leach, MS.), Steph. (*) Ill. p. 169, 1 (1836); Hag. (*) Stett. Zeit. 1860, p. 277, 2; Ent. Ann. 1861, p. 8, 98; Kol. Gen. et Spec. Trichop. pt. 2, p. 210, 4, pl. 2, fig. 15; *P. variegatus*, Steph. (*) Ill. p. 169, 2 (1836); *P. montanus*, Steph. (*) Ill. p. 170, 3 (1836); *Hydropsyche montana*, Pict. (*) Recherch. p. 210, 12, pl. 18, fig. 5; *Philopotamus tigrinus*, Brauer (*) Neurop. Aust. p. 39 (1857).

Antennæ brown, annulated with yellow. Head black, with golden-yellow hairs. Palpi fuscous. Mesothorax black. Anterior wings brown, thickly spotted with yellow, many of the spots being often confluent; first apical cell (fork 1) reaching as far, or nearly as far, as the transverse vein closing the discoidal cell. Posterior wings blackish-grey, spotted with yellow round the apical margin; veins fuscous. Legs fulvous, the thighs fuscescent. Abdomen black. In the male the dorsal lobe from the last segment is beak-shaped, with a rather broad end; app. sup. small and obtuse; app. inf. large, the basal joint rather shorter than the terminal, the upper portion of the terminal joint with the apex curved downwards and rather broad. In the female the lateral valves are obtuse.

Expanse of fore-wings 9—12 lines.

A common species about small swiftly-flowing streams and rivers, especially in mountain districts; continues all the summer and till late in the autumn.

A nearly allied species is *P. variegatus*, Scopoli, Brauer, which is included in Dr. Hagen's Synopsis (Ent. Ann. 1861, p. 7, 96), but I have not been able to find it either alive or in any of our English collections. It differs from *P. scopulorum* in having the antennæ wholly yellow; the first apical cell is shorter, and the terminal joint of the inferior appendices is narrower and less obtuse.

2. *Philopotamus scoticus*, M'Lachlan.

Philopotamus scoticus, M'Lach. Ent. Ann. 1862, p. 34, fig. 5.

Antennæ brown, annulated with yellow. Head black, clothed with golden-yellow hairs. Palpi fuscous. Mesothorax black. Anterior wings rich yellow, with numerous, more or less confluent, fuscous streaks and blotches; first apical cell not reaching the transverse vein closing the discoidal cell. Posterior wings purplish-fuscous, the costal and dorsal margins narrowly edged with yellow; pterostigma and spots round the apical margin also yellow. Legs ochreous, with fuscescent tibiæ. Abdomen black.

Expanse of fore-wings 11 lines.

I know of only one example, a female, in the collection of the British Museum, from Rannoch, Perthshire. It is possible that it may be only a highly coloured variety of *P. scopulorum*, yet I have seen no specimens clearly intermediate. If it be a species, it is the handsomest in the genus. I did not find it on the occasion of my visit to Rannoch in 1865; *P. scopulorum* was there, but of the ordinary colour, or perhaps rather darker than southern examples.

3. *Philopotamus montanus*, Donovan.

(Pl. II. fig. 7, larva; Pl. XIII. fig. 22, app.)

Phryganea montana, Donov. Brit. Ins. vol. xvi. pl. 548, fig. 1 (1813)?; *Philopotamus montanus*, Brauer (*), Neurop. Aust. p. 39, fig. 25; Hag. (*) Stett. Zeit. 1860, p. 277, 3; Ent.

Ann. 1861, p. 8, 97; Kol. Gen. et Spec. Trichop. pt. 2, p. 209, 3, pl. 2, fig. 14; *Phryganca Charpentieri*, Zett. Ins. Lapp. col. 1068, 35 (1840)?; *Philopotamus variegatus*, Ramb. Hist. Nat. Névrop. p. 502 (1842).

Antennæ dark fuscous, with indistinct pale annulations. Head black, with yellow hairs. Palpi fuscous. Mesothorax black. Anterior wings dark brown, thickly spotted with yellow; first apical cell reaching nearly as far as the transverse vein closing the discoidal cell. Posterior wings smoky-grey, with an indistinct yellowish spot at the pterostigma. Legs fulvous, darker externally. Abdomen black. In the male the upper arm of the terminal joint of the inferior appendices is curved stongly upwards, and rather broad and obtuse; the lower branch straight as in the other species.

Expanse of fore-wings 11—14 lines.

As British this species rests on the authority of three or four examples in the British Museum from Dr. Leach's Collection. Stephens' insect of this name is only *scopulorum*, and that of Donovan, although the name has been adopted both by Drs. Brauer and Hagen, seems to me to be more than doubtful.

The form of the inferior appendices in the male readily separates this from all others.

With respect to the comparative length of the first apical cell in the anterior wings, I find that in several Continental examples in my collection, it is quite as long in *montanus* as in *scopulorum*.

Genus Wormaldia (new genus).

Antennæ stout, shorter than the wings; the basal joint swollen, shorter than the head. Head moderately large, rather hairy. Ocelli present. Maxillary palpi long; the two first joints short, stouter than the rest, the second joint the shorter; third joint very long; fourth short, scarcely longer than the second; fifth about as long as the third. Labial palpi small, with two moderately long basal joints and a very long terminal one. Mesothorax short and broad. Anterior wings moderately broad, with a broadly elliptical apex; hairy clothing short and dense; a transverse vein unites the costa and subcosta before the middle; discoidal cell closed, rather elongate; two transverse veins nearly in a line below the discoidal cell, and two others placed towards the base; forks 1, 2, 3 and 5 present. Posterior wings shorter than the anterior, but nearly similar in shape; discoidal cell closed; forks 1, 2, 3 and 5 present. Legs long; intermediate tibiæ and tarsi not dilated in the female; anterior tibiæ with two moderately long and equal apical spurs; intermediate and posterior tibiæ each with two pairs of long unequal spurs. Abdomen short. The second joint of the inferior appendices in the male is simple. In the female the abdomen ends in a long compressed ovipositor.

Larva unknown, frequenting swiftly-running streams.

This genus I have named after Mr. P. C. Wormald, one of the few Entomologists who have paid attention to the *Trichoptera*. It is allied to *Philopotamus*, but differs in the form of the palpi and in the neuration of the wings, as was pointed out by Dr. Hagen in the Stettin "Entomologische Zeitung" for 1860, p. 279. The species are small and unicolorous.

1. *Wormaldia occipitalis*, Pictet

(Pl. VII. fig. 7, neuration and maxillary palpus; Pl. XIII. fig. 23, app.)

Hydropsyche occipitalis, Pict. (*) Recherch. p. 211, 14, pl. 19, fig. 8 (1834); *Philopotamus occipitalis*, Hag. (*) Stett. Zeit. 1860, p. 279; M'Lach. Ent. Ann. 1863, p. 135; *Aphelocheira subaurata*, Steph. (*) Ill. p. 180, 2 (1836); *Philopotamus longipennis*, Brauer, Neurop. Aust. p. 39 (1857); *P. Ramburii*, Kol. Gen. et Spec. Trichop. pt. 2, p. 207, 1 (1859); *Hydropsyche brevicornis*, Pict. Recherch. p. 211, 13, pl. 19, fig. 7 (1834)?

Antennæ brown, annulated with yellow. Head fuscous, clothed with yellowish hairs. Palpi fuscous. Mesothorax shining brown. Anterior wings yellowish-grey, the veins towards the base clothed with long yellow hairs. Posterior wings subhyaline, smoky-grey. Legs ochreous. Abdomen greyish-fuscous above, paler beneath. In the male the upper margin of the last abdominal segment is rounded off, slightly excised; app. sup. small, blackish; app. inf. long, testaceous, the apical joint rather broad and obtuse at the tip; penis-cover (or penis?) somewhat pointed, yellowish. The ovipositor of the female is long and yellowish.

Expanse of fore-wings 6—7 lines.

Not an uncommon species about swiftly-running streams, especially in the North and West of England. Stephens gives the metropolitan district as a locality, but I have not seen recent specimens from thence. It decidedly prefers mountainous districts, appearing in summer and autumn.

2. *Wormaldia subnigra*, M'Lachlan.
(Pl. XIII. figs. 24, 25, app.)

Philopotamus columbina, Hag. (*) Stett. Zeit. 1860, p. 279.

Antennæ brown, annulated with yellow. Head black, with yellowish hairs. Palpi blackish-fuscous. Mesothorax blackish-fuscous. Anterior wings dark brownish-black, with long blackish hairs on the basal veins. Posterior wings dark smoky-grey, sub-hyaline. Legs dark brownish-testaceous. Abdomen dull black. In the male the upper margin of the last abdominal segment is deeply notched in the middle; app. inf. with the basal joint fuscous, the apical joint somewhat testaceous, rather more acute at the tips than in the last species. The ovipositor of the female is fuscous at the base, testaceous at the apex.

Expanse of fore-wings $5\frac{1}{2}$—6 lines.

Has been taken by Mr. Wormald in North Wales in the autumn, and by Mr. Parfitt and myself in Devonshire at the end of summer.

May be separated from the last species by its generally darker colour, and especially by the notch in the upper margin of the last abdominal segment in the male.

Dr. Hagen informs me that *columbina* of Pictet is a small true *Philopotamus*.

Genus Plectrocnemia, Stephens.

Antennæ rather stout, placed close together at their bases; basal joint rather stouter and longer than the others. Head hairy, nearly quadrate. Ocelli wanting. Maxillary palpi very long; two basal joints very short and stouter than the others; third long; fourth rather shorter; fifth as long as the others united, very slender. Labial palpi small, with a long terminal joint. Prothorax distinct. Mesothorax short and robust. Anterior wings narrow at the base, much dilated before the elliptical apex; hairy clothing short and rather dense; a transverse vein unites the costa and subcosta near the middle; discoidal cell closed, long and narrow, its upper edge united to the radius by an oblique transverse vein; forks 1, 2, 3, 4 and 5 all present, fork 1 very short; two transverse veins towards the apex below the discoidal cell, another in the middle of the wing, and perhaps others near the base. Posterior wings folded, broader than the anterior, anal portion well developed, the apex broadly rounded; discoidal cell short, closed, united to the radius by a transverse vein, and with two others below it; forks 1, 2 and 5 present; fringes short.

Legs long, the intermediate tibiæ and tarsi not dilated in the female; anterior tibiæ with one long median and two long apical spurs; intermediate and posterior tibiæ each with two pairs of long unequal spurs. Abdomen short and thin. In the male there is a short lobe from the upper margin of the last segment, beneath which lies a penis-cover; app. sup. small and broad; app. inf. long and pointed.

Larva inhabiting streams; elongate. Pronotum very small and transverse. Legs moderately long. Abdomen without external respiratory filaments, but fringed with hairs; anal crotchets very long.

Pupa furnished with external respiratory filaments, one placed on each side of each segment.

Case a heap of small stones lightly held together. A firmer case is constructed when the larva is about to change to a pupa.

1. ***Plectrocnemia conspersa***, Curtis. (Pl. VII. fig. 8, neuration.)
   Philopotamus conspersus, Curt. (*) Phil. Mag. p. 213, 5 (1834); *Plectrocnemia conspersa*, Hag. (*) Ent. Ann. 1861, p. 2, 87; M'Lach. Ent. Mo. Mag. vol. i. p. 26; ***Hydropsyche senex***, Pict. (*) Recherch. p. 219, 28, pl. 19, fig. 1 (1834); ***Plectrocnemia senex***, Steph. (*) Ill. p. 168, 1; Brauer, Neurop. Aust. p. 39.

Antennæ brown, annulated with yellow. Head fuscous in fresh specimens, with a tuft of silvery hairs between the antennæ. Palpi testaceous. Prothorax clothed with pale yellowish-white hairs in the middle and with blackish hairs on each side. Mesothorax brown. Anterior wings ashy-grey, with fuscous markings forming irregular oblique streaks and reticulations; apical margin regularly spotted with fuscous; fringes yellowish. Posterior wings pale grey, with darker veins, most conspicuous at the apex; fringes pale grey. Legs testaceous. Abdomen fuscous above, paler beneath. In the male there is a short obtuse lobe from the middle of the upper margin of the last segment; beneath this is a longer and rather pointed upper penis-cover; app. sup. broad, oval and hairy; app. intermed. lying inside the app. sup., small and crooked at the tips; app. inf. long and hairy, placed close together at the base, gradually decreasing in size towards the prolonged apex, which is strongly directed upwards. In the female the apex of the abdomen is blunt, with two small valves.

Expanse of fore-wings 9—12 lines.

Larva with the head fawn-coloured, with black points forming a circle in the middle. Pronotum small and short, also fawn-coloured. Meso- and meta-nota and abdomen fawn-coloured, tinged with rose; the abdominal segments marked with longitudinal sinuose impressions; the last segment with a short base and two long pedicels terminated by simple hooks. Feet fawn-coloured. (Pictet.)

A widely spread but not common insect, frequenting the neighbourhood of streams in summer and autumn.

Genus Polycentropus, Curtis.

Antennæ stout, not so long as the wings; basal joint rather thicker and longer than the others. Head hairy. Ocelli absent. Maxillary palpi long; the two basal joints short; the third long; the fourth about half the length of the third; the fifth nearly as long as the others united. Mesothorax robust. Anterior wings rather short, narrower at the base, dilated and obliquely rounded at the apex; hairy clothing short and dense; the neuration almost entirely similar to *Plectrocnemia*. Posterior wings folded, shorter and broader than the anterior, the costal margin slightly concave; anal portion well developed; fringes short; discoidal cell closed or open; forks 1, 2 and 5 present, or 2 and 5 only. Legs moderately long; intermediate tibiæ and tarsi strongly dilated in the female; anterior tibiæ with one rather short median and two smaller and equal apical spurs; intermediate and posterior tibiæ each with two pairs of rather long and unequal spurs. Abdomen short, somewhat robust. The appendices are complicated and vary according to the species.

Larva inhabiting standing and running waters; similar in form to *Plectrocnemia;* living under and on stones, and drawing together *débris* with light silken threads; several larvæ often live under one common covering. When about to metamorphose a case of stones is constructed.

In the "Entomologist's Monthly Magazine," vol. i. pp. 25—31, I have given a *resumé* of the British genera and species of *Hydropsychidæ* with tricalcarate anterior tibiæ; the generic characters being principally based on differences of neuration. As therein stated, the species of this genus divide themselves naturally into two sections, which some may even feel disposed to consider distinct genera.

A. *In the posterior wings, discoidal cell open, forks* 1, 2 *and* 5 *present; two first costulæ united near the middle by a short transverse vein.*

1. *Polycentropus flavomaculatus*, Pictet.

(Pl. VIII. fig. 1, neuration; Pl. XIII. figs. 26, 27, app.)

Hydropsyche flavomaculatus, Pict. Recherch. p. 220, 29, pl. 19, fig. 2 (1834); *Polycentropus flavomaculatus*, M'Lach. Ent. Mo. Mag. vol. i. p. 27; *P. irroratus*, Curt. (*) Brit. Ent. p. 554 (1835); Steph. (*) Ill. p. 178, 7; Hag. (*) Ent. Ann. 1861, p. 3, 88; *P. pyrrhoceras*, Steph. (*) Ill. p. 177, 3 (1836); *P. fuliginosus*, Steph. (*) Ill. p. 177, 4 (1836); *P. concinnus*, Steph. (*) Ill. p. 178, 5 (1836); *P. trimaculatus*, Steph. (*) Ill. p. 178, 6 (1836); *P. subpunctatus*, Steph. (*) Ill. p. 177, 1 (1836), part.

Antennæ brown, annulated with yellowish. Head fuscous, clothed with pale golden-yellow hair. Palpi fuscous. Mesothorax dark blackish-fuscous. Anterior wings fuscous, with numerous small golden-yellow spots; some of these on the costal margin are rather larger than the others; apical margin regularly spotted. Posterior wings smoky-grey, with greyish fringes. Legs testaceous, the thighs fuscescent. Abdomen blackish-fuscous, paler beneath. In the male there is a broad membranous lobe from the middle of the upper margin of the last segment, the apex of which is somewhat dilated, truncated and excised; from beneath this lobe proceed the app. intermed., which are somewhat claw-shaped, and widely divergent; app. sup. small, broad and very obtuse; app. inf. large, slightly concave and broadly rounded at the apex.

Expanse of fore-wings, ♂ 7 lines, ♀ 9 lines.

A common species, frequenting streams, appearing at the end of spring, and continuing all the summer. It is very abundant in the metropolitan district.

2. *Polycentropus multiguttatus*, Curtis. (Pl. XIII. fig. 28, app.)

Polycentropus multiguttatus, Curt. (*) Brit. Ent. p. 544 (1835)?; Hag (*) Ent. Ann. 1861, p. 4, 89; M'Lach. Ent. Mo. Mag. vol. i. p. 27; *Plectrocnemia irrorata*, Brauer (*), Neurop. Aust. p. 40 (1857); *P. atomaria*, Kol. Gen. et Spec. Trichop. pt. 2, p. 212, pl. 1, figs. 10, 11 (1859).

Antennæ brown, annulated with yellow. Head fuscous, with pale golden-yellow hairs. Palpi dark testaceous. Mesothorax dark fuscous. Anterior wings fuscous, thickly sprinkled with golden-yellow spots; some of these on the costal margin are larger than the others, and alternate with large spaces of the dark ground colour; apical margin regularly spotted. Posterior wings smoky-grey, with dark grey fringes. Legs brownish-testaceous. Abdomen dark fuscous, paler beneath. The lobe from the upper margin of the last abdominal segment in the male more pointed than in *flavomaculatus;* the app. intermed. very sharply elbowed in the middle, the apical half directed outwards horizontally at nearly right angles; app. sup. long and pale yellow, the tips acute and suddenly incurved; app. inf. very similar to those of *flavomaculatus.*

Expanse of fore-wings, ♂ 7—8 lines, ♀ 9—10 lines.

This species is very likely overlooked. I possess four or five examples from various localities, one of which is Haslemere. It may readily be separated from the last by the form of the app. sup.; in size it is somewhat larger, and rather paler in colour.

I do not feel certain that this is *P. multiguttatus* of Curtis, as I noted that the species of this name in Curtis' cabinet was identical with *Cyrnus trimaculatus* (p. 149), but this may have been an error. The citation of Brauer's name is from a specimen from Zeller's Collection named by Brauer himself. Kolenati's name is given on the authority of a specimen sent by him to Dr. Hagen.

B. *In the posterior wings, discoidal cell closed, only forks 2 and 5 present; two first costulæ not united by a transverse vein.*

3. ***Polycentropus subnebulosus***, M'Lachlan.

(Pl. VIII. fig. 2, neuration; Pl. XIV. fig. 1, app.)

Polycentropus subnebulosus, Steph. (*) Cat. p. 317, 3598 (1829); M'Lach. Ent. Mo. Mag. i. 28 (1864); *P. multiguttatus*, Steph. (*) Ill. p. 178, 8, part (1836), not of Curtis; *P. pyrrhoceras*, Hag. (*) Ent. Ann. 1861, p. 4, 90 (not of Steph.).

Antennæ brown, annulated with yellow. Head fuscous, with greyish-yellow hairs. Palpi fuscous. Mesothorax dark fuscous. Anterior wings fuscous, thickly but not very conspicuously irrorated with pale yellow; slightly worn examples appear entirely pale fuscous; some long dark spaces of the ground-colour on the costal margin. Posterior wings smoky-grey. Legs externally fuscous, internally ochreous. Abdomen fuscous, paler beneath. In the male the lobe from the upper margin of the last abdominal segment is very long and narrow, the app. intermed. lying close on each side of it, and bent under at the tips in a haustellate form; app. sup. rather small, yellow, the tips slightly narrowed and bent downwards; app. inf. brown, small and nearly quadrate.

Expanse of fore-wings, ♂ 7 lines.

A common species near Haslemere in Surrey, and I have also seen specimens from the Fen district, Kew and Dorsetshire. Like the last, it is probably overlooked. I believe it frequents standing waters.

The extraordinary form of the lobe and of the app. intermed. render the discrimination of this species easy.

The female is unknown to me, unless it be the next following.

4. *Polycentropus Parfitti*, n. sp.

Antennæ brown, annulated with yellow. Head blackish-fuscous, thickly clothed with golden-yellow pubescence. Palpi fuscous. Mesothorax dark blackish-fuscous. Anterior wings pale greyish-brown, very thickly and evenly irrorated with small golden-yellow spots of uniform size; apical margin regularly spotted with yellow; costal fringe blackish, apical fringe dark grey. Posterior wings greyish, subhyaline; costal fringes dark blackish-grey, the rest pale grey; subcostal vein yellowish. Abdomen dark blackish-fuscous, the incisions of the segments somewhat paler, especially beneath; the appendices yellow. Above there is a semicircular piece, forming a nearly complete tube; below this on the middle of the lateral margin is a small shining obtuse piece, curved inwards; below this again is an obtuse app. inf.

Expanse of fore-wings 8—9 lines.

Of this I have seen but two examples, taken at Taunton by Mr. Parfitt, on the 20th June, 1860.

I am unable to decide whether these dry specimens are males or females. At any rate, they are totally different from anything with which I am acquainted; and I hope, by an examination of fresh examples, to decide both the sex and the stability of the species. Supposing that they are females, the only known species to which they can be referred is *P. subnebulosus*, of which I have seen males only; nevertheless, that species is not in Mr. Parfitt's Collection, and the insects here described hardly agree with it in ornamentation, though apparently identical in neuration.

5. *Polycentropus picicornis*, Stephens. (Pl. XIV. fig. 2, app.)

Polycentropus picicornis, Steph. (*) Ill. p. 177, 2 (1836); M'Lach. Ent. Mo. Mag. vol. i. p. 28; *Cyrnus pulchellus*, Steph. (*) Ill. p. 175, 2, part (1836); *Polycentropus pulchellus*, Hag. (*) Ent. Ann. 1861, p. 5, 92.

Antennæ very dark fuscous, narrowly annulated with yellow; paler in the female. Head dark fuscous, with rich golden-yellow hair. Palpi fuscous. Mesothorax dark fuscous, nearly black.

Anterior wings dark fuscous, with numerous small rich golden spots with a reddish tinge; on the costal margin, large spaces of the ground colour and conspicuous golden spots alternate. Posterior wings dark blackish-grey. Legs brown, darker externally. Abdomen dark blackish-fuscous, scarcely paler beneath. In the male the lobe from the upper margin of the last segment (during life) is broad, with a truncated and emarginate apex, appearing more pointed in dry specimens; app. sup. small and somewhat triangular; app. inf. larger, rather broad and directed upwards.

Varies in the number and intensity of the golden spots; in some examples the anterior wings appear entirely golden-yellow, and sometimes in fresh examples of the female the wings are entirely fuscous.

Expanse of fore-wings, ♂ 6—6½ lines, ♀ 7—8 lines.

A common species about standing waters, appearing in summer. It is wonderfully active, and runs with facility on the surface of the water.

Without doubt more species of this genus (as here restricted) will be found in this country.

Genus Cyrnus, Stephens.

Antennæ not so long as the wings, basal joint but little longer or stouter than the others. Head very hairy. Ocelli absent. Palpi the same as in *Polycentropus*. Mesothorax robust. Anterior wings rather narrow, especially at the base, but slightly dilated before the rounded apex; hairy clothing short and dense, but easily removed; neuration somewhat like that of *Polycentropus*, but only the forks 2, 3, 4 and 5 present. Posterior wings slightly folded, shorter and rather broader than the anterior; costal margin slightly concave; anal portion angular, scarcely developed; no discoidal cell; forks 2 and 5 present. Legs moderately long; intermediate tibiæ and tarsi dilated in the female; anterior tibiæ with one median and two equal apical spurs; intermediate and posterior tibiæ each with two pairs of long unequal spurs. Abdomen slender. In the male there is usually a short lobe from the upper margin of the last segment; app. sup. small; app. inf. large, with broad apices; sometimes there are straight app. intermed. In the female there are small, but rather prominent, lateral valves.

Larva unknown; inhabiting standing and slowly-flowing waters.

The more slender form and the differences in the neuration will readily separate these insects from *Polycentropus*, which they otherwise greatly resemble.

1. *Cyrnus trimaculatus*, Curtis.

(Pl. VIII. fig. 3, neuration; Pl. XIV. fig. 3, app.)

Philopotamus trimaculatus, Curt. (*) Phil. Mag. p. 213, 4 (1834); *Polycentropus trimaculatus*, Hag. (*) Ent. Ann. 1861, p. 4, 91; *Cyrnus trimaculatus*, M'Lach. Ent. Mo. Mag. vol. i. p. 29; *C. unipunctatus*, Steph. (*) Ill. p. 175, 1 (1836); *C. pulchellus*, Steph. (*) Ill. p. 175, 2, part (1836).

Antennæ brown, with yellowish annulations. Head fuscous, clothed with greyish-yellow hairs. Palpi brownish-ochreous. Mesothorax fuscous. Anterior wings fuscous, rather thickly irrorated with very small golden-yellow spots, of which two or three at the anal angle are rather larger than the rest, and alternate with spaces of the dark ground colour; upper margin of the discoidal cell rather angulated at the point where the transverse vein unites it to the radius; cellula thyridii short, the transverse vein closing it placed almost in a line with that closing the discoidal cell. Posterior wings smoky-grey, with concolorous fringes. Legs ochreous, posterior tibiæ and tarsi somewhat darker. Abdomen brown, scarcely paler beneath. The lobe from the middle of the upper margin of the last segment in the male is very short; app. intermed. short and straight; app. sup. very small; app. inf. large, short and broad, yellow, concave within, the apex almost truncated. In the female there are two short lateral valves.

Expanse of fore-wings, ♂ 5—6 lines, ♀ 7—8 lines.

A common species in summer and autumn about canals, marshy dikes, slowly-flowing rivers, &c.

2. *Cyrnus flavidus*, M'Lachlan. (Pl. XIV. fig. 4, app.)

Cyrnus flavidus, M'Lach. Ent. Mo. Mag. i. 29 (1864).

Antennæ very pale brown, with yellowish annulations. Head pale brown, with yellow hairs. Palpi pale brownish-ochreous. Anterior wings narrow, pale yellow, rather thickly but indistinctly reticulated with pale greyish-fuscous; apex regularly spotted with pale fuscous; discoidal cell not angulated; cellula thyridii rather long, the transverse vein closing it placed much further towards the apex than the one closing the discoidal cell. Legs pale yellow. Abdomen brown above, ochreous beneath. In the male the lobe from the upper margin of the last segment is small and rounded; app. intermed. absent; app. sup. larger than in the last species, obtuse at the apex; app. inf. larger, somewhat concave internally, the apex very obtuse, but more rounded than in *C. trimaculatus*.

Expanse of fore-wings 6—8 lines.

The only locality that I know to produce this species is the remnant of the Croydon Canal at Forest Hill, Kent, where it occurs in May and June. As this locality will probably be shortly destroyed, it is to be hoped that the species will be found elsewhere.

It is allied to *Philopotamus urbanus*, Ramb., but appears to be distinct. Dr. Hagen, who possesses the type of *urbanus*, says that it differs from *flavidus* in that the anterior wings are almost entirely pale without darker markings, and has some slight differences in the comparative length of the forks. Moreover, it possesses evident fringes on the anterior wings, and rather long ones on the posterior. In *C. flavidus* the anterior wings have scarcely any evident fringes, and those on the posterior are very short. *Plectrocnemia aurata* of Kolenati is also apparently an allied species, yet the neuration, according to the figure, seems to possess fork 1 in the anterior wings, which, if correct, will preclude its being placed in *Cyrnus*.

Genus Ecnomus, M'Lachlan.

Antennæ much shorter than the wings, the basal joint scarcely longer or stronger than the others. Head hairy. Ocelli absent. Maxillary palpi with two rather short and equal basal joints; two following scarcely longer and somewhat dilated; fifth as long as the others united. Mesothorax short and robust. Anterior wings long and very narrow, very slightly dilated before the elliptical apex; hairy clothing short and dense; a transverse vein unites the costa and subcosta near the middle; the radius and subcosta unite beyond the middle, but divide again before their termination; discoidal cell closed, short and broad; forks 1, 2, 3, 4 and 5 present, No. 1 very short; four transverse veins towards the apex, and one towards the base. Posterior wings scarcely folded, very narrow at the base, but considerably dilated before the very obtuse apex; costal margin slightly elevated in the middle, somewhat excised towards the apex; anal portion not developed; forks 2 and 5 only present; one transverse vein, uniting the ramus discoidalis and ramus thyrifer; no discoidal cell. Legs long; intermediate tibiæ very slightly dilated in the female; anterior tibiæ with one very short median and two moderately long apical spurs; intermediate and posterior tibiæ each with two pairs of long and unequal spurs. Abdomen rather slender. In the male the only visible appendices are the inferior, which are largely developed; between these on the ventral surface arise two long curved sheaths.

Larva unknown; inhabits standing waters.

The long narrow form, the structure of the hind wings, the somewhat differently formed palpi, the character of the appendices, and the general *facies* of the insect, all prove the necessity for placing it in a genus apart. At present only one species is known.

1. *Ecnomus tenellus*, Rambur.

(Pl. VIII. fig. 4, neuration and maxillary palpus; Pl. XIV. fig. 5, app.)

Philopotamus tenellus, Ramb. Hist. Nat. Névrop. p. 503, 4 (1842); *Ecnomus tenellus*, M'Lach. Ent. Mo. Mag. vol. i. p. 30; *Polycentropus concinnus*, Hag. (*) Ent. Ann. 1861, p. 5, 93.

Antennæ yellow, narrowly annulated with brown. Head thickly clothed with greyish-yellow hairs. Palpi yellowish, slightly brownish externally. Anterior wings pale-greyish, very thickly irrorated with pale-golden spots, most of which are more or less confluent; a rather large dark spot at the pterostigma, and similar but smaller spots placed regularly along the costal and apical and part of the dorsal margins; fringes grey, mixed with pale yellow. Posterior wings pale grey, with long greyish-yellow fringes. Legs pale ochreous, the anterior and intermediate tarsi annulated with brown; the anterior tibiæ have also a brown apical ring. Abdomen brown, the apical segments and appendices yellowish. In the male the upper margin of the last abdominal segment is much produced; the app. inf. very long, the tips incurved and furnished internally with small black teeth; below and between the app. inf. are two long upcurved appendices which I consider to be properly the penis-sheaths, though they may be called app. intermed.

Expanse of fore-wings 6—7 lines.

This has been taken in the Fen district by Mr. Winter, and also in Hyde Park in June by Mr. Wormald. It is not contained in Stephens' or Curtis' Collections.

Genus Neureclipsis, M'Lachlan.

Antennæ rather stout, shorter than the wings, the basal joint scarcely longer or thicker than the others. Head very hairy. Ocelli absent. Maxillary palpi with two very short basal joints; third rather long and dilated; fourth shorter than the third and also dilated; fifth about as long as the two preceding joints united.

Labial palpi very small; two basal joints rather elongate and flattened; third about as long as the others united. Mesothorax short and robust. Anterior wings narrow at the base, rather dilated towards the elliptical apex; hairy clothing short and dense; no transverse vein uniting the costa and subcosta near the middle; discoidal cell elongate, closed, a transverse vein unites the upper margin with the radius, another unites the lower margin with the cellula thyridii, another closes this cell, and a fourth unites the base of this with the inferior branch of the ramus thyrifer; forks 1, 2, 3, 4 and 5 all present. Posterior wings folded, shorter and broader than the anterior; costal margin nearly straight; discoidal cell closed, two transverse veins below it; forks 1, 2, 3 and 5 all present. Legs rather long; intermediate tibiæ and tarsi slightly dilated in the female; anterior tibiæ with one very short median and two longer apical spurs; intermediate and posterior tibiæ each with two pairs of long and unequal spurs. Abdomen short. In the male a long lobe proceeds from under the upper margin of the last segment; app. sup. very small; app. inf. large and elongate.

Larva unknown, inhabiting standing and slowly-flowing waters.

The absence of the transverse vein uniting the costa and subcosta in the anterior wings, and the presence of fork 3 in the posterior, readily separate this from all the other genera with tricalcarate anterior tibiæ.

1. *Neureclipsis bimaculata*, Linné.

(Pl. VIII. fig. 5, neuration and maxillary palpus; Pl. XIV. fig. 6, app.)

Phryganea bimaculata, Linn. Faun. Suec. n. 1487 (1761), and other works; *Polycentropus bimaculatus*, Hag. (*) Ent. Ann. 1861, p. 6, 95; Kol. Gen. et Spec. Trichop. pt. 2, p. 215, pl. 1, fig. 6; *Neureclipsis bimaculata*, M'Lach. Ent. Mo. Mag. vol. i. p. 31; *Phryganea Tigurinensis*, Fab. Ent. Syst. Suppl. p. 201, 18—19 (1798); *Anticyra robusta*, Walk. (*) Brit. Mus. Cat. p. 122, 5 (1852).

Antennæ brown annulated with yellow, paler in the female. Head fuscous with greyish hairs. Palpi yellow; the two terminal joints fuscescent. Mesothorax dark blackish-fuscous. Anterior wings smoky-grey, the hairy clothing varied with pale yellow, especially towards the base; a little beyond the middle there is a large irregularly formed pale yellow spot on the disc, and beyond this and sometimes connected with it, a similarly coloured semilunate spot more towards the costa; fringes pale yellowish; in the female these wings are much paler and the yellowish spots are indistinct. Posterior wings smoky-grey with concolorous fringes. Legs greyish-ochreous, paler in the female. Abdomen dark blackish-fuscous, slightly paler beneath. In the male there is a long straight narrow yellow lobe from the upper margin of the last segment, the apex of which is truncated; app. sup. very small; app. inf. very long, yellow, cylindrical, the tips approximating.

Expanse of fore-wings, ♂ 6—7 lines, ♀ 9—10 lines.

A common species in many localities, frequenting canals and slowly-flowing rivers. In Ireland it is abundant near Dublin and also at Killarney. It is wanting among the Stephensian types, but exists in Curtis' Collection under the MS. name of *memorabilis.* This insect is very widely distributed, Dr. Hagen having even received it from the Slave Lake in North America.

Fam. RHYACOPHILIDÆ.

Antennæ moderately stout, as long as, or shorter than, the wings; ocelli generally present; maxillary palpi alike in the sexes, scarcely hairy (except in *Beræa*), the last joint usually cylindrical; anterior wings usually with but slight hairy clothing, broad and dilated towards the apex; posterior wings generally broad and folded; legs nearly spineless, but furnished with long spurs, varying in number in the different genera.

Larva elongate, decreasing in size at the extremities; head and pronotum corneous; mesonotum and metanotum of the same consistency as the abdomen; legs short; first abdominal segment without protuberances, terminal segment provided with long anal hooks; respiratory filaments arranged in tufts, or these filaments are entirely absent externally.

Pupa elongate; mandibles internally dentate; abdomen not fringed at the sides, without external respiratory filaments. It is contained in an oval cocoon within the case, the cocoon being composed of a gelatinous material which hardens into a tough membrane.

Case a fixed heap of small angular stones placed beneath a large stone. The larvæ live almost free beneath stones, retiring into the cases on the approach of danger and when about to assume the pupa state.

Most of the genera frequent swift streams.

The following is a tabular arrangement of the British genera :—

Spurs 3-4-4	*Rhyacophila.*
Spurs 2-4-4	*Agapetus* and *Glossosoma.*
Spurs 2-2-4	*Beræa.*
Spurs 0-4-4 (♂), 1-4-4 (♀) . .	*Chimarra.*

Genus Rhyacophila, Pictet.

Antennæ rather shorter than the wings ; basal joint thick, shorter than the head. Head nearly quadrate. Ocelli present. Maxillary palpi with the first two joints very short and nearly globular, the others cylindrical and nearly equal, the third slightly the longest. Labial palpi with two broad and dilated basal joints and a somewhat longer and thinner cylindrical terminal joint. Mesothorax short and robust. Anterior wings narrow at the base, dilated towards the elliptical apex ; costal margin somewhat rounded ; hairy clothing very slight ; neuration strong and distinct ; an oblique transverse vein uniting the costa and subcosta near the middle ; radius slightly bent before its termination ; discoidal cell open (in all the wings) ; a straight transverse vein uniting the lower branch of the ramus discoidalis to the upper branch of the ramus thyrifer, and an oblique one, placed more posteriorly, uniting the two branches of the ramus thyrifer. Posterior wings similar in form to the anterior, but somewhat shorter. Legs long, anterior tibiæ with one median and two long equal apical spurs ; intermediate and posterior tibiæ each with two pairs of long and nearly equal spurs. Abdomen slender in the male, robust in the female. In the antepenultimate ventral segment in the male there is a small pointed tubercle ; the upper margin of the last abdominal segment is produced into a lobe varying according to the species, sometimes very long ; app. sup. small, lying under this lobe and often concealed by it ; app. inf. very long and bisarticulate ; penis long, furnished with two valves and with long needle-shaped sheaths on either side. In the female the extremity of the abdomen is obtuse ; at the apex are seen two somewhat hairy valves fitting round a short thick tubular piece, from the interior of which the small ovipositor can be exserted at will.

Larva inhabiting swiftly-running streams ; elongate, flattened ; head and first thoracic segment small and corneous (see Pl. II. fig. 16) ; mandibles simple ; two last thoracic segments and the abdomen soft ; legs short and thick ; abdominal segments broadly transverse, each (and also the two last thoracic segments) provided with a large tuft of respiratory filaments on each side ; anal crotchets very long and claw-shaped.

Pupa long and narrow, with small head and prothorax; mandibles externally provided with one large, and several smaller teeth (see Pl. II. fig. 22); abdomen without respiratory filaments or fringes. These pupæ shortly before they assume the perfect state are very active when taken out of the cases. I have seen one walk across an ordinary-sized round table, and use every endeavour to escape. In the pupæ of the males the anal appendices are highly developed, so much so that it is often possible by this means to identify the species to which they belong.

Case an oval heap of stones into which the larva occasionally retires; the cocoon of the pupa is long and brown.

We possess four recorded species of this numerous genus, three of which are recent discoveries. There can be no doubt that more will yet be found, especially in the mountain districts of Scotland and Ireland.

A. *Terminal joint of the inferior appendices in the male not cleft.*

1. *Rhyacophila dorsalis*, Curtis.

(Pl. II. fig. 9, larva and pupa; Pl. XIV. figs. 7, 8, app.)

Philopotamus dorsalis, Curt. (*) Phil. Mag. p. 213, 6 (1834); *Rhyacophila dorsalis*, Hag. (*) Stett. Zeit. 1859, p. 153, 1; Ent. Ann. 1860, p. 79, 78; *Philopotamus longipennis*, Curt. (*) Phil. Mag. p. 213, 6 *b* (1834); *Rhyacophila vulgaris*, Steph. (*) Ill. p. 165, 1 (1836); *Crunophila vulgaris*, Kol. Gen. et Spec. Trichop. pt. 2, p. 196, 3, pl. 1, fig. 3?; *Rhyacophila stigma*, Steph. (*) Ill. p. 166, 2 (1836); *R. opaca*, Steph. (*) Ill. p. 166, 3 (1836).

Antennæ brown, with paler annulations. Head and thorax dark reddish-brown. Palpi brown. Anterior wings greyish-brown, thickly irrorated with small pale-yellowish spots, many of which are confluent; a large rhombic whitish spot, with darker irrorations, is placed about the middle of the dorsal margin in each wing, and when the wings are closed, these spots meet and form one very conspicuous dorsal blotch; between this spot and the base are one or two longitudinal fuscous streaks; apical margin spotted with greyish; pterostigma slightly darker; veins brown; the female is always darker, with the paler irrorations and dorsal spot less conspicuous; the coloration varies very much in different individuals. Posterior wings greyish, subhyaline, with a brownish pterostigmatic mark. Legs testaceous. Abdomen dark brown above, ochreous beneath. In the male the lobe from the upper margin of the last segment is very long and narrow, band-like, with a dilated truncated apex; app. sup. flat and short, placed on each side of the lobe, and I am not certain but that these appendices have a moveable piece attached, concealed under the lobe; app. inf. very long, the basal joint longest, the terminal joint notched a little before the obtuse apex on the upper edge; sheaths usually curved strongly downwards; penis nearly cylindrical. In the female the valves are large and somewhat hairy, the truncated apical margins slightly excised.

Expanse of fore-wings 10—13 lines.

Larva with the head yellowish, with a blackish marking in front on each side before the eyes; an assemblage of brown spots on the middle of the disc forming a stellate marking; hinder edge notched, narrowly dark brown. Pronotum yellowish, broadly margined with brown on the hinder edge. Meso- and meta-nota and abdominal segments dull greenish when alive, the respiratory filaments pinkish. Legs yellowish, with brown spots; anal crotchets yellowish, with blackish lines.

Inhabits clear swiftly-running streams, all over the country; appearing from the end of spring till late in the autumn.

The true *R. vulgaris* of Pictet is very closely allied to this species, but appears to be distinct; nevertheless the characters are by no means striking. In *vulgaris* the penis-sheaths are always curved upwards, and the penis itself is more crooked and provided beneath with a large obtuse tooth or tubercle; but I have seen examples of *dorsalis* in which the sheaths had an upward tendency. *R. vulgaris* probably occurs here, but is overlooked.

2. *Rhyacophila obliterata*, M'Lachlan.

(Pl. I. figs. 8, 8*; Pl. VIII. fig. 6, neuration and palpi; Pl. XIV. fig. 9, app.)

Rhyacophila obliterata, M'Lach. Ent. Ann. 1863, p. 134, fig. 7.

Antennæ brownish, with paler annulations. Head and palpi brown. Mesothorax dark reddish-fuscous. Anterior wings pale yellowish, faintly reticulated with pale grey, and with brownish-grey spots, somewhat arranged in two transverse rows; a large brownish-grey blotch, with well defined edges, placed on the dorsal margin near the base, marks the inner edge of the pale dorsal blotch; a distinct whitish hyaline dot at the thyridium; veins brown; in the female the wings are narrower and pale brown, with indistinct yellowish irrorations, the dot at the thyridium more conspicuous, and the veins darker. Posterior wings subhyaline, faintly yellowish at the apex, and with the ptero-stigma also yellow. Legs testaceous. Abdomen fuscous above, ochreous beneath, with testaceous appendices. In the male the lobe from the middle of the upper margin of the last segment is short and very broad, almost square, but with the corners rounded, concealing the app. sup.; app. inf. very long, first joint shortest and truncated, second joint longer, broad at the base, then suddenly very obliquely excised, the apex much produced and slightly incurved; sheaths very short and straight; penis apparently dilated and notched at the end. In the female the truncated margins of the valves are rather suddenly and deeply notched.

Expanse of fore-wings 12—13 lines.

This species is common along all the mountain torrents of North Wales in September, often at considerable elevations. I have also seen examples from North Devon, Staffordshire and Scarborough.

I believe that the female described in the Ent. Ann. 1863 belonged to *R. dorsalis;* however, I met with undoubted females of *obliterata* (described above) in the autumn of 1863; they are much rarer than the males.

Of the described European species belonging to this section, *R. obliterata* is allied in form to *R. fasciata*, Hagen, of which I possess a continental example. This differs in its decidedly fasciated anterior wings, and in the form of the superior lobe, which is much longer, and does not entirely cover the app. sup.

R. vulgaris, Pict., as before mentioned, is very closely allied to *R. dorsalis*, Curtis. *R. paupera*, Hagen (which I possess from Sweden), is somewhat similar to *dorsalis* but darker, the penis-sheaths straight, the superior lobe narrow, but not dilated at the apex, and not so long as the app. sup. *R. torrentium*, Pict. (=*R. Armeniaca*, Guérin), is the largest of the European species, and differs considerably from the others. *R. ferruginea*, Scopoli, Hagen, somewhat resembles *fasciata* in the form of the appendices, and still more the next following, *R. septentrionis*, with which it may perhaps be identical.

3. *Rhyacophila septentrionis*, n. sp.

Rhyacophila ferruginea, Hag. Stett. Zeit. 1859, p. 133, 4?

Antennæ testaceous, with indistinct paler annulations. Head, palpi and mesothorax pale brown; the former with scattered golden hairs. Anterior wings broad, the apex nearly elliptical, golden-grey, thickly reticulated with dark grey; dark greyish-fuscous spots round the apical margin, one at the termination of each apical sector; the pale dorsal blotch is ill defined, and is indicated by an irregular pale space, scarcely reticulated; a similar but still more indistinct paler space occupies the whole of the lower two-thirds of the apical portion of the wing; neuration fuscous. Posterior wings pale greyish, subhyaline; apical veins darker grey, sometimes margined with grey at their points of insertion in the apical margin. Legs testaceous; the tips of the anterior and intermediate tibiæ externally fuscous; tibial spurs dark brown. Abdomen fuscous, ochreous beneath, testaceous at the apex above, and with testaceous appendices. In the male the superior lobe is short, rather attenuated at the base, but soon greatly dilated, the apical portion being nearly orbicular; app. sup. nearly concealed under the lobe, the external edge rounded, slightly excised in front; app. inf. rather short, the basal joint broad, with the sides parallel, the apical joint scarcely shorter than the basal, and of equal breadth, the apex very obliquely truncated; penis furnished above with a short broad dark chestnut-brown superior cover; lower sheaths bent slightly downwards (their direction varies in dead specimens), dark shining chestnut-brown, clear testaceous at the extreme base.

Expanse of fore-wings $12\frac{1}{2}$ lines.

I took five examples (all males) in the middle of June, 1865, at a little stream running into the sea on the coast of the Firth of Forth, near Longniddry. The discovery was made too late for me to give figures of the appendices.

I have some doubt in announcing this as a new species, since the form of the appendices agrees very well with the figure of those of *R. ferruginea*, sent to me by Dr. Hagen. I submitted an example to that gentleman, and he says that it is larger and darker than his continental types of that species, and may be distinct. *R. ferruginea* is described as "die kleinste Art" of the group (the true genus *Rhyacophila*) to which it belongs.

B. *Terminal joint of the inferior appendices in the male cleft.*

4. *Rhyacophila munda*, M'Lachlan. (Pl. XIV. fig. 10, app.)

Rhyacophila munda, M'Lach. Trans. Ent. Soc. ser. 3, vol. i. p. 309 (1862); Ent. Ann. 1863, p. 135, fig. 6.

Antennæ brown, annulated with yellow. Palpi pale brown. Head and thorax fuscous, with a few golden-yellow hairs. Anterior wings pale golden-brown, with scattered ashy-grey spots and an ashy-grey transverse band before the apex; a silvery-white spot at the thyridium, and another below it; towards the base are some short blackish streaks, the outer ends of which mark the inner edge of the very ill-defined dorsal blotch; apical margin spotted with grey at the terminations of the apical veins; pterostigma yellowish-brown; veins fuscous; the female is smaller, with much narrower wings, pale fuscous, with ashy-grey irrorations, one or two silvery spots below the thyridium, and short blackish streaks near the base. Posterior wings greyish, with a faint yellowish tinge, subhyaline; pterostigma, and the apical veins, brownish. Legs pale testaceous; anterior and intermediate tibiæ with a broad fuscous ring at the apex, the tarsi pale brownish. Abdomen fuscous above, ochreous beneath; appendices testaceous. In the male the lobe from the upper margin of the last segment is very short and truncated, with a straight channel-like depression in the centre, apical margin excised; app. sup. very small, only the broad apices visible; app. inf. with long basal joint, with the apex truncated and the edges turned inwards, apical joint shorter, the apex deeply divided, forming two teeth, of which the lower is the larger and more obtuse, the upper smaller and acute; sheaths very long and curved upwards. In the female the truncated margins of the valves are regularly excised.

Expanse of fore-wings 9—12 lines.

This pretty species occurs commonly in autumn in South Devon along all the streams having their origin on Dartmoor, such as the Meavey, Yealm, Erme, Teign, &c. I have also found it along the River Ceiriog at Chirk, North Wales, and near Bala. Of the female I have seen but two examples.

The other described European species belonging to this section differ considerably from *R. munda*. *R. aurata*, Brauer, possesses a long superior lobe, and widely diverging prongs to the terminal joint of the app. inf. *R. venusta*, Pict. MS. (from Curtis' collection of Pictet's types) is very similar to *aurata* in general appearance, but the prongs of the app. inf., although distant, are nearly parallel;* this species is in the Brit. Mus., taken by Dr. Leach

* The pupa figured by Pictet in his "Recherches," pl. 15, fig. 1^c, evidently belongs to *R. venusta*, and not to *R. vulgaris*, to which he refers it. The same remark applies to the figure of the appendices, pl. 4, fig. 29. In the explanation of the figures on plate 4, fig. 29 is said (perhaps accidentally) to represent the last segment of the female pupa, and fig. 30 that of the male, whereas the converse is truly the case.

in Italy. *R. stigmatica*, Kolenati, I am unacquainted with; the green pterostigma should make it easily recognizable.

There is another group of species, none of which have yet been found in Britain, of which *R. umbrosa*, Pict., may be taken as the type. These should form a new genus; they differ in being smaller and of a different *facies*, and especially in the structure of the larvæ, which (according to Pictet) do not possess external respiratory filaments. Dr. Hagen proposes to apply Kolenati's name *Crunophila* to this group, the latter author having discarded *Rhyacophila*, in consequence of its having been previously used for a genus of birds.

Dr. Hagen has also remarked (Stett. Zeit. 1859), on the existence of two unnamed species, which, in the structure of the perfect insects, seem intermediate between *Rhyacophila* and *Crunophila;* one of these I possess from the Carinthian Alps.

Genus Glossosoma, Curtis.

Antennæ shorter than the wings; basal joint thick, shorter than the head. Head transverse. Ocelli present. Maxillary palpi with two short and thick basal joints, the others longer, thin and cylindrical. Mesothorax ovate. Anterior wings narrow at the base, dilated before the elliptical apex; hairy clothing very slight, costal margin nearly straight; at the extreme base of the dorsal margin there is a small obtuse lobe; in the male there is at the base of these wings a somewhat kidney-shaped, hairy, callous appendage, which can be elevated at pleasure; neuration rather strong and distinct; the radius very slightly bent; discoidal cell large, short, broad and angular, connected with the radius by an oblique transverse vein; another transverse vein connects the lower margin of the discoidal cell with the upper branch of the superior branch of the ramus thyrifer, and another connects the two branches of this vein, placed at the point where the superior branch furcates. Posterior wings shorter, and more obtuse at the apex, than the anterior; discoidal cell closed; two transverse veins below it; the anal portion of the extreme base produced into a short rounded lobe, furnished with a longitudinal veinlet, and fringed with a tuft of hairs. Legs short; the intermediate tibiæ and tarsi strongly dilated in the female; anterior tibiæ with two short apical spurs; intermediate and posterior tibiæ each with two pairs of long and nearly equal spurs. Abdomen thin; on the antepenultimate segment there is a horny lobe on the ventral surface, and a smaller one on the penultimate; app. sup. long, apparently two-jointed; app. inf. absent; from the middle of the ventral margin of the last segment proceeds a long horny lobe. The apex of the abdomen in the female is obtuse, forming a cylindrical tube, from which proceeds a small ovipositor.

Larva inhabiting running waters; without external respiratory filaments. Case formed of stones, arranged in an irregular heap. Cocoon thinner than in *Rhyacophila*.

1. *Glossosoma Boltoni*, Curtis.

Glossosoma Boltoni, Curt. (*) Phil. Mag. p. 216, 1 (1834); Steph. Ill. p. 161, 1; Hag. (*) Ent. Ann. 1860, p. 82, 81; Kol. Gen. et Spec. Trichop. pt. 2, p. 200, 2; *Rhyacophila vernalis*, Pict. (*) Recherch. p. 189, 13, pl. 15, fig. 4 (1834); Burm. Handb. p. 909, 3.

Antennæ brownish-testaceous, annulated with brown. Head, palpi and mesothorax brown, the head clothed with sparse greyish pubescence. Anterior wings brownish-grey, the apical portion clothed with pale golden pubescence, forming rather indistinct spots round the apical margin at the arculus and on the disc, which are most conspicuous in the male and during life; neuration brown; fringes grey. Posterior wings greyish, subhyaline, with grey fringes. Legs brownish-testaceous, the spurs dark brown. Abdomen dull dark-brown above, somewhat ochreous beneath. In the male, the ventral surface of the antepenultimate segment has a broad obtuse spoon-shaped lobe; the penultimate segment has a small projecting triangular tooth; a broad rounded cover-like lobe proceeds from the upper margin of the last segment, forming as it were a continuation of it; beneath this are two nearly straight pieces, which I consider the app. intermed.; app. sup. lying on each side of the lobe, apparently bisarticulate, the basal portion short and broad, the apical portion obtuse and curved, beset with rather long brown hairs; app. inf. apparently wanting; penis (or penis-cover?) broad, the apical portion fringed with black hairs; ventral lobe very long, dilated and concave in the middle, the apical portion produced into a long fine point; all the appendages yellow. In the female there is a small tooth on the ventral surface of the antepenultimate segment; and the apex of the abdomen is provided with a slender exserted ovipositor.

Expanse of fore-wings 9—10 lines.

Larva with the head and pronotum black, the latter hexagonal in form. Mesonotum and metanotum clear red, bordered laterally with black. (Pictet.)

Not a common species, appearing in May; found near Exeter and in other localities.

2. *Glossosoma fimbriatum*, Stephens.

(Pl. VIII. fig. 7, neuration; Pl. XIV. figs. 11, 12, app.)

Glossosoma fimbriata, Steph. (*) Ill. p. 161, 2, pl. 32, fig. 1 (1836); Brauer, Neurop. Aust. p. 37; Kol. Gen. et Spec. Trichop. pt. 2, p. 199, 1, pl. 1, fig. 7; Hag. (*) Ent. Ann. 1860, p. 82, 82; *Tinodes obscurus*, Steph. (*) Ill. p. 164, 8 (1836); *Rhyacophila decolorata*, Pict. Recherch. p. 191, 16, pl. 16, fig. 13 (1834)?

Almost entirely similar to the last, but smaller; the antennæ paler and more distinctly annulated; the wings with few traces of the golden spots; anal appendages and ventral lobes apparently precisely similar.

Expanse of fore-wings 6—8 lines.

Common in autumn about streams, especially in hilly districts.

I have a strong opinion that this is only a variety of *G. Boltoni*, perhaps an autumnal brood of that species. It is apparently much more common than *Boltoni*, but I have had no opportunity of collecting in suitable localities at the time when the latter should occur.

According to a type sent by Prof. Pictet to Dr. Hagen, *Rhyacophila decolorata* of the former author is a small species of *Glossosoma*, and perhaps identical with this.

The words "head ochreous," in Stephens' description, are not borne out by his types; this part being dark brown, concolorous with the mesothorax.

Genus Agapetus, Curtis.

Antennæ rather stout, shorter than the wings; the basal joint short, thicker than the others. Head with a thick tuft of hairs on the vertex. Ocelli present. Maxillary palpi with two short and thick basal joints; third joint longest, rather thinner than the two basal ones; terminal joint thinner than any of the others. Labial palpi very small. Mesothorax stout. Anterior wings densely clothed with hair, with long fringes; narrow at the base, dilated before the rounded apex; neuration moderately strong; radius nearly straight; discoidal cell closed, short and rather broad; a transverse vein connects the lower edge of the discoidal cell with the upper branch of the superior branch of the ramus thyrifer, and another connects the two branches of this vein; there are also two transverse veins near the base of the wing; three forks below the apex. Posterior wings small with very long fringes;

no discoidal cell; three apical forks; two transverse veins about the middle placed nearly in a line, and another below these more towards the base. Legs long; the intermediate tibiæ and tarsi dilated in the female; anterior tibiæ with two short apical spurs; intermediate and posterior tibiæ each with two pairs of equal spurs. Abdomen short and rather robust. In the male there is a horny lobe on the ventral surface of the antepenultimate segment, and sometimes a tuft of hairs on the penultimate; app. sup. very small or absent; app. inf. large and spoon-shaped; the penis is furnished with a cover formed of two lateral pieces connected by an extensile membrane; sheaths long and needle-shaped. The female has a long extensile ovipositor from which filamentous processes can be projected at will.

Larva inhabiting running waters; apparently gregarious; abdomen without respiratory filaments, but furnished with hairs.

Case formed of stones placed irregularly. I have found these cases in innumerable quantities covering the lower surface of large stones.

The species are small insects of dull colours, with great external similarity of appearance. The anal appendices furnish easily recognizable characters, and the neuration should also be carefully examined. We possess two species.

1. *Agapetus fuscipes*, Curtis.

(Pl. VIII. fig. 8, neuration; Pl. XIV. fig. 13, app.)

Agapetus fuscipes, Curt. (*) Phil. Mag. p. 217, 1 (1834); Steph. (*) Ill. p. 156, 2; *A. ochripes*, Curt. Phil. Mag. p. 217, 2 (1834); *Rhyacophila tomentosa*, Pict. Recherch. p. 189, 11, pl. 16, fig. 9 (1834); *Agapetus funereus*, Steph. (*) Ill. p. 156, 1 (1836); Hag. (*) Ent. Ann. 1860, p. 81, 79; *A. comatus*, Steph. (*) Ill. p. 157, 4 (1836).

Antennæ and palpi blackish-fuscous. Head and thorax black, with yellowish hairs. Anterior wings greyish-fuscous, with yellowish hairy clothing; fringes greyish-fuscous. Posterior wings greyish-fuscous, somewhat iridescent, with concolorous fringes. Legs fuscous. Abdomen black. In the male there is a long curved testaceous horny lobe, placed on the ventral surface of the antepenultimate segment, reaching beyond the base of the anal appendices, rather dilated at the extremity; app. sup. wanting; app. inf. long, dilated at the base, the tips produced, dentate internally; penis-covers straight, with an extensile membrane between them; sheaths long and needle-shaped, the tips projecting rather beyond the app. inf. and curved upwards and outwards, hook-like. In the female there is an exserted ovipositor furnished with extensile filaments.

Expanse of fore-wings 3½—5 lines.

Common about streams in many parts of the country. The long lobe on the ventral surface of the abdomen of the male renders this species easily recognizable.

The type of *A. setiferus*, Steph. Ill. p. 157, 5, is wanting.

2. *Agapetus comatus*, Pictet. (Pl. XIV. figs. 14, 15, app.)

Rhyacophila comata, Pict. Recherch. p. 194, 21, pl. 16, fig. 17 (1834); *Agapetus laniger*, Steph. (*) Ill. p. 156, 3 (1836); *A. ciliatus*, Hag. (*) Ent. Ann. 1860, p. 81, 80.

Antennæ and palpi fuscous. Head and thorax pale fuscous, with yellowish hairs. Anterior wings greyish with an ochreous tinge, somewhat iridescent; fringes concolorous. Posterior wings pale grey, with concolorous fringes. Legs ochreous, somewhat fuscescent. Abdomen pale fuscous. The lobe on the ventral surface of the antepenultimate segment in the male short, straight and obtuse, not reaching nearly to the apex of the abdomen; on the penultimate segment is a tuft of long hairs; app. sup. very small; app. inf. long, dilated at the tips, not toothed within; penis-covers straight, with an extensile membrane between them; sheaths needle-shaped, quite straight, about the same length as the app. inf. In the female there is a notched tube whence proceeds the ovipositor, which is furnished with extensile filamentous processes.

Expanse of fore-wings 4—4½ lines.

Occurs about rivers in many parts of the country; very abundant along the Dee near Llangollen, in autumn. It is a paler and more delicate species than the last, and may be readily separated by the form of the ventral lobe in the male.

Genus Beræa, Stephens.

Antennæ slightly shorter than the wings, stout; the basal joint very long and thick, very hairy, with a tooth (or tuft of long hairs?) internally in the male; thinner in the female. Head nearly without hairs. Ocelli absent. Maxillary palpi very hairy; first joint short, the rest longer and nearly equal. Labial palpi with short basal joint, the two others longer and cylindrical. Mesothorax flattened above, smooth and polished. Anterior wings narrow at the base, much dilated before the apex, which is obtusely rounded; hairy clothing very dense and long, with long fringes; in the male there is a callous cornucopia-shaped knob-like appendage at the base (analogous to that in *Glossosoma*); neuration very fine and indistinct, even under the microscope; discoidal cell open; in the male the two branches of the ramus discoidalis are simple, in the female the lower branch is forked; in the male the superior branch of the ramus thyrifer is simple, the inferior branch forked, and each branch again furcates; in the female the superior branch is forked and the lower prong again divides, the inferior branch is twice forked at the apex. Posterior wings shorter than the anterior, but nearly as broad; apex broadly rounded; fringes very long; neuration alike in the sexes, but in the male there is a shallow curved fold or pouch in the middle of the wing directed towards the apex and beset with thicker hairs; forks two. The transverse veins are apparently absent in all the wings. Legs rather short; intermediate tibiæ not dilated in the female; anterior and intermediate tibiæ each with a pair of apical spurs; posterior tibiæ with two pairs of spurs.* Abdomen short, thin in the male, stout and somewhat depressed in the female. In the male the ventral surface of the antepenultimate abdominal segment has a small horny lobe, and the penultimate segment a pencil of hairs; the appendices vary considerably according to the species, they are usually thin and style-like, often curved. In the female the terminal abdominal segment is very broad and turned upwards, the upper and lower margins widely separated and forming an oval cavity in which the eggs are carried; the antepenultimate segment with a small ventral tubercle analogous to that in the male.

Larva unknown; inhabiting standing or slowly-running waters.

The small black insects comprised in this genus are very difficult to separate satisfactorily. The shape of the anterior wings and the form of the anal appendices in the males seem to furnish the best characters; but they stand in need of further investigation.

The synonymy of the species of *Beræa* is in a very confused state, and is likely to remain so. The different species resemble each other so greatly that it is impossible to apply the descriptions of various authors, as these have all neglected any investigation of the structural characters. I regret exceedingly that I am unable to speak with certainty of those described by Curtis (forming his genus *Thya*), as I was unacquainted with good characters whereby

* In Kol. Gen. et Spec. Trichop. pt. 2, p. 227; Brauer, Neurop. Aust. p. 38; Hag. Neurop. N. Amer. p. 296, and "Synopsis Synonymica" (Systema), *Beræa* is erroneously said to have 2-4-4 spurs.

to separate them, at the time when his Collection was sent to the Colony of Victoria. The character given in the description of *T. pullata*, "superior wings with a few obscure whitish spots," is imaginary; perhaps these wings were marked by the fingers in the capture of the insect. Of the species of *Rhyacophila* described by Pictet, *R. penicillus, melas, barbata, nigrocincta* and *articularis*, probably all belong to *Beræa;* the few types existing are females and indeterminable. Of the species described by Stephens, the types of *B. albipes* are absent from his Collection, and those of the other two species are unfortunately females. Kolenati admits three species, but appears to have been personally acquainted with one only; this I cannot identify with any of ours. We probably possess more species than are here given; I am acquainted with at least one other Continental species.*

I am doubtful as to the propriety of superseding Curtis' generic name *Thya*, which has the right of priority. That name was certainly employed previously by Dr. Leach to designate a genus of Crustacea, but the two genera are never likely to be confounded. The strict application of the rule that forbids the identity of generic names in the Animal Kingdom (and some writers would even apply this to the whole range of natural productions), is productive of great inconvenience, and is driving modern authors to the creation of names, purely imaginary, and which admit of no explanation.

1. *Beræa pullata*, Curtis.

(Pl. VIII. fig. 9, neuration; Pl. XIV. figs. 16, 17, app.)

Thya pullata, Curt. Phil. Mag. p. 215, 7 (1834)?; *Beræa albipes*, Steph. Ill. p. 158, 1 (1836)?; *B. Marshamella*, Steph. Ill. p. 158, 3 (1836)?.

Antennæ, head, palpi, thorax, wings and abdomen black.

* Mr. Eaton has taken, at Cambridge, in 1865, a minute black insect with the *facies* of *Beræa*, which appears to be identical with *Silo minutus*, Kol. (Gen. et Spec. Trichop. pt. 1, p. 101, 1), and probably with *Phryganea minuta*, Linn. (Faun. Suec. n. 1501). Dr. Hagen has compared Mr. Eaton's insect with types of *S. minutus* sent to him by Kolenati, and also with specimens sent by him to Kolenati, and named by the latter. But it is to be remarked that, according to the generic description, Kolenati's *Silo* should have 2-4-4 spurs, whereas our insect has only 2-2-4, and the figure of the neuration does not agree; however, in the face of this double determination, there can be no doubt that this generic description is erroneous. The insect is probably allied to *Beræa*, but differs considerably in the neuration. I have not sufficient materials in hand for a description. As before mentioned (p. 82), Kolenati misapplied Curtis' generic term *Silo;* and a new name will have to be adopted for this species.

Wings very broadly rounded at the apex. Legs with black thighs, and brownish-black tibiæ and tarsi. In the male the app. sup. are broad and obtuse, black; app. intermed. long, fine, needle-shaped, curved and testaceous; app. inf. long and slender, very strongly curved inwards, the tips testaceous; the ventral margin of the last abdominal segment is produced in the middle into a narrow truncated lobe; the horny lobe on the ventral surface of the antepenultimate segment is subtriangular, black, testaceous at the apex. In the female the dorsal and ventral margins of the last segment form an egg-pouch, whence are protruded two broad and obtuse appendices.

Expanse of fore-wings $4\frac{1}{2}$—$5\frac{1}{2}$ lines.

Occurs not uncommonly about standing and slowly-running waters in summer.

The size (6 lines) given by Curtis makes me think that this is the species intended by him, but I have never seen an example so large, and when I compared my specimens with his, I did not notice that the latter exceeded mine in this particular. I am strongly of opinion that *Marshamella* of Stephens is identical, but the single type is a female, which has not appreciably narrower wings, as the description would lead us to expect.

It appears evident to me that Dr. Hagen had this species before him, when drawing up the characters of the genus in the Stettin Zeitung, 1859, pp. 163, 164. The description of the appendices there given agrees precisely with *B. pullata*, but does not apply to other species, especially as regards the prolonged lobe from the middle of the ventral margin of the last abdominal segment, which I do not see in any other.

2. *Beræa Maurus,* Curtis. (Pl. XIV. fig. 18, app.)

Thya Maurus, Curt. Phil. Mag. p. 215, 4 (1834)? ; *Beræa pygmæa,* Steph. Ill. p. 158, 2 (1836)?.

Antennæ, head, palpi and abdomen black. Wings narrower than in the last species, the apex more pointed; black, with a faint brownish tinge, which is especially evident on the fringes of the posterior pair. Legs dark brownish-black, the tarsi somewhat paler. In the male the appendices differ greatly from *B. pullata;* app. sup. long, slender, needle-shaped, curved strongly inwards, testaceous; app. intermed. apparently absent, but in their place is a long obtuse lobe proceeding from the upper margin of the last segment; app. inf. placed on a triangular base, short, ending in two short widely divaricating branches, black;

ventral margin of last segment not produced in the middle; ventral horny lobe slender and testaceous.

Expanse of fore-wings $4\frac{1}{2}$ lines.

I possess two examples, one of which is from Taunton. It is probably equally common with the preceding, but overlooked.

The characters given by Curtis, "wings narrower and more lanceolate," render it probable that this is rightly determined. The two female types of *pygmæa*, in Stephens' Collection, also appear to have decidedly narrower wings.

Genus Chimarra, Leach.

Antennæ thin, not so long as the wings, the basal joint not longer or stronger than the others; placed very widely apart. Head rounded, densely clothed with hair. Ocelli present. Maxillary palpi long; basal joint short, second joint very long with a tuft of hairs at the apex, third shorter than the second, fourth still shorter, fifth rather longer than the fourth and somewhat flexible. Labial palpi long, basal joint thin, second joint longer and much dilated, third joint flexible. Mesothorax robust. Anterior wings narrow, the costal and dorsal margins nearly parallel, apex rounded; hairy clothing short and rather dense; discoidal cell apparently open; just before the ramus discoidalis furcates it is interrupted by a small naked cell-like space, and both branches of it end in long furcations; upper branch of the anterior branch of the ramus thyrifer forked, the lower simple. Posterior wings shorter and rather broader than the anterior, rounded at the apex; a small closed discoidal cell; otherwise the arrangement of the apical veins is very similar to that of the anterior wings. Legs moderately long, the intermediate tarsi somewhat dilated in the female; anterior tibiæ in the male spurless, in the female with one short apical spur; intermediate and posterior tibiæ each with two pairs of rather long spurs. Abdomen robust, especially in the female. Anal appendices small.

Larva unknown; inhabiting swift torrents.

1. *Chimarra marginata*, Linné.

(Pl. VIII. fig. 10, neuration and maxillary palpus.)

Phryganea marginata, Linn. Syst. Nat. ed. 12, p. 910, 14 (1766); Fab. Syst. Ent. 307, 11; and other authors; *Chimarra marginata*, Curt. (*) Brit. Ent. pl. 561; Steph. (*) Ill. p. 191, 1, pl. 33, fig. 4; Burm. Handb. p. 910, 1; Ramb. Hist. Nat.

Névrop. p. 498; Kol. Gen. et Spec. Trichop. pt. 2, p. 205, 1, pl. 1, fig. 5 ; Hag. (*) Ent. Ann. 1860, p. 84, 86.

Antennæ dark fuscous, nearly black, not annulated, basal joint clothed with yellow hairs. Head and prothorax thickly clothed with yellow hairs. Mesothorax deep blackish-fuscous. Anterior wings dark smoky-fuscous ; costal margin broadly yellow nearly to the apex, an oblique yellow stripe reaches from the middle of the base to the anal angle, and the dorsal margin is narrowly yellow ; apical cilia yellow. Posterior wings smoky-fuscous, with a broad yellow pterostigma. Legs brownish-ochreous. Abdomen dark blackish-fuscous. In the male there appear to be two small hooked app. sup., the apices turned outwards, and between these two small divergent app. intermed. ; app. inf. apparently wanting.

Expanse of fore-wings 6—8 lines.

This peculiar insect, which, from its structure and coloration, cannot be confounded with any other species, is common about waterfalls and torrents in many parts of these islands. It delights to sit on the green mossy boulders usually to be found in mountain streams. It occurs in summer in various localities in Devonshire, Wales, the North of England, &c., and also in Scotland, and at Killarney in Ireland.

Note.—The two species of *Lepidoptera*, erroneously described as *Trichoptera*, and referred to at p. 3, are as follow :—

1. *Acentropus niveus* (*Phryganea nivea*), Oliv., Steph. Ill. p. 150, 1=*Zancle Hansoni*, Steph.=*Acentropus Garnonsii*, Curt. Brit. Ent. pl. 497.

2. *Narycia elegans*, Steph. Ill. p. 154, 1, pl. xxxiii. fig. 4, identical with *Lampronia melanella*, Steph. Ill. Haustell. iv. 358, 8=*Xysmatodoma melanella*, Zell., Sta.

Kolenati inserts *N. elegans* in part 2 of his Gen. et Spec. Trichop. p. 294, but does not appear to have been personally acquainted with the insect; his figure, pl. v. fig. 62, is an exact copy of that of Stephens.

SYNOPSIS OF THE DIVISIONS, FAMILIES, AND GENERA.

Order TRICHOPTERA.

Div. I. INÆQUIPALPIDÆ.
II. ÆQUIPALPIDÆ.

Div. I. INÆQUIPALPIDÆ.

Fam. I. PHRYGANIDÆ.
II. LIMNEPHILIDÆ.
III. SERICOSTOMIDÆ.
IV. HYDROPTILIDÆ.

Div. II. ÆQUIPALPIDÆ.

Fam. V. LEPTOCERIDÆ.
VI. HYDROPSYCHIDÆ.
VII. RHYACOPHILIDÆ.

Fam. I. PHRYGANIDÆ.

Gen. i. PHRYGANEA, Linn.
Trichostegia, Kol.

ii. NEURONIA, Leach.
Phryganea, Auct.
Oligotricha, Ramb.
Anabolia, Kol. (olim).

iii. AGRYPNIA, Curt.
Phryganea, Auct.
Oligotricha, Ramb.

Fam. II. LIMNEPHILIDÆ.

Gen. iv. COLPOTAULIUS, Kol.
Limnephilus, Curt.
Limnephila, Ramb.

v. GRAMMOTAULIUS, Kol.
Phryganea, Auct.
Limnophilus, Burm.
Limnephilus, Curt.
Limnephila, Ramb.

vi. LIMNEPHILUS, Leach.
Phryganea, Auct.
Limnophilus, Burm.
Limnephila, Ramb.
Glyphotaulius, Steph.
Glyphidotaulius, Kol.
Chætotaulius, Kol.
Goniotaulius, Kol.
Desmotaulius, Kol.

Gen. vii. ANABOLIA, Steph.
Phryganea, Pict.
Limnephilus, Curt.
Limnephila, Ramb.

viii. STENOPHYLAX, Kol.
Phryganea, Pict.
Halesus, Steph.
Anabolia, Steph.
Limnephila, Ramb.
Limnephilus, Curt.

ix. HALESUS, Steph.
Phryganea, Auct.
Limnophilus. Burm.
Limnephilus, Curt.
Limnephila, Ramb.
Anabolia, Steph.

x. ECCLISOPTERYX, Kol.
Phryganea, Pict.

xi. PHACOPTERYX, Kol.
Limnephilus, Curt.

xii. CHÆTOPTERYX, Steph.
Phryganea, Pict.

xiii. APATANIA, Kol.

Fam. III. SERICOSTOMIDÆ.

Gen. xiv. SERICOSTOMA, Latr.
Prosoponia, Kirby.
Potomaria, Steph.

Gen. xv. NOTIDOBIA, Steph.
Phryganea, Auct.
Sericostoma, Pict.

xvi. GOERA, Hoff.
Silo, Curt.
Trichostoma, Pict.
Spathiodopteryx, Kol.
Lasiostoma, Ramb.

xvii. SILO, Curt.
Phryganea, Fab.
Trichostoma, Pict.
Aspatherium, Kol.
Goera, Steph.

xviii. MORMONIA, Curt.
Phryganea, Fab.
Goera, Curt.
Lepidostoma, Ramb.

xix. BRACHYCENTRUS, Curt.
Phryganea, Zett.
Pogonostoma, Ramb.
Hydronautia, Kol.

Fam. IV. HYDROPTILIDÆ.

Gen. xx. AGRAYLEA, Curt.
Hydrorchestria, Kol.

xxi. HYDROPTILA, Dalm.

Fam. V. LEPTOCERIDÆ.

Gen. xxii. ODONTOCERUS, Leach.
Phryganea, Scop.
Mystacides, Pict.
Molanna, Kol.

xxiii. MOLANNA, Curt.
Nais, Ramb.

xxiv. LEPTOCERUS, Leach.
Phryganea, Auct.
Ceraclea, Steph.
Mystacida, Ramb.
Mystacides, Pict.

xxv. TRIÆNODES, M'Lach.
Phryganea, Scop.
Leptocerus, Curt.
Mystacida, Ramb.
Mystacides, Kol.
Setodes, Hag.

Gen. xxvi. MYSTACIDES, Latr.
Phryganea, Auct.
Leptocerus, Steph.
Setodes, Kol.
Mystacida, Ramb.

xxvii. SETODES, Ramb.
Phryganea, Auct.
Leptocerus, Curt.
Mystacides, Pict.
Mystacida, Ramb.

Fam. VI. HYDROPSYCHIDÆ.

Gen. xxviii. HYDROPSYCHE, Pict.
Tinodes, Steph.
Philopotamus, Curt.

xxix. TINODES, Leach.
Philopotamus, Ramb.

xxx. PSYCHOMIA, Latr.
Anticyra, Curt.
Tinodes, Kol.

xxxi. DIPLECTRONA, Westw.
Aphelocheira, Steph.

xxxii. PHILOPOTAMUS, Leach.
Phryganea, Auct.
Hydropsyche, Pict.

xxxiii. WORMALDIA, M'Lach.
Hydropsyche, Pict.
Philopotamus, Ramb.
Aphelocheira, Steph.

xxxiv. PLECTROCNEMIA, Steph.
Hydropsyche, Pict.
Philopotamus, Curt.

xxxv. POLYCENTROPUS, Curt.
Hydropsyche, Pict.
Plectrocnemia, Kol.

xxxvi. CYRNUS, Steph.
Philopotamus, Curt.
Polycentropus, Hag.

xxxvii. ECNOMUS, M'Lach.
Philopotamus, Ramb.
Polycentropus, Hag.

xxxviii. NEURECLIPSIS, M'Lach.
Phryganea, Auct.
Polycentropus, Hag.
Anticyra, Walk.

Fam. VII. RHYACOPHILIDÆ.

Gen. xxxix. Rhyacophila, Pict.
Philopotamus, Curt.
Crunophila, Kol.

Gen. xl. Glossosoma, Curt.
Rhyacophila, Pict.
Tinodes, Steph.

Gen. xli. Agapetus, Curt.
Rhyacophila, Pict.

xlii. Beræa, Steph.
Thya, Curt.

xliii. Chimarra, Leach.
Phryganea, Auct.

Synonymic Catalogue of the Species.

Gen. i. Phryganea, Linn.

Sp. 1. *P. grandis*, Linn.
atomaria, Steph.

2. *P. striata*, Linn.
Beckwithii, Steph.
fulvipes, Burm.

3. *P. varia*, Fab.
annularis, Oliv.
variegata, Humm.

4. *P. obsoleta*, Hag.

5. *P. minor*, Curt.
mixta, Burm.
tortriceana, Ramb.

Gen. ii. Neuronia, Leach.

Sp. 6. *N. ruficrus*, Scop.
fusca, Steph.
striata, Burm.
chloroneura, Ramb.
analis, Kol.

Gen. iii. Agrypnia, Curt.

Sp. 7. *A. Pagetana*, Curt.
ægrota, Burm.
lævis, Zett.
strigosa, Ramb.

Gen. iv. Colpotaulius, Kol.

Sp. 8. *C. incisus*, Curt.
striolata, Ramb.
excisus, Kol.
vulsellus, Walk.

Gen. v. Grammotaulius, Kol.

Sp. 9. *G. nitidus*, Müll.
lineola, Schrk.
gracilis, Burm.

Sp. 10. *G. atomarius*, Fab.
strigosus, Curt.
lineola, Steph.
irrorata, Zett.

Gen. vi. Limnephilus, Leach.

Sp. 11. *L. pellucidus*, Oliv.
pellicidula, Steph.
basalis, Curt.
emarginatus, Curt.

12. *L. rhombicus*, Linn.

13. *L. pavidus*, Hag.

14. *L. flavicornis*, Fab.
dorsalis, Steph.

15. *L. nobilis*, Kol.

16. *L. marmoratus*, Curt.
binotatus, Curt.
discoidalis, Curt.
vitrea, Ramb.

17. *L. lunatus*, Curt.
apicalis, Curt.
nebulosus, Curt.
lunaris, Pict.
affinis, Steph.
vitrata, Zett.

18. *L. stigma*, Curt.
impura, Ramb.
fulva, Ramb.?
stigmaticus, Kol.

19. *L. borealis*, Zett.

20. *L. politus*, M'Lach.
concentricus, Kol.
vibex, Brauer.

Sp. 21. *L. elegans*, Curt.
signifer, Zett.

22. *L. griseus*, Linn.
fenestralis, Curt.
marginalis, Steph.
bipunctatus, Steph.
obliquus, Steph.
signatus, Steph.
luniger, Steph.
variegata, Ramb.

23. *L. bipunctatus*, Curt.
griseus, Steph.
obscura, Ramb.
tuberculatus, Brauer?

24. *L. affinis*, Curt.
costalis, Steph.
anastomosis, Kol.

25. *L. auricula*, Curt.
obscurus, Curt.
nigridorsa, Pict.
geminus, Steph.
signatus, Steph.
guttata, Ramb.
fenestratus, Kol.

26. *L. vittatus*, Fab.
consobrinus, Curt.
elegans, Pict.
notatus, Steph.
substrigosus, Steph.
bipartitus, Steph.
præustus, Steph.
flavus, Kol.

27. *L. centralis*, Curt.
terminalis, Curt.
ochraceus, Curt.
flava, Pict.
punctatus, Steph.
elongatus, Steph.
fuliginosus, Steph.
ustulatus, Steph.
nebulosa, Ramb.

28. *L. flavescens*, Steph.

29. *L. ignavus*, Hag.
flavescens, Hag.

30. *L. extricatus*, M'Lach.
hirsutus, Kol.

Sp. 31. *L. hirsutus*, Pict.

32. *L. luridus*, Curt.
irroratus, Steph.

33. *L. sparsus*, Curt.
tenebricus, Curt.
vinculum, Curt.
fuscus, Steph.
punctatissimus, Steph.
fuscatus, Steph.
Megerlei, Kol.

34. *L. fumigatus*, Germ.
fuscicornis, Ramb.
cingulatus, Brauer.

Gen. vii. Anabolia, Steph.

Sp. 35. *A. nervosa*, Curt.
fusca, Pict.
lurida, Steph.
nigricornis, Steph.
destituta, Hag.

36. *A. cœnosa*, Curt.

Gen. viii. Stenophylax, Kol.

Sp. 37. *S. hieroglyphicus*, Steph.
vibex, Steph.
striata, Ramb.

38. *S. vibex*, Curt.

39. *S. striatus*, Pict.

40. *S. lateralis*, Steph.
latipennis, Steph.

41. *S. dubius*, Steph.

42. *S. cingulatus*, Steph.

43. *S. stellatus*, Curt.
latipennis, Curt.
pantherina, Pict.

44. *S. radiatus*, Ramb.

45. *S. infumatus*, M'Lach.

Gen. ix. Halesus, Steph.

Sp. 46. *H. digitatus*, Schrk.
radiatus, Curt.
hieroglyphicus, Curt.
tessellata, Ramb.

47. *H. guttatipennis*, M'Lach.

48. *H. annulatus*, Steph.
testacea, Steph.
flavipennis, Steph.

Gen. x. Ecclisopteryx, Kol.
Sp. 49. *E. guttulata*, Pict.
Dalecarlica, Kol.
guttata, Hag.

Gen. xi. Phacopteryx, Kol.
Sp. 50. *P. brevipennis*, Curt.
granulata, Kol.

Gen. xii. Chætopteryx, Steph.
Sp. 51. *C. tuberculosa*, Pict.
villosa, Steph.
brevipennis, Steph.

Gen. xiii. Apatania, Kol.
Sp. 52. *A. vestita*, Kol.

Gen. xiv. Sericostoma, Latr.
Sp. 53. *S. Spencii*, Kirby.
Latreillii, Curt.
collare, Pict.
analis, Steph.
assimilis, Steph.
hyalina, Steph.

Gen. xv. Notidobia, Steph.
Sp. 54. *N. ciliaris*, Linn.
atrata, Fab.

Gen. xvi. Goera, Hoff.
Sp. 55. *G. flavipes*, Curt.
capillatum, Pict.
fuscicorne, Pict.
pilosa, Steph.
fulvum, Ramb.

Gen. xvii. Silo, Curt.
Sp. 56. *S. pallipes*, Fab.
picicorne, Pict.
nigricorne, Pict.
vulgata, Steph.
57. *S. fumipennis*, M'Lach.

Gen. xviii. Mormonia, Curt.
Sp. 58. *M. hirta*, Fab.
gracilicornis, Curt.
maculicornis, Curt.
nigromaculata, Steph.
immaculata, Steph.
squamulosum, Ramb.
59. *M. irrorata*, Curt.
minor, Steph.
60. *M. basalis*, Kol.
hirta, Burm.

Gen. xix. Brachycentrus, Curt.
Sp. 61. *B. subnubilus*, Curt.
concolor, Steph.
costalis, Steph.
tincta, Zett.
vernum, Ramb.
maculata, Kol.

Gen. xx. Agraylea, Curt.
Sp. 62. *A. multipunctata*, Curt.
sexmaculata, Curt.
argyricola, Kol.

Gen. xxi. Hydroptila, Dalm.
Sp. 63. *H. tineoides*, Dalm.
pulchricornis, Pict.
brunneicornis, Steph.
64. *H. angustella*, M'Lach.
65. *H. costalis*, Curt.
brunneicornis, Pict. ?
sparsa, Steph.

Gen. xxii. Odontocerus, Leach.
Sp. 66. *O. albicornis*, Scop.
maculipennis, Curt.
cylindrica, Pict.

Gen. xxiii. Molanna, Curt.
Sp. 67. *M. angustata*, Curt.
nigripalpis, Steph.
plicata, Ramb.

Gen. xxiv. Leptocerus, Leach.
Sp. 68. *L. nervosus*, Fab.
barbata, Zett.
venosa, Ramb.
69. *L. grossus*, M'Lach.
cinereus, Steph.
notatus, Hag.
70. *L. fulvus*, Ramb.
ochraceus, Kol.
71. *L. bimaculatus*, Steph.
alboguttatus, Hag.
albimacula, Ramb. ?
72. *L. annulicornis*, Steph.
annulatus, Hag.
73. *L. cinereus*, Curt.
aureus, Steph.
annulatus, Steph.
seminiger, Steph.
bifasciatus, Kol.

Sp. 74. *L. aterrimus*, Steph.
ater, Steph.
caliginosus, Steph.
niger, Steph.
perfuscus, Steph.

75. *L. dissimilis*, Steph.
assimilis, Steph.
vetula, Ramb.?
fennicus, Kol.?

76. *L. bifasciatus*, Oliv.
affinis, Steph.

77. *L. albifrons*, Linn.
interrupta, Don.
bilineatus, Steph.

Gen. xxv. Triænodes, M'Lach.

Sp. 78. *T. bicolor*, Curt.
rufogriseus, Steph.
ferruginea, Ramb.
tineoides, Scop.?

79. *T. conspersa*, Ramb.
longicornis, Steph.
rufogriseus, Kol.

Gen. xxvi. Mystacides, Latr.

Sp. 80. *M. atra*, Pict.
nigricans, Steph.

81. *M. nigra*, Linn.
azurea, Zett.

82. *M. quadrifasciata*, Fab.

Gen. xxvii. Setodes, Ramb.

Sp. 83. *S. ochracea*, Curt.
hectica, Zett.
obsoleta, Ramb.
pilosa, Müll.?

84. *S. intaminata*, M'Lach.

85. *S. lacustris*, Pict.
testaceus, Hag.

86. *S. testacea*, Curt.

87. *S. reducta*, M'Lach.
bicolor, Steph.

88. *S. tineiformis*, Curt.
elongatus, Steph.
aspersella, Ramb.?

89. *S. interrupta*, Fab.

Gen. xxviii. Hydropsyche, Pict.

Sp. 90. *H. albipunctata*, Steph.
angustata, Pict.?
ventralis, Curt.?
lepida, Hag.

91. *H. pellucidula*, Curt.
lanceolatus, Curt.?
tenuicornis, Steph.
hibernica, Steph.?
maxima, Brauer.

92. *H. lanceolata*, Steph.
atomaria, Steph.
guttata, Steph.?
instabilis, Curt.?
Danubii, Brauer?

93. *H. angustipennis*, Curt.?
fulvipes, Curt.

94. *H. contubernalis*, M'Lach.

95. *H. ophthalmica*, Ramb.

Gen. xxix. Tinodes, Leach.

Sp. 96. *T. lurida*, Curt.
pallescens, Steph.
flaviceps, Steph.
xanthoceras, Steph.
pallipes, Steph.
annulicornis, Steph.
longipennis, Ramb.
flavipes, Hag.
Waenerii, Kol.?

97. *T. pusilla*, M'Lach.

98. *T. assimilis*, M'Lach.

Gen. xxx. Psychomia, Latr.

Sp. 99. *P. gracilipes*, Curt.
latipes, Curt.
ciliaris, Steph.
subochracea, Steph.
annulicornis, Pict.?

100. *P. phæopa*, Steph.
gracilipes, Steph.
pusillus, Kol.
derelicta, M'Lach.

Gen. xxxi. Diplectrona, Westw.

Sp. 101. *D. flavomaculata*, Steph.

Gen. xxxii. PHILOPOTAMUS, Leach.

Sp. 102. *P. scopulorum*, Steph.
variegatus, Steph.
montanus, Steph.
tigrinus, Brauer.

103. *P. scoticus*, M'Lach.

104. *P. montanus*, Don.
Charpentieri, Zett. ?
variegatus, Ramb.

Gen. xxxiii. WORMALDIA, M'Lach.

Sp. 105. *W. occipitalis*, Pict.
subaurata, Steph.
longipennis, Brauer.
Ramburii, Kol.
brevicornis, Pict. ?

106. *W. subnigra*, M'Lach.
columbina, Hag.

Gen. xxxiv. PLECTROCNEMIA, Steph.

Sp. 107. *P. conspersa*, Curt.
senex, Pict.

Gen. xxxv. POLYCENTROPUS, Curt.

Sp. 108. *P. flavomaculatus*, Pict.
irroratus, Curt.
pyrrhoceras, Steph.
fuliginosus, Steph.
concinnus, Steph.
trimaculatus, Steph.
subpunctatus, Steph.

109. *P. multiguttatus*, Curt.
irrorata, Brauer.
atomaria, Kol.

110. *P. subnebulosus*, M'Lach.
multiguttatus, Steph.
pyrrhoceras, Hag.

111. *P. Parfitti*, M'Lach.

112. *P. picicornis*, Steph.
pulchellus, Steph.

Gen. xxxvi. CYRNUS, Steph.

Sp. 113. *C. trimaculatus*, Curt.
unipunctatus, Steph.
pulchellus, Steph.

114. *C. flavidus*, M'Lach.

Gen. xxxvii. ECNOMUS, M'Lach.

Sp. 115. *E. tenellus*, Ramb.
concinnus, Hag.

Gen. xxxviii. NEURECLIPSIS, M'Lach.

Sp. 116. *N. bimaculata*, Linn.
Tigurinensis, Fab.
robusta, Walk.

Gen. xxxix. RHYACOPHILA, Pict.

Sp. 117. *R. dorsalis*, Curt.
longipennis, Curt.
vulgaris, Steph.
stigma, Steph.
opaca, Steph.

118. *R. obliterata*, M'Lach.

119. *R. septentrionis*, M'Lach.
ferruginea, Hag. ?

120. *R. munda*, M'Lach.

Gen. xl. GLOSSOSOMA, Curt.

Sp. 121. *G. Boltoni*, Curt.
vernalis, Pict.

122. *G. fimbriatum*, Steph.
obscurus, Steph.
decolorata, Pict. ?

Gen. xli. AGAPETUS, Curt.

Sp. 123. *A. fuscipes*, Curt.
ochripes, Curt.
tomentosa, Pict.
funereus, Steph.
comatus, Steph.

124. *A. comatus*, Pict.
laniger, Steph.
ciliatus, Hag.

Gen. xlii. BERÆA, Steph.

Sp. 125. *B. pullata*, Curt.
albipes, Steph. ?
Marshamella, Steph. ?

126. *B. Maurus*, Curt.
pygmæa, Steph. ?

Gen. xliii. CHIMARRA, Leach.

Sp. 127. *C. marginata*, Linn.

EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1. *Limnephilus pavidus.*
2. *Halesus guttatipennis.*
3. *Phacopteryx brevipennis.*
4. *Mormonia basalis*, ♂.
5. *Hydroptila angustella*, ♀.
6. *Setodes interrupta.*
7. *Hydropsyche lanceolata.*
8. *Rhyacophila obliterata*, ♂.
8*. ,, ,, ♀.

PLATE II.

Fig. 1. Larva of *Neuronia ruficrus*; 1 *a*, pupa.
2. ,, *Anabolia nervosa.*
3. ,, *Goera flavipes.*
4. ,, *Hydroptila* (after Pictet).
5. ,, *Molanna angustata* [not good].
6. ,, *Mystacides nigra* (after Pictet).
7. ,, *Philopotamus montanus* (after Pictet).
8. ,, *Hydropsyche angustipennis*; 8 *a*, pupa.
9. ,, *Rhyacophila dorsalis*; 9 *a*, pupa.
10. Outline of head and thoracic segments of larva of *Phryganea.*
11. ,, ,, ,, *Limnephilus.*
12. ,, ,, ,, *Sericostoma.*
13. ,, ,, ,, *Goera.*
14. ,, ,, ,, *Molanna.*
15. ,, ,, ,, *Hydropsyche.*
16. ,, ,, ,, *Rhyacophila.*
17. Mandible of pupa of *Neuronia.*
18. ,, ,, *Limnephilus.*
19. ,, ,, *Sericostoma* (after Pictet).
20. ,, ,, *Hydropsyche.*
21. ,, ,, *Philopotamus* (after Pictet).
22. ,, ,, *Rhyacophila.*
23. Case of *Phryganea grandis.*
24. ,, *Limnephilus flavicornis* } different forms.
25. ,, ,, ,, }
26. ,, ,, ,, }
27. ,, ,, *vittatus* (after Pictet).
28. ,, ,, *lunatus.*
29. ,, *Anabolia nervosa.*
30. ,, *Goera flavipes.*
31. ,, *Hydroptila* (after Pictet).
32. ,, *Molanna angustata.*
33. ,, *Setodes tineiformis.*
34. Quadrangular case of uncertain genus. See p. 89.

PLATE III.

Fig. 1. Neuration of *Phryganea grandis*, ♂; 1 *a*, apical portion of wings of ♀; 1 *b*, maxillary palpus of ♂; 1 *c*, labial palpus of ♂; 1 *d*, maxillary palpus of ♀.

2. Neuration of *Neuronia ruficrus*; 2 *a*, maxillary palpus of ♂; 2 *b*, labial palpus of ♂; 2*c*, maxillary palpus of ♀.

3. Neuration of *Agrypnia Pagetana*.

4. ,, *Colpotaulius incisus.*

5. ,, *Limnephilus flavicornis.*

Index wings. A, anterior wing: *a*, subcosta; *b*, radius; *c*, ramus discoidalis; d^1, superior branch of ramus thyrifer; d^2, inferior branch of ramus thyrifer; *e*, cubitus; *f*, pterostigma; *g*, discoidal cell, which is either "closed" by a transverse vein, as in this species, or without any transverse vein, in which case it is said to be "open"; *h*, cellula thyridii; *i*, thyridium, a pale spot found in many species; *j*, arculus, frequently indicated by a pale spot; *k* 1—*k* 9, apical cells; *l*, apical sectors; the anastomosis is the row of transverse nervures placed about the middle of the wing; it is said to be "complete" when a transverse vein is placed between each of the longitudinal ones (not counting the costa and subcosta), and "incomplete" when some of these transverse veins are absent.

B, posterior wing: *a*, ramus discoidalis; *b*, ramus subdiscoidalis; *c*, cubitus; *d*, costulæ; *e*, pterostigma; *f*, discoidal cell; *g* 1—*g* 7, apical cells; *h*, apical sectors.

6. Neuration of apical portion of wings of *Limnephilus vittatus.*

PLATE IV.

Fig. 1. Neuration of *Grammotaulius nitidus*; 1 *a*, maxillary palpus of *Limnephilus pellucidus*, ♂; 1 *b*, maxillary palpus of ♀; 1 *c*, labial palpus.

2. Neuration of apical portion of wings of a *Limnephilus centralis* in which the arrangement is very abnormal and unequal; 2 *a*, right wings; 2 a_1, left wings. (I have not seen another instance of aberrant neuration that bears the slightest analogy to this.)

3. Neuration of *Anabolia nervosa*.

4. ,, *Stenophylax stellatus*; 4 *a*, maxillary palpus of ♂; 4 *b*, maxillary palpus of ♀; 4 *c*, labial palpus.

5. ,, *Halesus digitatus.*

6. ,, *Ecclisopteryx guttulata.*

7. ,, *Phacopteryx brevipennis.*

8. ,, *Chætopteryx tuberculosa*; 8 *a*, an apical cell, magnified; 8 *b*, maxillary palpus of ♂; 8 *c*, maxillary palpus of ♀; 8 *d*, labial palpus.

9. ,, *Apatania vestita*; 9 *a*, maxillary palpus of ♂; 9 *b*, labial palpus.

10. ,, *Sericostoma Spencii.*

PLATE V.

Fig. 1. Neuration of *Notidobia ciliaris.*
2. ,, *Goera flavipes.*
3. ,, *Silo pallipes,* ♂; 3 *a,* of posterior wing of ♀; 3 *b,* discoidal cell and first apical sector of ♀; 3 *c,* the same of *Silo fumipennis.*
4. ,, *Mormonia hirta,* ♂; 4 *a,* of ♀; 4 *b,* maxillary palpus of ♂; 4 *c,* labial palpus; 4 *d,* maxillary palpus of ♀; 4 *e,* maxillary palpus of *Mormonia (Helictomerus) basalis,* ♂; 4 *f,* basal portion of antenna of the same.
5. ,, *Brachycentrus subnubilus,* ♂; 5 *a,* of apical portion of wings of ♀; 5 *b,* maxillary palpus of ♂; 5 *c,* labial palpus of ♂.
6. ,, *Agraylea multipunctata.*
7. ,, *Hydroptila tineoides.*

PLATE VI.

Fig. 1. Neuration of apical portion of wings of *Odontocerus albicornis,* ♂; 1 *a,* of ♀.
2. ,, ,, ,, *Molanna angustata,* ♂; 2 *a,* of ♀; 2 *b,* maxillary palpus.
3. Neuration of *Leptocerus nervosus,* ♂; 3 *a,* of apical portion of anterior wing of ♀; 3 *b,* maxillary palpus of *Leptocerus cinereus.*
4. ,, *Triænodes bicolor,* ♂; 4 *a,* of posterior wing of ♀; 4 *b,* maxillary palpus; 4 *c,* basal portion of antenna; 4 *d,* neuration of apical portion of anterior wing of *Triænodes conspersa.*
5. ,, *Mystacides nigra*; 5 *a,* costal crotchets on posterior wing (magnified); 5 *b,* maxillary palpus.
6. ,, *Setodes ochracea*; 6 *a,* maxillary palpus.

PLATE VII.

Fig. 1. Neuration of *Setodes reducta.*
2. ,, *Hydropsyche pellucidula*; 2 *a,* maxillary palpus; 2 *b,* labial palpus; 2 *c,* intermediate leg of ♂; 2 *d,* of ♀; 2 *e,* maxillary palpus of *Hydropsyche albipunctata*; 2 *f,* basal portion of antenna of *H. pellucidula.*
3. ,, *Tinodes lurida*; 3 *a,* maxillary palpus.
4. ,, *Psychomia gracilipes.*
5. ,, *Diplectrona flavomaculata.*
6. ,, *Philopotamus scopulorum*; 6 *a,* maxillary palpus; 6 *b,* basal portion of antenna.
7. ,, *Wormaldia occipitalis*; 7 *a,* maxillary palpus.
8. ,, *Plectrocnemia conspersa.*

PLATE VIII.

Fig. 1. Neuration of *Polycentropus flavomaculatus*.
2. ,, ,, *subnebulosus*.
3. ,, *Cyrnus trimaculatus*.
4. ,, *Ecnomus tenellus*; 4 *a*, maxillary palpus.
5. ,, *Neureclipsis bimaculata*; 5 *a*, maxillary palpus.
6. ,, *Rhyacophila obliterata*; 6 *a*, maxillary palpus; 6 *b*, labial palpus.
7. ,, *Glossosoma fimbriatum*.
8. ,, *Agapetus fuscipes*.
9. ,, *Beræa pullata*.
10. ,, *Chimarra marginata*; 10 *a*, maxillary palpus.

PLATE IX.

Fig. 1. Anal appendices of *Phryganea grandis*, ♂, above; 1 *a*, side.
2. ,, ,, *striata*, ♂, above; 2 *a*, side.
3. ,, ,, *obsoleta*, ♂, side.
4. ,, ,, *varia*, ♂, above; 4 *a*, side.
5. ,, *Neuronia ruficrus*, ♂, above.
6. ,, *Colpotaulius incisus*, ♂, above; 6 *a*, side.
7. ,, *Grammotaulius nitidus*, ♂, side.
8. ,, ,, ,, ♀, above.
9. ,, ,, *atomarius*, ♂, side.
10. ,, *Limnephilus pellucidus*, ♂, above; 10 *a*, side.
11. ,, ,, ,, ♀, above; 11 *a*, side.
12. ,, ,, *rhombicus*, ♂, above; 12 *a*, side.
13. ,, ,, ,, ♀, above; 13 *a*, side.
14. ,, ,, *pavidus*, ♂, above; 14 *a*, side.
15. ,, ,, *flavicornis*, ♀, above; 15 *a*, side.
16. ,, ,, *nobilis*, ♂, above; 16 *a*, side.
17. ,, ,, *marmoratus*, ♂, above; 17 *a*, side.
18. ,, ,, ,, ♀, above; 18 *a*, side.
19. ,, ,, *lunatus*, ♂, above; 19 *a*, side.
20. ,, ,, ,, ♀, above; 20 *a*, side.
21. ,, ,, *stigma*, ♂, above; 21 *a*, side.
22. ,, ,, ,, ♀, above; 22 *a*, side.
23. ,, ,, *borealis*, ♂, above; 23 *a*, side.
24. ,, ,, *politus*, ♂, above; 24 *a*, side; 24 *b*, beneath.
25. ,, ,, *elegans*, ♂, above; 25 *a*, side.
26. ,, ,, *griseus*, ♂, above; 26 *a*, side.
27. ,, ,, ,, ♀, above; 27 *a*, side.

PLATE X.

Fig. 1. Anal appendices of *Limnephilus bipunctatus*, ♂, above; 1 *a*, side.
2. ,, ,, ,, ♀, above; 2 *a*, side.
3. ,, ,, *affinis*, ♂, above; 3 *a*, side; 3 *b*, ♀, above; 3 *c*, side.
4. ,, ,, *auricula*, ♂, above; 4 *a*, side.
5. ,, ,, ,, ♀, above; 5 *a*, side.

PLATE X.—*continued.*

Fig. 6. Anal appendices of *Limnephilus ignavus*, ♂, above; 6 *a*, side.
7. ,, ,, *vittatus*, ♂, above; 7 *a*, side.
8. ,, ,, ,, , ♀, above; 8 *a*, side.
9. ,, ,, *centralis*, ♂, above; 9 *a*, side.
10. ,, ,, ,, , ♀, above; 10 *a*, side.
11. ,, ,, *extricatus*, ♂, above; 11 *a*, side.
12. ,, ,, ,, , ♀, above; 12 *a*, side.
13. ,, ,, *hirsutus*, ♂, above; 13 *a*, side.
14. ,, ,, ,, , ♀, above; 14 *a*, side.
15. ,, ,, *luridus*, ♂, above; 15 *a*, side.
16. ,, ,, ,, , ♀, above; 16 *a*, side.
17. ,, ,, *sparsus*, ♂, above; 17 *a*, side.
18. ,, ,, ,, , ♀, above; 18 *a*, side.
19. ,, *Anabolia nervosa*, ♂, above; 19 *a*, side; 19 *b*, beneath.
20. ,, ,, ,, , ♀, above; 20 *a*, side.
21. ,, *Stenophylax hieroglyphicus*, ♂, above; 21 *a*, side; 21 *b*, beneath.

PLATE XI.

Fig. 1. Anal appendices of *Stenophylax vibex*, ♂, above; 1 *a*, side; 1 *b*, beneath.
2. ,, ,, *striatus*, ♂, above; 2 *a*, side.
3. ,, ,, *lateralis*, ♂, above; 3 *a*, side.
4. ,, ,, ,, , ♀, above.
5. ,, ,, *dubius*, ♂, above; 5 *a*, side.
6. ,, ,, *cingulatus*, ♂, above; 6 *a*, side.
7. ,, ,, *stellatus*, ♂, side; 7 *a*, app. inf., magnified.
8. ,, ,, ,, , ♀, above; 8 *a*, side.
9. ,, ,, *radiatus*, ♂, side; 9 *a*, app. inf., magnified.
10. ,, *Halesus guttatipennis*, ♂, above; 10 *a*, side; 10 *b*, beneath.
11. ,, ,, *annulatus*, ♂, above; 11 *a*, side.
12. ,, ,, ,, , ♀, above, 12 *a*, side.
13. ,, *Ecclisopteryx guttulata*, ♂, above (after Brauer).
14. ,, ,, ,, , ♀, above (after Brauer).
15. ,, *Phacopteryx brevipennis*, ♂, above; 15 *a*, side.
16. ,, *Chætopteryx tuberculosa*, ♂, above; 16 *a*, side; 16 *b*, beneath.
17. ,, ,, ,, , ♀, above; 17 *a*, side; 17 *b*, beneath.
18. ,, *Apatania vestita*, ♂, above; 18 *a*, side.
19. ,, *Sericostoma Spencii*, ♂, above, 19 *a*, side; 19 *b*, lower sheaths.
20. ,, *Notidobia ciliaris*, ♂, above; 20 *a*, side.
21. ,, ,, ,, , ♀, above.
22. ,, *Goera flavipes*, ♂, above; 22 *a*, side.
23. ,, ,, ,, , ♀, above; 23 *a*, side.

PLATE XII.

Fig. 1. Anal appendices of *Silo pallipes*, ♂, above; 1 *a*, side.
2. ,, ,, ,, , ♀, above; 2 *a*, side.
3. ,, ,, *fumipennis*, ♂, above; 3 *a*, side.
4. ,, ,, ,, , ♀, above; 4 *a*, side.
5. ,, *Mormonia hirta*, ♂, above; 5 *a*, side.
6. ,, ,, ,, , ♀, above.
7. ,, ,, *irrorata*, ♂, above; 7 *a*, side.
8. ,, ,, *basalis*, ♂, above; 8 *a*, side.
9. ,, *Brachycentrus subnubilus*, ♂, above; 9 *a*, side.
10. ,, *Molanna angustata*, ♂, above; 10 *a*, side.
11. ,, *Leptocerus grossus*, ♂, above; 11 *a*, side.
12. ,, ,, *fulvus*, ♂, above; 12 *a*, side.
13. ,, ,, *bimaculatus*, ♂, above; 13 *a*, side.
14. ,, ,, *annulicornis*, ♂, above; 14 *a*, side.
15. ,, ,, ,, , ♀, above.
16. ,, ,, *cinereus*, ♂, above; 16 *a*, side.
17. ,, ,, ,, , ♀, above; 17 *a*, side.
18. ,, ,, *aterrimus*, ♂, above; 18 *a*, side.
19. ,, ,, ,, , ♀, above.
20. ,, ,, *dissimilis*, ♂, above; 20 *a*, side.
21. ,, ,, *bifasciatus*, ♂, above; 21 *a*, side.
22. ,, ,, ,, , ♀, above.
23. ,, ,, *albifrons*, ♂, above; 23 *a*, side.
24. ,, ,, ,, , ♀, above.
25. ,, *Triænodes bicolor*, ♂, above; 25 *a*, side.
26. ,, ,, ,, , ♀, above; 26 *a*, side.
27. ,, *Mystacides atra*, ♂, above; 27 *a*, side; 27 *b*, beneath.
28. ,, ,, ,, , ♀, above; 28 *a*, side.
29. ,, ,, *nigra*, ♂, above; 29 *a*, side; 29 *b*, beneath.
30. ,, ,, ,, , ♀, above; 30 *a*, side.

PLATE XIII.

Fig. 1. Anal appendices of *Mystacides 4-fasciata*, ♂, above; 1 *a*, side; 1 *b*, beneath.
2. ,, ,, ,, , ♀, above; 2 *a*, side.
3. ,, *Setodes lacustris*, ♂, above; 3 *a*, side.
4. ,, ,, *testacea*, ♂, above; 4 *a*, side.
5. ,, ,, *reducta*, ♂, above; 5 *a*, side.
6. ,, ,, *tineiformis*, ♂, above; 6 *a*, side.
7. ,, ,, *interrupta*, ♂, above; 7 *a*, side.
8. ,, *Hydropsyche pellucidula*, ♂, above; 8 *a*, side; 8 *b*, penis beneath, magnified.
9. ,, ,, ,, , ♀, above; 9 *a*, side.

PLATE XIII.—*continued.*

Fig. 10. Anal appendices of *Hydropsyche lanceolata*, ♂, side; 10 *a*, beneath; 10 *b*, penis beneath, magnified.
11. ,, ,, ,, ♀, above; 11 *a*, side.
12. ,, ,, *contubernalis*, ♂, above; 12 *a*, side; 12 *b*, penis beneath, magnified.
13. ,, *Tinodes lurida*, ♂, above; 13 *a*, side.
14. ,, ,, ,, ♀, above; 14 *a*, side.
15. ,, ,, *pusilla*, ♂, above; 15 *a*, side.
16. ,, ,, *assimilis*, ♂, above; 16 *a*, side.
17. ,, *Psychomia gracilipes*, ♂, above; 17 *a*, side.
18. ,, ,, *phæopa*, ♂, above; 18 *a*, side.
19. ,, ,, ,, ♀, side.
20. ,, *Diplectrona flavomaculata*, ♂, above.
21. ,, *Philopotamus scopulorum*, ♂, above; 21 *a*, side.
22. ,, ,, *montanus*, ♂, above; 22 *a*, side.
23. ,, *Wormaldia occipitalis*, ♂, above; 23 *a*, side.
24. ,, ,, *subnigra*, ♂, above.
25. ,, ,, ,, ♀, above.
26. ,, *Polycentropus flavomaculatus*, ♂, above; 26 *a*, side.
27. ,, ,, ,, ♀, above; 27 *a*, side.
28. ,, ,, *multiguttatus*, ♀, above; 28 *a*, side.

PLATE XIV.

Fig. 1. Anal appendices of *Polycentropus subnebulosus*, ♂, above; 1 *a*, side.
2. ,, ,, *picicornis*, ♂, above; 2 a, side.
3. ,, *Cyrnus trimaculatus*, ♂, above; 3 *a*, side.
4. ,, ,, *flavidus*, ♂, above; 4 *a*, side.
5. ,, *Ecnomus tenellus*, ♂, above; 5 *a*, side.
6. ,, *Neureclipsis bimaculata*, ♂, above; 6 *a*, side.
7. ,, *Rhyacophila dorsalis*, ♂, above; 7 *a*, side.
8. ,, ,, ,, ♀, above; 8 *a*, side.
9. ,, ,, *obliterata*, ♂, above; 9 *a*, side.
10. ,, ,, *munda*, ♂, above; 10 *a*, side.
11. ,, *Glossosoma fimbriatum*, ♂, above; 11 *a*, side.
12. ,, ,, ,, ♀, side.
13. ,, *Agapetus fuscipes*, ♂, above; 13 *a*, side; 13 *b*, beneath.
14. ,, ,, *comatus*, ♂, above; 14 *a*, side; 14 *b*, beneath.
15. ,, ,, ,, ♀, above; 15 *a*, side.
16. ,, *Beræa pullata*, ♂, above; 16 *a*, beneath.
17. ,, ,, ,, ♀, above; 17 *a*, beneath.
18. ,, ,, *Maurus*, ♂, above; 18 *a*, beneath.

INDEX TO FAMILIES AND GENERA.

II. *Ailanthiculture; or, the Prospect of a new English Industry.* By Alexander Wallace, M.D. Oxon., M.R.C.P. Lond.

"No amount of failure can destroy the effect of a single instance of success: for where one experiment has succeeded, there is every reason to believe that further investigation must lead to the discovery of the elements which will render success certain."* (*Rep. Acclim. Soc.* 1862.)

About the year 550, a.d., two monks, having procured in India the eggs of the silkworm moth (*Bombyx Mori*), concealed them in hollow canes and hastened to Constantinople;† there this new race speedily multiplied, and Sericiculture (or the cultivation of silk-producing insects) spreading thence into Sicily, Italy, France, &c., became in Central and Southern Europe an extensive and staple industry, vieing in importance with Viticulture and even with Agriculture itself.

In the 14th and 15th centuries, and especially in the early part of the 17th, during the reign of James I., many efforts were made to introduce this industry into England, but our climate proved too variable and cold, particularly in the spring months, for the well-doing either of the tree or of the insect; for a temperature of 40° F. proves fatal to the young caterpillar of *B. Mori*, which emerges from the egg in the month of May, a time when in this country there are few or no leaves on the mulberry tree for its sustenance; hence all efforts to cultivate *B. Mori* for the sake of its silken produce have in England been precarious and unsuccessful. But European Sericiculture, dependent for the last thirteen centuries on the mulberry tree and on the three or four varieties of the *Bombyx Mori*‡ which feed on the leaves of that tree, presents to a far-seeing eye at the present time an entirely novel prospect. Within the last few years new species of silk-producing *Bombyces* have been introduced into Europe, feeding on a variety of food plants, some of which are indigenous,

* [To the Memoir endorsed with the above Motto was awarded a Prize offered by the Council of the Society for 1865, for an Essay on Economic Entomology.—*Sec. Ent. Soc.*]

† Kirby & Spence, Introd. Entom. i. 333 (ed. 2).

‡ See Captain Hutton's paper on Silkworms, Trans. Ent. Soc., 3rd series, ii. 299.

some already naturalized, some undergoing the process of acclimatization. These new and valuable species have been brought some from the far East, some from the far West, many thousands of miles during their stages of torpidity, a result possible only through the rapid transit afforded in the present day by the aid of steam; they vary much in their habits and economy, but are mostly hardy, requiring out-of-door culture; their cocoons differ much in shape, size and in quality of the silk from the cocoon of *B. Mori*, and they require a far different treatment, both during their growth, and subsequently, for the purpose of unwinding the thread from the cocoons and reeling it into a compound thread fit for the manufacturer.

The cause which has led to the search for and the introduction of new species of silkworms into Europe is the great failure in the crop of cocoons of the *B. Mori*, owing to a disease called "La Gattine," which has raged epidemically in the silk-producing districts for the last ten years or more. In illustration of the great loss caused by this disease, I quote from "The Times" of Sept. 25th, 1865, as follows: "In Tuscany the silk crop is now gathered in and the result is ascertained; last year 55,000, this year 42,000 kilogrammes of cocoons are harvested. Previous to the disease 480,000 kilogrammes were annually gathered, and, as more mulberry trees have since been planted, the average ought now to have been 500,000 kilogrammes. The silk crop in the valley of Niceola, a province of Lucca, is better than last year, the cocoons being from seed procured from the island of Sardinia and some from Japan."

In order therefore to replace the loss caused by the ravages of this epidemic (for which there is known no remedy), the French government commissioned M. Guérin-Méneville, an able and persevering investigator of natural science, 1st, to introduce new races of the *B. Mori* from its original habitat, in order to strengthen, by reverting to the old stock, the constitution of the silkworm, which was supposed to have become deteriorated by European residence and treatment; 2ndly, to suggest means, if possible, whereby the ravages of the epidemic might be lessened; and, 3rdly, to introduce and naturalize other and hardier species of silk-producing *Bombyces*. Under the immediate surveillance therefore of this distinguished naturalist, experiments have been carried on in various parts of France by a band of zealous and spirited cooperators, and more especially by permission of the Emperor in a laboratory at the Imperial Farm of Vincennes, where the soil is of the lightest and most sterile character. These experiments have already resulted in the acclimatization of two new species, and in the introduction of many more, some at least of which we may hope will in time prove valuable additions to European Sericiculture. The two species referred to are *Bombyx Ricini*, from India, feeding on *Ricinus communis* and *Ailanthus glandulosa*, and having from four to five generations in Europe annually, and *Bombyx Cynthia*, from China, feeding on *Ailanthus glandulosa*, and having from two to three generations annually; both* are extremely hardy and thoroughly naturalized in Europe. Among the latter are five oak-feeding species, namely, *Bombyx Mylitta* from Northern India, which produces there the Tusseh silk; *B. Pernyi* from China; *B. Yamamai* from Japan, spinning a silken thread of the best quality, and greatly esteemed on that account in Japan—thousands of cocoons of this species have already been reared in France; *B. Roylei* from the lofty Himalayan plains bordering on Cashmere; and *Saturnia Polyphemus* from America, the silk of which is very fine and apparently of great value. There are also other species awaiting trial of naturalization, viz., *Saturnia Cecropia*, a plum-feeder, and *S. Prometheus* feeding on wild cherry, poplar, &c., both from America; another species, name unknown, is reported as shortly to arrive from Australia, feeding on plum; while living specimens of *Bombyx Atlas*, the largest known species, have been exhibited in Paris, but without opportunity for fecundation. Two other species are indigenous in French colonies, one at Cayenne, called *Bombyx Hesperus*, feeding out of doors on a tree called "Café Diable" but thriving equally well on the *Ailanthus glandulosa*; the other at Senegal, *B. Bauhiniæ*, feeding on the jujube tree; the silk of each of these is likely to be of value.

Of these species, the silk of some promises to equal the best mulberry or Japanese silk, of others to produce a serviceable fabric useful for inferior purposes. It is clear therefore that in European Sericiculture new ideas and results have been already introduced, and it is as yet impossible to foresee what changes may ensue. As regards English Sericiculture, it is worth while considering whether the dream of the 14th century, which James the First vainly strove to realize, may not now be near its completion, and that ere long English ladies may produce silk for their own vestments.

Of the two species now naturalized in France, *B. Ricini* and *B. Cynthia*, the latter only seems suited for this country. Experiments carried on in Great Britain since 1861, by myself and

* *B. Ricini* is perhaps only a variety of *B. Cynthia*, the result of prolonged domestication and of differences in climate, soil, and food-plant.

various other observers, have satisfactorily proved that this insect, *Bombyx Cynthia*, will thrive well in this climate, in fact equally well with the tree (*Ailanthus glandulosa*) on which it feeds, and which has been naturalized in Europe more than 110 years; similar statements have been received with reference to this insect and tree from the Middle and Southern parts of Europe.

Ailanthiculture in England demands only a practical demonstration to assure success, and induce many to engage in a novel and promising industry. I propose therefore to investigate this subject as far as it has hitherto been practically tested in England.

But it may be objected that the price of labour in this country is, by comparison with other countries, too dear to enable us to compete successfully with them. I reply, that after the first plantation, the principal labour required is that of women and children in rearing the silkworm, gathering the cocoons, and spinning the silk; that much less labour is necessary in Ailanthiculture than in mulberry silk culture; that there is but little margin for much difference in cost between women's labour in England and elsewhere; that it is very desirable to find suitable labour for women and children in rural districts; that silk mills are common in England, and their owners (in process of time) will buy the new material and thus save the cost of carriage; that the Ailanthus tree will flourish on very sterile soils, and thus lands hitherto not in cultivation, as for instance Dartmoor and Bagshot Heath (where Ailanthiculture is now being carried on), the embankments of railways, Irish bogs, Scotch mosses and other wastes may be cultivated with profit; and, lastly, practical experience in moist climates, as in England and Holland, seems to indicate that the Ailanthus tree grows more luxuriantly than in the arid soils of France, and that the insect attains a larger size and spins a larger cocoon; nay, it has been stated, that the silk of English cocoons is more glossy and of superior quality to the French specimens. But I do not conceal from myself that great difficulties attend the development of new ideas, before they can be practically successful. The potatoe, now a daily article of diet, had to struggle for a long time against prejudice and inexperience, and it required three centuries of cultivation before the tuber which Raleigh brought over from America became developed into the "Regents," "Flukes" and "Ash-leaved Kidneys" of our tables. It is remembered how in time of scarcity of corn, at the close of the last century, the lower orders refused to substitute the potatoe as an article of diet in language such as this, "Shall we give our children pig's muck?"

But to proceed now with the subject of Ailanthiculture:

In the year 1856 a few living cocoons of a new silkworm were sent by the Abbé Fantoni, a Piedmontese missionary, from the province of Shan Tung, lat. 35°—40°, in the north of China, situate just south of Pekin, to some friends at Turin. The climate of that part of China, as I am informed by a relative who has resided there, is very similar to the climate of Northern Germany, that is, it differs from our English climate only in the winter being a little colder, and the summer somewhat hotter, and that alternations of temperature so common in this country are rare there, the seasons being more thorough. Received in November, 1856, these cocoons hatched out the following year, and towards the middle of May, 1857, the first living specimen of *Bombyx Cynthia* was born in Europe. Fertile eggs were obtained, and two generations were that year successfully reared at Turin.

In 1858, on the 5th July, at Paris, M. Guérin-Méneville received from Turin quills containing eggs of the insect, as well as three fertile females engaged in depositing eggs, which were the same day exhibited at the Académie des Sciences; under the care of M. Méneville these eggs were successfully reared, the insect was distributed over many parts of Europe and her colonies, and has since thriven and multiplied in a marvellous degree.

But it was a puzzle at first to know how to feed these worms; the name of the tree on the leaves of which they fed in China was to the Abbé Fantoni a mystery, but as he described it in his letters as being very like the Acacia leaf, when the young European brood hatched out, all kinds of leaves of that likeness were submitted to their taste, and fortunately among them there chanced to be some Ailanthus leaves; these they selected, ate greedily, and perfected therewith all their changes. It was therefore concluded, and rightly, to be their proper food.

In 1861 *Bombyx Cynthia* was introduced into England, M. Guérin-Méneville having sent over eggs to Lady Dorothy Nevill of Dangstein, near Petersfield, Hants; she wrote in reply as follows,* August 1st, 1861, "J'ai beaucoup de plaisir à vous apprendre que les vers-à-soie de l'Ailante ont réussi au-delà de mes désirs quant à l'éclosion. Ils sont magnifiques comme grosseur; mais malheureusement nous n'avons pas eu assez d'arbres pour leur fournir une nourriture suffisante, ce qui fait que beaucoup ont été perdus. Les vers qui ont fait des cocons les ont produit moins beaux sans doute par le manque de feuilles pour se nourrir. Ni le froid, ni de fortes pluies, rien ne paraît avoir nui à leur parfaite acclimatation."

"Depuis Lady Nevill a fait parvenir plusieurs cocons de sa

* Rapport de M. Guérin-Méneville à S. E. le Ministre de l'Agriculture, 1862.

récolte, qui sont remarquable par leur grosseur et leur richesse en soie. Le climat maritime et un peu humide de l'Angleterre, serait-il favorable à l'amélioration de cette espèce?"

It is, however, due to Mr. F. Moore, of the East India Museum, to state that he first in England possessed and reared this species; larvæ of which, feeding on the castor-oil plant, *Ricinus Palma Christi*, and hatched from eggs sent by M. Guérin-Méneville, were exhibited by Mr. Moore before the Entomological Society of London in October, 1859.

In 1863 Lady D. Nevill thus writes,* "Last summer (1862) I netted over three dozen trees, and placed 500 worms on them; they yielded 480 cocoons: a bird got under the net and took off some before it was arrested in its mischievous career. No wind or weather seemed to hurt the worms, and we kept some of the later ones on the trees when even the leaves were frost-bitten, but the worms did not seem to suffer. I have no doubt as to their hardiness. The three dozen trees about five feet high would have fed at least 2,000 worms if we had had them, as the more the worms devour the leaves the stronger the latter shoot forth." And in "The Queen" for February 28, 1863, was published an account by Mr. Frank Buckland of what he saw at Dangstein in the preceding summer. "Her ladyship has set apart a portion of her beautiful and well-ordered garden, and has planted it with young Ailanthus trees, covering them over with a light canvass-made building: a precaution rendered necessary by the birds, who pick off the young worms. On entering the building I saw, for the first time, the living worms; they were in the highest state of perfection and really beautiful things to look at: not white-faced, pale-looking things like the common silkworm, but magnificent fellows from $2\frac{1}{2}$ to 3 inches long, of an intense emerald-green colour, with the tubercles tipped with a gorgeous marine-blue. Her ladyship pointed out to me how the silkworms held on to the leaves: they cared nothing for the rain, less for the wind: their feet have greater adhesive power than the suckers of the cuttle fish; and their bodies are covered with a fine down [powder?], which turns the rain drops like the tiny hairs on the leaf of a cabbage. Many of them had made their cocoons, picking out snug quiet corners, and were working away like diligent and useful weavers as they are. Lady Nevill explained how readily and at what little expense they were cultivated, and that she found a ready market for all the cocoons she could grow: a gentleman in Paris having offered to take all she could supply for

* See Report of the Acclimatization Society for 1863, p. 19.

French manufacture." Such was the first success in England; and never, I venture to predict, will this new and magnificent *Bombyx* fail to find ardent admirers and cultivators in this country.

In 1862, at Lady D. Nevill's town house, I first beheld these beautiful larvæ feeding on the leaves of the *Ailanthus glandulosa*. In 1863 I became possessed, through the kindness of her ladyship, of some eggs and procured others from France, and I obtained that summer, as also in 1865, two generations. In confirmation of the statement that the cocoons in England were remarkable for their size, M. de Roo van Westmas, writing from the Netherlands, a moister and more temperate clime than France, in August, 1864, says * "The acclimatization of *B. Cynthia* has perfectly succeeded, and presents a remarkable fact, viz., that the race is, without doubt, ameliorated. The moths are larger and more vigorous than those of the preceding year. The females laid last year from 100 to 150 eggs, but now give from 300 to 350, and what is still more remarkable is, that the eggs are larger and heavier, for whereas before a gramme contained 540—560, now I find only 440—460 in that weight: this fact appeared to me of such importance, that I counted the eggs in five grammes taken from a weight of thirty grammes. I found the number 2,261, which gives an average of 452 eggs to a gramme." A gramme being equal to 15½ grains (nearly), this gives twenty-nine or thirty eggs to the grain. My own experience tallies exactly with that of M. de Roo; specimens bred in 1865, the progeny in part of French eggs purchased in 1863, exhibited as the result of two years' acclimatization in England a marked improvement in size, colour, &c., in all their stages, as contrasted with their French progenitors, and the cocoons were finer in 1865 than in 1864. Lady Dorothy Nevill also reports that the English eggs and cocoons are finer than the French. If this be proved by further observation it becomes an important argument in favour of English Ailanthiculture, for a larger cocoon implies a greater weight of silk.

It is now time to describe the food-plant, with a view to show that it is well fitted for English Sericiculture. In 1751, little more than 110 years ago—an interval providentially sufficient to enable the tree to become known and acclimatized in Europe and its colonies, before the insect which converts its juices into silk was introduced—the Royal Society of London received from the Abbé Incarville, a French missionary in China, the first seeds of the *Ailanthus glandulosa;* cultivated by Miller and Carteret Webb, this tree spread over the continent: from its appearance it was

* Revue de Sériciculture, 1864. No. 8, p. 221.

mistaken for a Sumac, for the *Rhus Vernix,* and hence named the Vernis du Japon, or Japan Varnish Tree, under the idea that it was really the tree which produces that precious varnish so much employed in Japan and China. Linnæus himself was of that opinion, but the real tree was afterwards introduced, and the Ailanthus was then called the False Varnish Tree. In 1771 it was introduced into the Jardin des Plantes; Desfontaines there studied the tree, and, recognizing a new species and genus, gave it the name of Ailanthus.* It was at first cultivated as an ornamental tree, for which purpose it is well fitted, being very hardy in our climate, standing severe winters well, and producing an abundant crop of leaves, especially if stooled. It will grow well on any soil, and is said to flourish even on sandy dunes. It has been planted for the purpose of Ailanthiculture on the Landes of France and the sandy dunes of Holland, where, according to M. Milly of the former place and M. C. D. Huet of Haarlem, it grows well.† In London squares and parks are to be seen many luxuriant trees showing their indifference to a smoky atmosphere. By the sea side it thrives admirably. In Colchester there are many trees of from thirty to fifty years old, several fifty feet high, and some higher. I have observed these to flower and seed in warm summers, but I have not yet succeeded in rearing trees from English seed.

The genus *Ailanthus* belongs to the family *Rutaceæ* and to the tribe *Xanthoxyleæ*, or yellow-woods; it contains three or four species: the *Ailanthus glandulosa* of Desfontaines is a large and beautiful tree, having a straight trunk and rounded head, reminding us somewhat of the walnut. Its roots run along near the surface of the soil and shoot up suckers a great distance off; the stem is very straight, covered with a smooth greyish bark; the pith is large in the stem and in the bough; the leaves in this climate usually appear in the first week in May, but in 1865,

* Desfontaines, Mémoire sur un nouveau Genre d'Arbre, *Ailanthus glandulosa,* l'Ailanthe glanduleux; Mém. Acad. Paris. 1786, p. 265, pl. viii. "L'*Arbor Cœli* de Rumphius, *Hort. Amboin.*, que les Indiens appellent *Ailanthe* dans leur langue, est une espèce qui nous paroît appartenir au genre que nous venons de décrire; c'est pourquoi nous avons conservé cette dénomination pour nom générique." L'Heritier, *Stirp. nov.*, fascic. 6, p. 179, (1785), says "*Ailanthi* nomen clariss. Renatus L. Desfontaines, qui hoc genus antepenultimo anno in Actis Parisinis stabilivit, ab alterâ ejusdem videlicet generis specie apud Amboinenses teste Rumphio *Aylanto i. e.* Arbor Cœli nuncupatâ, mutuatus est." Desfontaines' Mémoire, however, is printed amongst those for 1786 and does not appear to have been published before 1788.

† Revue de Sériciculture, 1863, p. 75; 1864, p. 191.

owing to the early spring, they appeared the last week in April: they fall at the end of October. If the tree is kept stooled so as to provide a luxuriant foliage, the buds break earlier than in the large trees, and the leaves may be retained to the 10th of November, or even for a fortnight later in a warm, sheltered nook. The growth of the tree is most luxuriant; from seven to ten feet is no unusual length of shoot in a single summer in good soil, when the tree is young or has been stooled. A correspondent from Suffolk mentions ten and even twelve feet as the growth of a single shoot in 1865, besides another shoot of seven feet from the same tree—four years old; and in Devonshire eight feet is no unusual growth. The circumference of such shoots would be from two to three inches. The height of a seedling one year old averages from nine to eighteen inches, the second year from three to five feet. The tap roots are long and strong; in one seedling, four inches above the soil, the tap root was four feet long. In rapid growth it exceeds even the Italian poplar. It is not uncommon in France to see copses of five or six years old of the same size and having as much wood fit for firewood as an oak plantation of eighteen to twenty years old; admitting, therefore, of a fall every ten years, and in favourable conditions of soil, &c., every eight years.*

Repeated measurings give an annual increase averaging about an inch and a half in the circumference of the tree. The leaf-stalks are of great length; some I have measured were three feet and a half to four feet long, pendant with a graceful curve at the lower third of their length; the leaflets are large, some measuring eight and half inches in length by three in breadth, from thirteen to seventeen on a leaf-stalk: near the base of the leaf the margin is toothed, and at the extremity of the tooth is a little gland, emitting a strong resinous odour, whence the name *glandulosa;* of these teeth and glands there are generally two, three, or more on each leaflet. The same odour seems to be communicated more or less to the leaf, also to the larva, and in a less degree to the imago of *Bombyx Cynthia.*

The flowers are both male and female and some hermaphrodite, they appear at the end of July, exhale a strong scent, and are of a greenish-yellow colour, fasciculate, and arranged in a terminal panicle; the calyx and corolla are in five divisions; the stamens are 10 in the male, 2 or 3 in the hermaphrodite flowers; the carpels are from 3 to 5. The seed-pod somewhat resembles the keys of an ash tree, is compressed, long, membranous, tongue-

* Notice sur l'Ailante glanduleux, par A. Dupuis, p. 12.

shaped, swollen in the middle, containing a single seed, which is hard and lenticular. In early autumn the colour of the seed-pods becomes a bright-red, and they remain hanging a little after the leaves have fallen.

Throughout Middle and Southern Europe generally, and in England in favourable warm seasons, this tree flowers and seeds freely. The seeds sprout and grow readily in England, they should be gathered in November, dried, and planted in March, April, or May, broadcast or in rows, covered lightly with about an inch of soil, and they will appear in from three to six weeks according to the season: with the exception of the maple there are hardly any shrubs or trees whose seeds germinate so rapidly. On June 23rd, 1865, some seeds were sown under glass; on July 15th, twenty-two days afterwards, they were up, and by the end of October made little trees, about nine inches in length, with fair roots. Like the Sumac it throws up numerous suckers from its roots, so that in this way and by means of the seeds it is easily propagated. There is also a third way less productive, for if the roots of a tree be cut in pieces like a potatoe, they will, under favourable circumstances, throw up shoots and in time form vigorous trees. In planting out or moving, all the severed roots should be collected, cut up, and replanted near the surface in a warm spot. The reproduction, therefore, of this tree is very easy and simple. Its duration of life averages 100 years.* It is said to be very free from the attacks of wood-boring insects, as *Scolytus*, *Cossus*, &c.

This tree prefers a warm aspect, but being very brittle requires in exposed sites some shelter from the winds. In long continued drought it maintains its verdure better than any other tree known; in September, 1865, when other trees in Paris were deprived of their leaves, owing to the severe drought, the Ailanthus trees planted on the Boulevards and in front of the "Passage de l'Opéra," preserved their foliage completely, and afforded a welcome shade to the grateful citizens.† The tree has also been planted in France to clothe mountainous slopes where but little else will grow, with a view to fix the soil and avoid the disastrous results of avalanches and land-slips; it has similarly been used on the banks of railways and rivers, its spreading branching roots serving that purpose well. It thrives, as before stated, on the chalky plains of Chalons, on the sandy Landes, and in the Steppes of Russia.

* Dupuis, Notice sur l'Ailante glanduleux, p. 5.

† Guérin-Méneville, Revue de Sériciculture, 1865, p. 248.

The wood of the *Ailanthus glandulosa* is yellowish-white, satiny, sometimes veined with green, equalling in beauty the maple, of a close texture, very hard, and polishes well. The quality of the wood is best when grown on a gravelly soil; its great fault is its brittleness, or rather its want of elasticity, but it is said that after a time it gains as great a hardness and solidity as the walnut. It is recommended to treat it similarly to that tree, and immerse it in water for several months and then dry it thoroughly. It then remains unaffected by weather and may be used freely in the most delicate cabinet work.

As there are conflicting opinions on the subject of its value,* it may be well to cite the opinion of M. Guérin-Méneville in its favour; that it may have the full force of his own language I transcribe the passage in French †:—

" J'ai profité de la bonne volonté d'un ingénieur très-distingué du Port du Toulon, de M. Raoulx, ingénieur des ponts et chaussées à la direction des travaux hydrauliques, pour faire des essais sur ce bois, comparativement à ceux que l'on fait journellement pour apprécier les qualités des bois employés à la construction des vaisseaux de la marine impériale. M. Raoulx a soumis du bois d'ailante (de 25 à 30 ans) à toutes les expériences que l'on fait subir aux autres bois. Il m'a autorisé à faire connaître les résultats remarquables et inattendus qui font le sujet de cette note et montrent que le bois de l'ailante est réellement supérieur à celui du chêne et même de l'orme, le bois par excellence pour le charronnage, à cause de sa force et de sa flexibilité. Dans le travail de M. Raoulx on trouvera un tableau dans lequel le poids, la densité, la tenacité, et la flèche immédiatement avant la rupture, ou la flexibilité, de tous les bois employés dans les chantiers du Port du Toulon, sont indiqués d'après un grand nombre d'expériences faites toutes dans les mêmes conditions. Voici les moyennes de celles qui ont été faites sur les trois espèces de bois citées plus haut.

	Densité‡	Tenacité§	Flexibilité‖
" Ailante 3 Expér. moyennes	0·713	32·812	0·033.
" Orme 7 ,, ,,	0·604	24·867	0·023.
" Chêne 10 ,, ,,	0·751	19·743	0·027.

" Ce bois prend très-bien le poli et le vernis. D'une densité à peu près égale à celle du chêne, il possède une tenacité presque

* See Proc. Ent. Soc. 1865, pp. 112, 121.

† Revue de Sériciculture, 1865. No. 7, p. 178.

‡ Pésanteur spécifique.

§ Charge de rupture par centimètre carré.

‖ Flèche immédiatement avant la rupture.

double et une flexibilité supérieure, et j'ai appris des ouvriers qui l'ont travaillé, qu'il ne fatiguait nullement les outils, tout en étant très dur."

We may therefore await fresh investigation before considering the question of the value of the wood of the Ailanthus tree definitely settled as worthless.

I have thought it needful to go at some length into the description of the Ailanthus tree and its habits, for much of the success of Ailanthiculture in England depends on the luxuriant yet hardy and quick growth of this tree, and on its rapid reproduction. In planting with a view to Ailanthiculture, a warm sunny aspect is desirable, as well as shelter from the force of the wind, for I have observed that the leaves if exposed to a gale of wind get torn or stripped off the trees, and fall to the ground, carrying with them the larvæ, or that the long leaf-stalks dash against and bruise the larvæ, and further that while exposed to the force of a gale the larvæ are unable to feed, being forced to cling tightly to the leaves to prevent falling. Moderate winds do no harm, but some protection from violent gales is necessary. For that purpose I planted Jerusalem artichokes in a double row about every twenty yards in my *Ailanthery* (or plantation of Ailanthus trees devoted to the rearing of the *Bombyx Cynthia*), which consists of a hedge of about five to seven rows of trees in breadth, extending for the space of half a mile along a strip of ground, about a rod wide, by the side of the branch to Wivenhoe from the Colchester station of the Great Eastern Railway. By thus interposing a series of Jerusalem artichokes I found a great advantage; the trees were more luxuriant, cold winds were kept off, the caterpillars fed up more rapidly, and, in spinning their cocoons, took advantage of the large leaves of the artichoke and resorted thither in great numbers. It is recommended to plant the trees with an alley between every five rows, to facilitate hoeing of the weeds, observation of the larvæ, and interference where necessary. In this climate on good soil the trees may be planted at first from two to three feet apart, if on inferior soil not further apart than two feet each way; the object being to afford a dense screen of foliage to the young silkworms, so that they can readily travel from one to another tree by means of the interlacing leaves. If the seed is sown for the purpose of forming a permanent plantation, the larvæ may be placed on the trees in the third year of their growth; if however two-year old seedlings are planted out, then in their fourth year larvæ may feed on them; so that in Ailanthiculture a small crop may be obtained the second or third year after planting, a result widely different from mulberry culture, where trees obtain the age of ten or fifteen years before coming into bearing.

For example, in March, 1864, I planted on the railway bank above mentioned 3,000 trees, two-year old seedlings from France; in 1865, 1,340 of these attained sufficient luxuriance, i. e., a minimum of three feet high, to enable me to feed them off, and I got a crop of 5,368 cocoons from these, besides feeding them off a second time with a second brood, giving an average of about four cocoons to each tree; many of these trees attained a height of eight feet in the present year. They were planted at a distance of two feet from tree to tree, in rows which were some two feet, some three, and some four feet apart, but only the trees planted two feet apart were sufficiently close to enable the silkworms to travel readily from one tree to another when necessary. In course of time, however, as the stools increase in size every other tree may be taken out, leaving the stools four feet apart. In poorer and inferior soils a minor degree of luxuriance may justly be expected, and it will then become necessary to plant a little closer, and probably to wait a little longer before placing the worms on the trees: each winter the shoots are to be cut back to a height of eighteen inches or two feet from the ground, like an osier bed, in order to bring the shoots within easy reach, and to favour their luxuriance. In this way too the leaves are thrown out earlier and last longer on the trees.

The trees may be planted by the spade or plough; by the former 900 a-day have been planted on the light soil of France, by the latter a good many more.

Ailanthiculture is never likely to supplant, but rather to supplement Agriculture, by bringing into cultivation land hitherto untouched; and if the late Lord Palmerston may be considered as a public benefactor, who by sowing bent in sandy regions made grass grow where it had never grown before, how much greater a benefactor would he be thought who introduced a profitable industry where nothing had previously been cultivated?

Hoeing will be necessary during the summer to keep down the weeds, but when the trees are once established, the expense of keeping up the plantation will be trivial. Annexed is a French calculation of the cost of planting by M. Ernest Rousseau, who planted six hectares with Ailanthus trees at Rabutinière in Sologne* (a hectare being 2·47 acres). The land, previously untilled, was prepared with mattacks in rows 32 inches wide, and 18 inches deep, at the price of $2\frac{1}{2}$ centimes the metre, or about $\frac{1}{2}d.$ the

* Rapport à S. E. le Ministre de l'Agriculture, par M. G. Méneville, p. 35.

40 inches; in the hectare there were 50 rows, each 80 inches apart from one another, and 100 metres long; the trees were planted 900 a-day, by plunging the spade into the soft ground, pressing it forward, and slipping the plant into the crevice behind the spade.

50 rows of 100 metres=5,000 metres in length.	
5,000 metres in length at $2\frac{1}{2}$ centimes ..	125 francs.
Planting 900 trees per day, 6 days, at 3 francs per day	18 ,,
5,000 trees at 15 francs the thousand ..	75 ,,
6 hectares=15 acres, nearly ....Total	218 francs, or about £8 : 15*s*.

Such an account of the expenses of planting seems almost too favourable for belief, and could only be obtainable in very light soils.

In describing the domestic habits of *Bombyx Cynthia*, it will perhaps be the most convenient to begin with the winter life, and trace its progress through the various seasons of the year. It remains through the winter in the cocoon, whereas *Bombyx Mori* passes that season in the egg state. My cocoons are now strung up in rows or chaplets of 50 or 100 each, threaded on twine and suspended in a room for the winter: or they may be kept in clothes-baskets or bags: they may however hang out of doors on the trees. Every winter I allow a few cocoons to remain hanging where spun. In the succeeding summer these produce large healthy moths, but at a later period than those housed, since the colder temperature to which they are subject during the winter and spring retards their development. Consequently, if (in order to provide for a second brood) it is wished to hatch out the moths early in the spring, the cocoons must be kept housed during the winter at a temperature of 40°—45° F., which, towards the end of February, should be raised to 60° F. (in a kitchen or green-house), and in March to 70° or 80° F., when the moths will emerge in April; their progeny will in England, in ordinary seasons, emerge from the cocoons in time to allow another generation to spin their cocoons. In order to provide food for the early larvæ so forced, a few Ailanthus trees in pots should be placed in a green-house, so as to provide foliage in April, and during the first and second week in May, after which time the trees in the open air have plenty of leaves.

By this plan in 1865 Lady Dorothy Nevill obtained eggs in May, and was thus enabled to rear a second brood, whose cocoons

I saw finished on my visit there in the last week in September. If housed but not forced, the moths will probably begin to hatch out the last week in May and during June; but if they pass the winter out of doors, not till the end of July. A higher or lower temperature hastens or retards their development and growth in all their several stages: below 50° F. they are dormant; above 50° and below 70° their growth progresses steadily and healthily; above 70° their vital activity is greatly accelerated, and the duration of their several stages is proportionately lessened. Of this important character of constitution I have observed so many instances as to be thoroughly convinced of its existence and value as regards English Ailanthiculture.

For a day or two before emerging the pupa case stiffens, turns a dark colour, and shows the white streaks and ocelli on the body of the enclosed imago; then when the weather seems likely to be fine and favourable the pupa case splits open at the top of the head, and by the struggles of the insect is gradually pushed down; little by little the insect emerges, dilating the aperture at the apex of the cocoon which has been left for an exit; the elastic walls serve as a means whereby the pupa case may be forced backwards and got rid of. It is a quaint and curious sight to see the pretty creatures emerge and spread their wings. We will suppose the chaplets of cocoons strung up in a green-house at a temperature of 90° in the first week in June, with a south-west wind; a shower in the morning has moistened the air (or if not, man has supplied the desired moisture by syringing with a hydropult the floor and walls of the green-house); at 4 o'clock, p.m., there are no insects out, 5 o'clock and none emerge; we now go in to tea; at 5·30 there are two out, with wings soft but fully developed, one a magnificent female of a tawny-yellow colour; three more have but just emerged, as may be noted by their tiny wings, curiously curved and bellyed out; and now if we watch we shall have a good chance of seeing one escape from its winter prison, and become a glorious thing of life. See! a quiver and a shake runs through that chaplet! which is the cocoon wherein newly-born life struggles to be free? Another and another struggle and we detect the individual cocoon; see! a greyish-yellow face emerges, then the head, then a leg, then the opposite one, now a third leg; then a wing on the same side is partially pulled out, the shoulders being bent over on the opposite side, then a fourth leg (the first two pairs), and now bending first to one side and then another the limp wings are withdrawn from their cases and emerge from the cocoon, and then with the last pair of legs the large lax abdomen tumbles over the side, and as it were drags the willing insect down to the base of the cocoon, where, firmly fixing its pretty tiny feet, the moth rests to gather strength for the next task, that of expanding and drying its wings. The whole process of birth does not occupy a minute.

The moth (see Pl. XV.) has long been familiar to us in collections of insects sent over from China; the head and antennæ are greyish-brown, the latter strongly pectinated in the male, less so in the female; the thorax and abdomen are of a lighter greyish-yellow; at the junction of the thorax and abdomen is a broad greyish-white transverse band, on the first abdominal segment another narrower band arched, and then follow six pair of white tufts of scales, with six larger tufts intermediate closely approximating, the last two segments are tinged with greyish-white.

On the underside are two rows of ocelli on either side the abdomen, having a greenish-brown centre, a purple-brown ring, and an outer white margin; of these rows the superior is the most definite; the feet are graceful, light greenish-brown underneath, above margined at the sides with greyish-white fringe.

Two or three marginal brown lines, becoming streaky in the lower wing, border their hind margins, and are somewhat interrupted before reaching a black ocellus, placed near the falcate tip of the upper wing. This ocellus shades into purple inferiorly and is surmounted by a white crescent; a zig-zag line runs from it to the tip. Transversely across the wings runs a narrow white streak, wavy where it admits the approach of the large lunules, bounded internally by a narrower dark green brown line, externally by a broad rosy band shading off into a lighter hue; outside of which is a broad greenish band dusted over with small dusky atoms; within the white transverse lines, which nearly form an equilateral triangle, is a space of a darker greenish hue, containing four lunules, one in each wing; the outer tip of each lunule rests on the curve of the rosy band already described, interrupting the white line. These lunules are at their outer portion denuded of scales and transparent, in their middle are yellowish-brown, darkening towards the edge into the ground colour of the wings; from the inner tip of the lunules in the upper wings run two white streaks, one to the costa nearly at right angles, the second towards the base of the wing in a straight line with the lower margin of the lunules, and continuous with the white band at the junction of the thorax and abdomen.

In the lower wing there is a similar white streak, arched midway between the lunule and the base of the wing, continuous with the transverse white streak at its upper margin, and curving round to intersect the inner margin of the wing, which is very fully feathered.

The falcation of the upper wing is most strongly marked in the male; in the female the under wing is broader and fuller, the better to support in flight her weighty abdomen.

Expanse of wings 5 to 6 inches.

It is quite a mistake to suppose, as is often alleged, that pupæ, if taken out of the cocoon and left to themselves, cannot produce insects. If the pupæ are kept moist, the insects will in due time be born, and go through exactly the same process as above described; but not having the help of the cocoon to push back the pupa case from their lax wings, they frequently manage to get only two or three wings free, and the pupa shell remains attached to the fourth wing (generally an under wing), which therefore is never developed. From this cause many insects are crippled if taken out of their cocoon before birth; and when once crippled they seem to possess no sexual power or desire, and are incapacitated alike for flight and copulation; for I have found by repeated trials that coition among cripples rarely if ever takes place.

If the weather is changing from a lower to a higher temperature, the moths will emerge more freely, and even anticipate such a change; if however it be falling to a lower temperature they do not come out so well. One night, 29th August, 1862, two males and two females emerged (second crop), the thermometer being 65° F. in the greenhouse. On the 27th eleven, and on the 28th fifteen had emerged, so that I could not understand the sudden diminution: but during the night, which was cold and dewy, the temperature fell. Of four pairs put together to copulate, only two pairs were found joined in the morning, which was quite unusual. The following morning however was warm and sunny, and at 9 a.m. when I entered the greenhouse I found (which also was quite unusual) seven newly-born imagos; during that day eleven more moths emerged. It was, therefore, quite plain that the changed temperature, before it was perceptible to man, operated so as to prevent the exit of the insects at the usual hour. It also to a certain extent prevented coition, and this happened more or less so frequently that I was almost enabled to predicate a shower or a cold night by the absence or presence in abundance at the usual hour of newly-born imagos.

The usual hour of exit from the cocoon was from 6 to 8 p.m.: some however would be born during the night, and were found expanded and quiescent in the morning; some few also were born about 10 a.m. and a few about 2 or 3 p.m.; those born before 9 p.m. generally flew and paired that night.

That the cocoons should be suspended in chaplets or strings is I think desirable for this reason, that it is requisite that the large limp wings of the newly-born insect should hang perpendicularly prone, so that their own gravity may further their expansion; the abdomen, being lax, is bent at first downwards, but afterwards slightly upwards, the under surface of the insect being uppermost during the operation; and this is exactly the natural position assumed by the insect at the base of its cocoon. But should the moth rest against any perpendicular object, this help of position is entirely lost: as the wings expand, they are folded back over the thorax, having now to support their own weight; and the experience of this position proves that a great many so resting are more or less crippled.

Now supposing the chaplets to be suspended in festoons, and the moths to be emerging, how best are we to attain our next object, their coition and the deposition of eggs? The imagos during the day are extremely tame, bear handling very well, and seem inclined even if let go to fly back again for shelter whence they were dislodged; but if once escaped and fairly on the wing they soon soar away over trees out of sight. A very pretty and graceful movement to and fro of the wings is a common salutation when any one approaches, and the same waving of the wings more or less accompanies all their proceedings. One variety of the French "boîtes aux mariages" is a three-chambered box, not less than eighteen inches high by eighteen inches wide and about three feet long. It may be made larger or smaller; the sides and top are open, but lined with canvass or zinc; the top is so constructed, in three pieces, as to enable each compartment to be examined separately. Divided into three separate chambers, it serves first to hold the cocoons, whence issue the insects; secondly, as a receptacle (the middle chamber) for the emerged insects to pair; thirdly, to keep fertile females apart for the deposition of their eggs.

But this plan does not answer so well as a design of my own of zinc cylinders (which I will presently describe) for these reasons: first, that the insects just born have not the same facilities for expanding and drying their wings, and consequently will be more crippled; secondly, that it is larger and more cumbrous to move about where space may be limited; thirdly, that it does not afford equal facilities for coition or egg-laying, or for close observation during these actions; fourthly, that manipulation of the insects and the collection of eggs is not so easy.

These cylinders are constructed of the cheapest ordinary perforated zinc, and are formed by soldering one end to the other of previously measured lengths, so cut in sizes as to form when soldered cylinders of different diameters, thereby enabling one cylinder to slip inside another. One end is left open, the other is covered with gauze or canvass; to each cylinder belongs a round or square top of a little larger size, made of elm or deal.

	Height.		Diameter.	
Dimensions of cylinders,	$10\frac{1}{2}$ inches	×	$8\frac{3}{4}$ inches.	
" "	11 "	×	9 "	
" "	$11\frac{1}{2}$ "	×	$9\frac{1}{4}$ "	
" "	12 "	×	$9\frac{1}{2}$ "	, &c.

Cylinders of equal diameter but less height (8 inches diameter × 4 inches high) are useful for placing the insects in when newly born. They may be held by their wings if developed, or by the shoulders if otherwise; the males are placed in one cylinder, the females in another, to the number of 8 or 10 in each; a glance will tell the initiated which are the sexes, and towards night it is easy to adjust the numbers, so that an equal number of males and of females may be introduced into one of the larger cylinders, and the wooden lid placed on it: this is then carefully put away in a quiet place. If looked at in the morning, it will be found that the pairs are united; this will happen as the rule, but in some cases, either from a sudden falling of the temperature, or if some of the insects are not quite ready for coition, or have been developed rather late in the evening, they do not pair. If so, carefully remove the wooden lid, take out those that have not paired, and leave behind those in copulation, which will remain quiescent till dusk. When they separate, the female instantly, as if there was no time to lose, begins to lay her eggs. Those not paired will probably do so the following night. After coition has ceased, the males should be let go if not required for other purposes: M. Méneville gives them to his chickens.

A male will serve more than one female successfully, as I have proved by an experiment below quoted. It is curious also that, even if no impregnation takes place for want of a male or otherwise, eggs are deposited by the female the third or fourth night after exit; hence coition ought normally to take place on the first or second night after exit: and further I have observed, that if the male happens to remain without coition for two or more nights, it is very doubtful whether, even if he should have access to a fresh female, coition will ensue. Coition must, therefore, in both sexes follow within forty-eight hours after birth to be generally successful.

Experiment, August 20th, one ♀ of the second brood emerged, after thirty-six days spent in cocoon; on the 21st, a second ♀ came out in the evening after thirty-four days' interval in cocoon; on the 23rd a ♂ emerged; coition ensued that night with the second female. (I was afraid the first ♀ might be stale, so to make sure I excluded her from the cylinder "aux mariages.") The female separated the following night from the male and laid eggs to the number of 170; the following nights she laid 54, then 42, 27, 17 and 8; the last two lots were composed of eggs smaller in size, making a total of 318 eggs. After she had left the male on the evening of the 24th, I placed the same male with the first female, which had been kept in a cool place to retard its development, but which had already begun to lay eggs, 38 in number; the same night coition ensued, and as no other imagos but these three were out, no mistake could possibly arise; the night after coition she laid 121 eggs, then 45, 7, 13, 14, in all 238 eggs; the eggs laid by her before coition proved to be of course barren. I numbered these lots 1 and 2 and kept them distinct, having dated them, and I placed them on Ailanthus trees under precisely the same conditions; the larvæ hatched out well and seemed to be vigorous, but I thought that the second lot were smaller and passed more slowly through their changes, and certainly fewer remained to be sent down from the nursery to the larger plantation, viz.:

No. 1. 318 eggs: of these, placed out of doors on the trees, 266 hatched out Sept. 7th; they passed through their 1st moult Sept. 12th—15th, five days' interval; they commenced their 2nd moult on Sept. 16th, four days' interval; and of these 130 were sent down to the Ailanthery by the railway side on the 20th Sept.: on Oct. 5th they were passing through their last moult.

No. 2. 173 larvæ hatched out of 200 eggs; on Sept. 19th they commenced their 2nd moult, and, on the 20th, 67 only were left to go down to the railway.

It is clear, therefore, that a male can if necessary be used twice for coition, but it is very probable that the resulting generation will be possessed of inferior vitality.

During coition the males remain sometimes suspended in mid-air from the bodies of the females, sometimes clinging to their bodies. When the females require the male they call, or rather extrude their ovipositor and generative apparatus; the males fluttering near seem attracted by a sense unknown to us, and, rapidly approaching, settle on the under-surface of the abdomen of the female, and at once unite, being not dos-à-dos, but face to face. Subsequently the male hangs down in mid-air, or slips into the usual position, i. e. tail to tail, both clinging to the cylinder.

The eggs are laid at night in little masses among the interstices of the zinc, which are just large enough to allow the eggs to be pressed through, so that many are really deposited by the ovipositor of the ♀ on the outside of the cylinder. Each morning with the finger and thumb the eggs may be easily rubbed off the zinc and collected, the females meanwhile being placed in a fresh cylinder; while depositing the eggs the females, as is the case with many other insects, keep up a noisy fluttering.

The duration of life in summer weather is eight days; but, as in all the stages of this insect, a higher or lower temperature quickens or retards vital activity, so it may be kept alive for three or more weeks at a temperature of 50° or less, as in November.

Each day the eggs are to be collected and kept in a separate parcel. A good mode of keeping the eggs is on blotting or filtering paper, on a square of glass and under a glass funnel, or in a glass tumbler having blotting paper inside and covered at the top: the object being to obtain an unvarying rather moist temperature of about 70° F., the blotting paper should be moistened in dry weather once daily, and a warm place be secured, but if the sun's rays fall directly upon the eggs, they run the risk of being over heated and dried; in this way many beginners lose their eggs.

The eggs will hatch out in from eighteen to twelve days or less, according to the temperature to which they are exposed: thus in 1865, eggs laid May 24th, commenced to hatch out June 11th (eighteen days); eggs laid June 6th, 7th, hatched 22nd, 23rd (sixteen days); laid June 25th—28th, hatched July 9th (fourteen days); laid July 7th, 8th, hatched 21st, 22nd (thirteen days); while eggs laid Sept. 1st, 2nd, hatched on the 13th, and others laid Sept. 4th, 5th, hatched on the 16th, 17th (interval twelve days).

Almost invariably the eggs begin to hatch out about 6 a.m., and continue to emerge in greatest quantity till 8 a.m.; after that time few come out till next morning, so that they require early matutinal attention, and if neglected at that tender stage will soon perish. It is, however, easy to calculate the day of their birth according to the temperature, especially after the first batch of eggs has hatched out; the exact interval required for their development thereby determined, the date of the emergence of future batches may easily be guessed at.

I subjoin a few calculations of the weights of eggs.

(1.) Aug. 4th. Various eggs laid 18th—22nd July, i. e. about fifteen days' old.

	No. of Eggs.	Average.
1 grain	39	39
2 grains	80	40
3	110	37
4	153	38
4	158	39½
4	156	39
5	195	39
6	230	38½

These eggs were taken out of a batch of 2,650; many of them were small, some addled; the weighing machine was an ordinary one, with glass receptacles, for weighing drugs, requiring to be suspended by one hand. This was the first trial made to weigh the eggs, and I believe greater nicety was attained subsequently, as the result of greater practice.

(2.) Aug. 30th. Eggs laid 28th, 29th Aug., total 608. These were a better specimen, being larger and healthier eggs.

	No. of Eggs.	Average.
1 grain	32	32
2 grains	66	33
3	101	34
5	170	34
8	272	34
10	324	32½

(3.) Out of 309 eggs, laid Aug. 29th, 30th, weighed on 30th.

	No. of Eggs.	Average.
1 grain	27	27
2 grains	55	27½
3	97	32
4	129	32
5	171	34
6	199	33
7	239	34
8	270	34
9	301	33½

(4.) Eggs all large and fine, laid Oct. 12th—18th, weighed Oct. 18th.

	No. of Eggs.	Average.
1 grain	27	27
2 grains	55	27½
3	81	27

It seems, therefore, that the number of eggs to the weight of 1 grain varied from forty to twenty-seven (compare M. de Roo's calculation, *ante*, p. 191). I think this is to be explained in the following way; the first moths that emerged were much smaller, and laid fewer eggs than those produced later in the season; their eggs, too, were certainly not so large as those laid afterwards; a larger proportion of larvæ also were observed to hatch out of the eggs laid later in the season. It would seem, therefore, that in selling eggs by weight, the finer and larger the brood the fewer they would be, while the more numerous the eggs the greater proportion would be lost before attaining perfection. I think most people would prefer having the smaller number but the finer eggs.

As to the number of eggs laid by a single female, I have the following observations: one ♀ of the second brood in 1863 emerged 26th August, coition took place that night, and by September 3rd she had laid 262 eggs in all.

1864.	July 4th—9th	..	1 ♀	laid	185 eggs.
	14th	..	1 ♀	,,	202
	21st	..	1 ♀	,,	290
	Oct. 29th—Nov. 8th		1 ♀	,,	246

				Eggs.		Average.
1865.	May 24th	..	1 ♀	laid 102	..	102
	July 7th—15th		4 ♀	,, 938	..	$234\frac{1}{2}$
	10th—21st		4 ♀	,, 835	..	209
	Aug. 24th	..	1 ♀	,, 238	..	238
	,,	..	1 ♀	,, 318	..	318

It would therefore seem that the number of eggs laid by individual females varies from 100 to 300 and upwards, and that the earlier in the season the insect appears the fewer the eggs laid. It would, perhaps, be a safe calculation to expect from 150 eggs to 200 from each female.

The number of males generally preponderates over that of the females; as, for instance, out of 104 cocoons in 1865 set apart for obtaining a second brood, by Sept. 2nd there had emerged thirty-nine females, forty-six males; from these thirty-five pairs were obtained. Subsequently nine females and six males were born between Sept. 3rd and 21st; from these but one pair was obtained, one cripple emerged, and two or three cocoons did not produce anything. From these 36 pairs 8,438 eggs were obtained, giving to each fertile ♀ an average of 235 eggs, or about 83 eggs to each cocoon. The males generally proponderate at the beginning, the females towards the end of the time of exit. It will therefore be impossible to obtain fertile pairs from all that emerge; some will be wasted at the beginning, some at the end of the season, some will be cripples.

Again, of my main crop in 1865 of about 600 cocoons, 563 moths emerged between May 22nd and July 27th; of these 230 fertile pairs were obtained; their eggs laid from May 24th to July 26th were 37,000 in number, or about 160 eggs to each female, and about 65 eggs to each insect.

The eggs are much larger than those of *B. Mori* (but that insect lays twice as many); they are about the size of the eggs of *Lasiocampa Quercus* or *Odonestis Potatoria*, are oval, equally large at both ends, white or greyish-white, and scantily marked with black spots or specks or streaks, owing to the particles of gum without (see Pl. XVI.). When the eggs are near hatching they flatten a little, lose their weight and assume a greyish tint, produced by the caterpillar inside; when empty they still are of a greyish tint; the shell is very hard and tough, it is difficult to cut it with a knife, and will resist a considerable amount of pressure; when deposited it is covered during the act with a thin gum, which binds it tolerably firmly to adjacent objects; when the gum is dry the egg may easily be detached by pressure, and, if placed on moist paper, will adhere to the paper as if originally laid thereon.

Various modes have been adopted to incubate the eggs; some retain them in glass vessels, others in boxes, some in muslin bags attached to the tree; in all cases a slight amount of moisture must be rendered to imitate nature. The simplest plan undoubtedly would be to place them in muslin or paper bags on the tree, sheltered by some cover from rain and weather, so that when the young worms are hatched they may at once eat the living leaf as in a state of nature; care must be always taken to number and mark the bags with the date of the deposition, and to keep all eggs of the same parcel as nearly as possible of the same date. Some have confined the fertile female among Ailanthus trees netted over, when she will readily deposit her eggs on the leaf-stalks; others gum the eggs on paper, and cutting out a certain number attach these again to the tree. I prefer, however, as more convenient and admitting of easier observation, the mode I have recommended of keeping the eggs on bibulous paper under a glass funnel in a warm moist spot; and the night before they hatch out pinning on the tree a little paper or muslin bag, containing not more than 100 eggs; the pin which fastens the bag should be pushed into the leaf-stalk just below the base of a leaflet, and the leaflet folded down into the bag and there retained by a second pin, so that the young worms on emerging at once crawl on to the tip of the leaflet, and being on its concave under-surface are protected equally from wind, wet and sun, and in a few days migrate further.

There is a reason why I have restricted the number of eggs to 100. I have frequently put more on, often 500, sometimes more than 1,000, but I have found that smaller quantities do better, because at first the young larvæ are very gregarious and the under surface of the leaf is so crowded that its green colour can scarcely be seen; it then happens that portions of the leaf are eaten off and fall to the ground, having small larvæ upon them, and these larvæ mostly perish. Again, if there is much wind, leaf chafes against leaf, and the larvæ at the edge fall down; also during their moults, if too numerously crowded, those backward to change are eaten off by their companions who have already moulted, and so tumble to the ground; once on the ground, very few when young reascend, but fall a prey to their enemies. Hence I advise not to put more than 100 eggs on a single leaf.

The eggs will not I believe retain their vitality during the winter, as is the custom with *B. Mori*. Indeed it seems contrary to nature that an egg, which naturally emerges in about fourteen days, should retain its vitality uninjured during six months' cold; however, I tried last winter to keep some eggs laid late in the autumn, in November; I placed them in a chip-box and exposed them out of doors to all weathers, but not one hatched out in the spring; so in the previous winter I placed some in ice, but they all lost their vitality. Similarly in Guernsey Dr. Collins tried, but failed, to keep eggs alive during the winter. Though *B. Mori* may have an advantage over *B. Cynthia* in passing the winter in the egg-stage, inasmuch as it can more easily be carried from one country to another, and obtains a lengthened period for the sale of the eggs, yet I am inclined to think that as regards English Sericiculture it is better to possess a species which, like *B. Cynthia*, passes the winter in cocoon. For protected as it is by a stout silken cocoon, it needs but little other protection from winter's frost and cold. Healthy and fine specimens emerged in the following summers, though exposed out of doors to the severe weather of 1863-4, 1864-5; it is possible that in the egg-state the insect may be less hardy. But further, the eggs of *B. Mori* hatch out and require food early in the spring; not so *B. Cynthia*, whose imago being the first to appear in the spring, more time is afforded for the development of the food of the larva; and whereas *B. Mori* requires sustenance in May and is killed by a temperature of 40° F. in the tender stage of the newly-born larva, the larva of *B. Cynthia* is not born till the end of June or the beginning of July, when the weather is warm and there is abundance of food.

The larvæ (see Pl. XVI.), when newly-born, are from $\frac{1}{8}$ to $\frac{3}{16}$ of an inch long, and of a pale light yellow colour; but soon after feeding, a number of black spots and dark-coloured tubercles, arranged in rings, become so conspicuous as to give the idea that the larvæ are black with yellow rings; after the first moult the yellow ground becomes more manifest, and they attain a length of $\frac{1}{2}$ to $\frac{3}{4}$ of an inch. Soon after the second moult they become greyish-white from the presence of a grey waxy powder secreted from the tubercles; the spots are a bluish-black; they now grow nearly to 1 inch in length. After the third moult the ground colour alters to a pale blue-green, with tubercles of the same colour; the spots, which are regularly arranged in four rows, remain of a bluish-black, while the head, feet and last segment are of a golden colour. After the fourth moult the larva has a length of $1\frac{1}{4}$ inch; the green colour becomes more intense, the extremities of the tubercles, the tips of the hind feet, the collar and parts of the last two segments become of a beautiful marine blue, while golden colour still adorns the head and hind claspers and the last two segments; the larva now eats enormously and attains a length of 3 inches to $3\frac{1}{2}$ and 4 inches when extended, with a thickness of $\frac{1}{2}$ an inch.

Now suppose the twelve days have elapsed and that to-morrow morning the eggs will hatch out,—how shall we best treat them? Undoubtedly I believe even if the weather be wet and windy, it will be easiest for us and best for the larvæ to put them over-night in little bags on the sheltered side of a sheltered tree as before described. If however we have not the means to do so, a similar plan may be adopted with a tree grown in a pot, and kept in a sunny window or a green-house: by so doing we avoid all trouble of feeding, and rear a larger per-centage of larvæ. The next best plan will be in early morn to lay fresh-gathered leaflets, say three or four attached to their piece of leaf-stalk, lightly over the newly-born worms; they will soon crawl on to this, and may be then carried and pinned through the leaf-stalk to a neighbouring tree. But if there are no trees to feed them on, then in all probability a much larger per-centage of young larvæ will die, as moist succulent food seems a necessity for them in their early life, and if treated as are the mulberry silkworms with leaves strewn over them, they will crawl on them, but wither away and dry up with the withering of the leaf, and from 90 to 95 per cent. will most surely die. Clearly then this plan will not do; but by plunging the leaf-stalk in water in bottles, or better still, by following the mode practised by Dr. Knaggs of rearing larvæ on common plates, or the before-mentioned wooden tops of the zinc cylinders, which without damaging their use as covers may have holes cut in them so as to allow the leaf-stalks to be plunged through into a jam-pot full of water below, the loss of larvæ will not be very great, provided they are kept in a cool moist place. The larvæ will not however grow quite so rapidly as when placed on the living tree and exposed to the sun-light and free circulation of air. They do not evince any desire to stray from their food, and therefore do not require to be covered over, so long as the food is fresh, but they will soon leave it if it becomes dry. The earliest born seem to be the largest and grow most rapidly, while there are generally, even from eggs laid on the same day, some that are not born till twenty-four and forty-eight hours after; these seem to proceed from the smaller eggs, which, possessing less vitality, produce a feebler offspring, like the last pig in a litter. It is perhaps just as well that these should die, for they then give no further trouble, consume no food, and as it were improve the stock by weeding out the sickly ones.

It is a curious experience to have hanging in one's Ailanthery, say a dozen bags of eggs laid on succeeding days, hanging on different trees, and to be able with certainty to point out to visitors in the evening a bag full of eggs and tell them to come in the morning before breakfast, and they will find the little worms spread over the under surface of the leaf feeding. There is a very curious satisfaction in witnessing the almost absolute certainty and regularity with which their growth and development proceeds, without requiring, as it would seem, any interference at the hand of man. But before describing that most interesting state of its existence, the larva, I ought, in order to render my allusions more clear, to describe my Ailantheries, or plantations of Ailanthus trees. Having changed my residence in March, 1865, I planted early in April 34 young trees of different ages, in 5 rows about 2½ feet apart each way, in a small walled-in garden about 20 yards from my house, having a south-east aspect and completely overlooked by the windows facing that way; a wall of 5 feet high enclosed two sides of the garden, and it was easy to look over the top of this without frightening away any birds that might be on the ground or on the trees. Of these trees two died and two more made but little growth, but I had 30 trees of sufficient luxuriance of foliage to place thereon the young larvæ. On these trees I placed about 18,000 eggs for my first brood, beginning July 17th with eggs laid from July 1st to July 10th; these hatched out and passed through their first two moults in this nursery and then, beginning August 3rd, were transferred to the larger Ailanthery, where they finally fed up and spun their cocoons. The nursery was not covered in or protected in any way, except that in order to prevent the ants from getting at the young larvæ (which they will carry off), I surrounded the stems of the trees with cotton wool; this, however, proved a great embarrassment to those larvæ which fell to the ground, as it hindered them from re-ascending the trees, and I shall not repeat it another year, though I must add I did not see any ants about the trees till after the cotton wool was all gone. It is however just possible that the cotton wool operated as a protection to the silkworm in an indirect way. For, watching over the dwarf wall and from the windows of the house, I frequently saw sparrows who had occupied some nests which the swallows built under the roof (having driven those birds away), fly down hastily to the little garden, pick off a piece of wool and return to their nest. It may be that their attention was fixed upon cotton wool, and a guilty sense of thieving hurried their actions, so that they failed to observe the young larvæ feeding just above their heads; anyhow, I never could observe that they committed depredations on the larvæ, though I frequently watched them by means of an opera-glass for the purpose of detection.

The larger Ailanthery was planted on a narrow strip of ground about a rod wide, running for half a mile along a branch of the Great Eastern Railway. Just after the branch leaves the main line, it makes a sweep back towards the town of Colchester; in this sweep, protected from the north and open to the south and west, runs a narrow strip of ground, intended for a second set of rails when needed. Here were planted in 1863, in March, 3,000 two-year old Ailanthus trees obtained from France. About 700 were lost that year, owing to the prolonged drought in the spring; the rest made little progress that year. The soil is a deep rich loam, very sticky and plastic in wet weather; the trees were planted 2 feet apart, in rows some 2 feet distant, some 3 feet, some 4 feet. Of these trees about 1,340 were sufficiently luxuriant in 1865 to allow of a crop of silkworms; many of their shoots were from 6 to 8 feet along, and an inch in diameter. Hither the young larvæ, when half-grown, were brought down in boxes, and distributed over the plantation, allowing from 5 to 10 to each tree according to its luxuriance. In order to convey them, the entire leaf on which they rested in the morning was cut off the tree, and the leaf-stalk cut up into lengths, depending on the number of worms thereon; these lengths were placed in boxes and carried down, then a pin was thrust through the leaf-stalk of the cut leaf into the stalk of a living leaf, and the larvæ soon migrated from the dead to the living foliage. In practice the process was easy and entirely done by a boy of 12 years old, who was installed as sole attendant at 6*d.* a-day wages, during the season. It was desirable to choose a fine morning for this process, as sunshine rendered the worms active, and desirous of fresh food. It was necessary afterwards for a day or two to go over the ground carefully, and pick up any that had fallen down, and it was also found necessary to have paper or muslin bags pinned to the trees, wherein to place any larvæ which were then changing their skins, or which had crawled away from their cut leaves on to the box.

With the exception then of the cotton wool placed round the trees, there was no attempt at protection in any form for the silkworms. From my experience in 1865, I think that a covered-in-nursery for the protection of the worms during their early stages would be highly desirable and likewise economical, in lessening the ravages of their enemies and of bad weather; and I purpose another year (and I recommend others to do the same) to cover over with canvass the trees intended for a nursery.

I am convinced from actual observation, first, that from 15 to 20 per cent. of the eggs laid in 1865 never came out, since having examined three different lots of 100 each I found severally 19, 16 and 15 eggs unfertile; secondly, I believe that a very large proportion, probably half of the larvæ hatched out, perished before leaving the nursery, partly from my want of skill in managing their early stages, partly because they were too crowded on the leaves, but mainly from attacks of spiders, lady-birds, earwigs, &c., &c.; whereas I believe from constant observation that if the loss in the large Ailanthery was calculated as between two and three thousand, it would be greatly in excess of the reality. My eggs which were laid on July 1st and successive days began to hatch out on the 13th of the same month; but it was not till the 25th July, by which time 10,000 eggs were hatched out, that having tried various modes of establishing the young worms on the trees, by the advice of Dr. Maclean, a very observant and astute naturalist, I hung up my eggs in paper cots on the trees, thereby effecting a considerable saving in life, labour and time; for the preceding batches of eggs had been deposited and hatched out upon papers, which, the leaves of the trees being tied up in a bunch, were deposited therein, whence, if much wind arose, they were violently ejected, and the baby worms scattered on the ground; again, many of the worms never left the papers, and so were starved to death. Another mode which I adopted, when I had but a few to deal with, was to dip a stiff badgers-hair brush in water, and, passing it under the young larva, detach him with a jerk and deposit him on the leaf of the living tree placed in a pot, but in this mode also a great mortality ensued. I found that a violent wind also detached many from the leaves, by inducing friction of one leaf against another, so that the worms rubbed against soon fell off. I have observed too that after much wind, generally among older larvæ, some few are found with discolorations on one or two segments as if bruised, and these subsequently die. Doubtless therefore a great mortality ensued among the young larvæ owing to my inexperience and meddlesome manipulation.

But to return to the young larvæ: till after their second moult they are gregarious, the under surface of the leaves is sometimes completely hidden by their numbers; they feed and grow rapidly, but comparatively less so during their first stages than after their last moult; they pass through their first moult of skin in from 7 to 10 days after birth, and become of a light-yellow colour, whereas after birth their dark rings give them a dusky look; their second moult takes place 5 or 6 days after the first, and they now secrete from their tubercles a waxy powder, which throws off rain; they undergo their third moult in about 6 days more, they then get very powdery and assume a greyish-blue colour, the tubercles are studded with the white powder, and they look, especially by moon-light, like huge sugarplums; another 6 days brings on another moult, their last before spinning This period is a very critical one; immediately after this change the larva eats enormously and grows very rapidly, increasing in size as much as sixfold in 9 days, and it is now that the formation of silk takes place within the two elongated and convoluted tubes situate one on each side between the tracheæ and intestinal canal. The larva is peculiarly hand-some in this its last robe; and it seems strange that, conspicuous as it becomes while resting at the end of a leaf-stalk which it may have denuded of foliage, it does not seem to be noticed by passing birds. It is especially common at this period of their growth to see a tree one day covered with foliage and bare the next, while the voracious larvæ are gnawing down the tender ends of the leaf-stalks or are wandering off to other trees in quest of food. It is a startling surprise to see one day bare leaf-stalks where thick foliage existed 24 hours before.

Now and during the spinning-time an Ailanthery presents a most lively and animated look, huge fat larvæ 4 inches long are seen feeding away right heartily, others are resting, preparing themselves for their last effort, others already have begun their cocoons. At a coup-d'œil in a space of 20 yards you may see hundreds of these fine and beautiful creatures in a state of nature, unprotected and completely exposed to the glance of every passing bird, and it was most surprising to me that they did not attack them; yet I never saw a bird in my Ailanthery, except on one occasion when I started a thrush out, though I saw hundreds of sparrows in the adjoining fields, and though blackbirds and thrushes were numerous in the neighbouring gardens. I would on this point offer a few remarks: 1st, being by the side of a railway the noise of passing trains might operate to keep some birds at a distance; 2nd, being a new crop the birds may not have found them out or have become sufficiently acquainted with their habits and the foliage of the Ailanthus tree to look for them in plantations of those trees. I would moreover add that the fact of changing their head-quarters from the nursery to the larger Ailanthery must operate against their being found out by the birds; for, supposing that a young colony is hatched out, it might and probably would be some days before they were found out by the birds; then if they were moved off to another spot at a distance, the same birds would never find them again, and the birds of the new locality, never having seen larvæ on Ailanthus trees before, would be slow to look for them there. But I think they are not attractive to birds, except to the tomtit, robin and rook, two of which are very mischievous, and all three naturally very destructive to insect life. The tomtit may be avoided by avoiding plantations and trees which these birds frequent; the robin will be found only near houses and farms, and the neighbourhood of rookeries may likewise be shunned. But there are other reasons why birds probably will not ravage the larvæ to the extent which many persons might fancy. For it would be well to avoid carrying on extensive rearing of larvæ in early summer, when sparrows, &c., are in great quest of larvæ for their brood. There are also two other great inducements to postpone Ailanthiculture to a later period: 1st, because there is in June a scanty foliage on the trees compared with the luxuriance of August; 2nd, the moths of an early crop would probably emerge in the autumn and their eggs consequently be useless. It will therefore be wise to postpone the main crop till midsummer, and I should prefer to commence when the cherry season begins, an event which always attracts all birds towards gardens, and will therefore leave the Ailantheries pretty quiet.

This will be the month of July, which in my opinion in this country is the best time to commence Ailanthiculture; the early stages of the larvæ are then commenced in the cherry season, and the later stages during harvest; during the middle stages, the silkworm being no longer gregarious is scattered over the trees, and being of moderate size is less conspicuous and likely to escape detection. The weight too of the foliage is continually increasing up to the end of September, so that the largest crop of cocoons may be obtained by beginning in July, and putting on relays of larvæ, without actually having two generations.

For the development of the insect is so very readily accelerated or retarded by a higher or lower temperature, that it would be perfectly easy to ensure, after a little practice, a succession of moths to come out every day in the year, by exposing the cocoon to artificial heat or cold. Hence without absolutely having two generations, we might allow the trees to obtain considerable vigour during May, June and half July, before placing any worms thereon; the shoots will then be four feet or more high; then for the first three weeks of the life of the insect the trees will grow faster than the larvæ can consume the leaves; during their third stage the larvæ eat more, and during their last stage, which would be the end of August and beginning of September if the eggs were laid July 1st to 14th, the trees may be completely stripped. A slight growth of young leaves at the top will subsequently take place, from six to eight leaves being emitted, sufficient to enable the tree to recover from the check which it has received from being denuded of foliage.

For it must not be imagined, as many relate, that the tree throws out the more vigorous and luxuriant growth, in proportion as it has been fed down by the larvæ. The late Mr. Knight, the celebrated horticulturist, laid it down as an axiom in horticulture, that the growth of a plant is in proportion to the amount of foliage exposed to sunlight; it follows then that of two trees, one being fed off by larvæ, the other untouched, the growth of the latter will be far greater than of the former; this is exactly what I have observed during the past summer. Where the larvæ were placed so thickly on the trees as to create a complete denudation, the growth for the year, though luxuriant, was not nearly so luxuriant as of those where the silkworms were placed on sparingly, while trees which had no larvæ placed on them grew more luxuriantly than either. That the trees do receive a check from having their foliage eaten is in accordance with nature and with the result of these comparisons, notwithstanding any assertions to the contrary. It follows then that as our object is to attain each year the greatest amount of luxuriance of foliage to be consumed as food by silkworms and transmuted into silk, we must so manage as to give the least possible check to the growth of the tree. If now we propose to have two crops as in France,* our first crop must be placed on the trees in early summer (June and July), and the first vegetation will be fed off the tree while it is yet young and by comparison small; a check follows, in another six weeks or two months a fresh vegetation is ready for the silkworms again to be fed off. I am convinced in my own mind that by this means a loss of luxuriance occurs, and that a far greater weight of foliage in this country would be obtained by allowing the tree its full growth till August and September, and then placing on it the larvæ half-grown. In this way for three months the tree is in full vigour of vegetation; its roots are spreading, its foliage massive, its trunk increasing in size, its vigour so superabundant as then not to receive harm from an entire denudation of leaves, while a second growth of leaves appears, after the worms have spun their cocoons, sufficiently vigorous to make up for the check it has received. Moreover, it is evident that the labour and cost required for the one crop will be much less than that required for two crops: nevertheless, experience may probably teach in time, that on some warm and sunny spots two crops may pay better than one.

With reference to their enemies: when small, ants carry them off—this was much complained of by Lady Dorothy Nevill, and also was observed by Mr. Calvert of East Bergholt, Suffolk, as occurring in his Ailanthery; I suspect the *Formica rufa* would prove a formidable enemy. Still it is an easy matter to destroy ants' nests in the neighbourhood of Ailantheries to such an extent that the loss from them would be slight. Spiders, earwigs and lady-birds (?) prey upon the young larvæ, wasps find them out when half-grown, (i. e. before they become greyish-white), and carry them off. To avoid all these enemies I suggest that a nursery be formed for the protection of the young larvæ till near their third moult. The nursery should be covered in with canvass or other material, having a mesh so small that these enemies would be excluded. One tree in full vigour ought to nourish at least 5,000 larvæ up to their middle age; I fed last summer more than 1,000 larvæ up to middle age on a tree planted last March, which consequently had attained a very moderate amount of luxuriance.

Carabi and other *Geodephaga* will destroy the larvæ. I was much vexed in the summer of 1864 to find some of my finest

* In the Revue de Séricicultnre, 10th December, 1865, M. Méneville states that he obtained in his laboratory, in the summer of 1865, four generations of *B. Cynthia*, and that the last generation had produced eggs, so that a fifth brood might have been attempted, but it was feared that the cold of October would destroy them.

larvæ, when nearly full fed, mutilated in a very strange manner; they were resting on the leaf as usual, but with head erect and face looking black. On closer inspection I found the face eaten away, nearly gone, and a brownish ichor exuding from the wound; in a few days they died, starved, being unable to eat. I was puzzled for some days, but observing that this always took place in the night, and that I never found any larvæ so attacked in the day-time, I suspected a new enemy other than I knew of. Taking my lantern I sallied out when dark to make a close examination; I found the common large garden *Carabus violaceus* fastened to the face of a larva sucking its juices; whether it selected that part for attack I know not, but I am inclined to think, from the habit of the larva to turn round and face any object which touches it, after the manner of the larva of the puss-moth, and even to open its jaws as if to bite, that when the *Carabus* approached the larva, it presented its face as if to attack and was then pinned by the *Carabus*, who when he got his jaws in would soon suck the juices, which exude very freely. This enemy was very quickly and easily got rid of. I sunk some pots in the ground and placed therein pieces of meat as baits; the *Carabi* came in numbers, tumbled in, and could not get out. Other insect enemies are various parasitic *Diptera*, which lay their eggs in the body of the larva; one is a species of *Tachina*, another a larger, and another a smaller fly. It is also asserted that the ichneumon of the common cabbage-butterfly will deposit its eggs in the body of the larva of *B. Cynthia*, but this I have not observed. With reference to these enemies I would make this observation, that when acres of ground produce thousands and millions of cocoons the loss from these enemies will be comparatively trivial, because it will always be worth while to examine the cocoons soon after they are completed, it being an easy matter to detect the sound from the unsound; and those which are ichneumonised will be so treated (probably at once sent to be wound off) as to ensure the death of the parasite. Furthermore, it is highly probable that the habits of these parasites may not sufficiently coincide with the habits of our larvæ to enable them for succeeding generations to establish themselves as regularly parasitic on *Bombyx Cynthia*.

I said it was easy to separate the sound from the unsound cocoons: it is done in this way; first, the silk of the unsound cocoons is darker, often of a dead rusty-brown colour; secondly, the cocoon is often much softer; thirdly, when shaken fourteen days after its commencement, the pupa within does not rattle; this is an unfailing sign of damage. I have repeatedly found cocoons which gave no rattle when shook, and almost without exception I have found that damage had accrued to the larva within, generally from parasites, which had prevented the change into pupa. One remarkable instance I met with: I tried the pupa, it was softer and browner than usual, and did not shake; I inferred a parasite. Before however cutting open the cocoon I tried another plan; I manœuvred the end of a pencil so as to get it within the opening of the cocoon, which by-the-by is much more difficult to manage in a sound than in an unsound cocoon, and I found it to impinge at once on a solid round body, giving a sensation similar to that presented by a pupa; if a shrunken larva be within the cocoon the sensation of impingement is quite different and the pencil goes in further before impinging: being puzzled I cut open the cocoon and found therein a pupa-case, not however of the usual light yellow-brown colour, but darker and crackling to the touch; it came apart and a yellowish-white parasitic larva was within, elongated to a point at one end, occupying nearly the whole of the pupa-case. I have kept this parasite, hoping to hatch it out, but the test of shaking the cocoon fully disclosed there was mischief within. I am not clear whether these cocoons are of equal value for winding purposes with the sound cocoons, but I incline to think they will turn out to be of less value.

Amongst birds, tomtits are the most destructive; they plunge their beaks inside the larva, making a hole at the side, and suck thence the juices; thrushes are reported to do the same. Mr. Calvert tells me, that a robin created much havoc in his Ailanthery; and Lady Heathcote writes, that a flight of rooks discovered her Ailanthery one morning and carried off some fifty larvæ, which were on small stunted trees. Probably too sparrows would commit depredations, and magpies be mischievously inclined. The starling and jackdaw are to be feared. Still I am inclined to think that by choosing a time in summer when there are other and greater attractions for birds, by the use of a gun and of scarecrows, by avoiding the neighbourhood of rookeries and plantations where tomtits abound, and by limiting the time as much as possible during which the larvæ are "en plein air" without protection, a crop may be harvested without much loss from birds.

Another serious enemy to this larva is a disease which I observed last summer, coincident in point of time with the occurrence of the potatoe disease, during the prevalence of very heavy and prolonged rain for a period of nearly three weeks from August 10th to 28th; the ground was previously very warm from the prolonged drought and heat. The disease was first observed on the 19th of August, which was a warm sunny day, but the preceding days had been rainy and stormy, with one or two cold nights and north-west winds. I quote from my diary: "about six larvæ were either found on the ground, or were hanging from the leaf-stalk, head downwards, clinging by their hind claspers; they were of a pale lilac tint, soft, slightly livid, some darker-looking, more sanious, these had been in process of passing through their last moult; some of those still feeding-up looked pale and livid, these subsequently fell off and died, previously turning livid, and if squeezed emitting a sanious black gore; they seemed, too, when alive, colder to the touch than was natural." The larvæ which were between their second and third moult, also those which had passed through their fourth moult and had fed afterwards, seemed to escape this epidemic, but the malady chiefly attacked the larvæ which were undergoing, or on the eve of undergoing, or had just undergone, their last moult; hence I conclude this to be a critical period for the constitution of the worm. I find, too, this note: "In the garden near the house a larva, which had been since the 23rd instant moulting for the last time and completed this change on the 26th instant, not having fed afterwards, was found soft and dead on the ground on the 27th." Hence I infer that if the period of moulting, owing to the weather, be prolonged beyond the normal period, a great loss of vitality and a tendency to death ensues. After the 28th no more deaths from this disease were observed; at that time the weather again became warm and sunny. I calculated that at least 200 were lost from this disease, which lasted about ten days, during which time I picked up about twenty a-day, but it is quite possible that some escaped my observation. I ought to mention that some parts of my plantation were severely visited by this disease, others scarcely at all affected; that the former portions were in close vicinity with potatoes which had been planted in rows between each row of Ailanthus trees and in some interspaces, and just at that particular time the disease attacked the potatoe haulm, and I had the haulm pulled up and gathered in heaps. At a distance from the potatoes there were scarcely any instances observed of diseased larvæ; but, on the contrary, the larvæ on those trees which were nearest to the heaps of decaying potatoe haulm were nearly all destroyed by this singular epidemic. I am, therefore, inclined in a great measure to attribute it to a vitiated atmosphere permeating their tracheæ and poisoning their blood juices at a critical time when they were weakened by the prolongation of their last moult. This one thing

I am quite clear upon, that I plant no more late potatoes near my Ailanthery. A similar epidemic attacked other larvæ in the same spot, for I found outstretched on a plantain leaf the larva of a *Noctua* which had evidently perished in the same way: it was cold, porrected, stiff, easily ruptured, and emitting a dark-green sanious fluid. Mr. Calvert, of East Bergholt, found some of his silkworms affected in a similar manner. And this epidemic appears to be identical with that which was observed to attack many worms at Lady Nevill's, at Dangstein, and which destroyed all the larvæ of *Bombyx Yamamai* when just commencing their last moult. At Dangstein, too, I found on inquiry that potatoes had been planted near the Ailanthery, and that these potatoes had been much diseased.

It would seem therefore that at the last moult these larvæ are especially susceptible of cold winds, prolonged rain and epidemic influences—another argument for so distributing the crop over a moderately-prolonged time, that if one portion of the crop was affected, the rest would escape.

It would not be safe to conclude from the experience of merely one year obtained from a few localities; nevertheless, I may express an opinion that, so far as I have seen, the loss from weather and enemies would not be large enough to be felt in this country, wherever acres of land are planted out for Ailanthiculture.

While the larvæ are feeding-up, the ground should be kept quite clear of weeds, so that if any larvæ fall down, they will not be diverted from the trunks of the trees by the stems of any weeds; otherwise they would crawl up on the nearest plant, and, resting there, commence feeding, and subsequently perish. It is a common custom to plant cabbages, potatoes or other vegetables among the Ailanthus trees for the sake of economy; I am convinced it is a mistake, I myself fell into that error, and thereby lost a great many larvæ which fell from the Ailanthus trees and never got back again; whereas, had there been no other shelter near, some would have crawled back again up the stems of the trees. And we may here note a beautiful instance of the adaptation of the tree to the larva, in the emission of numerous suckers: the roots contain a great many dormant eyes or buds, and wherever they get injured, an accumulation of sap takes place for the purpose of healing the wound; the dormant buds in the neighbourhood of the wound thus receive an extra supply of nourishment, and in moist weather young shoots are emitted: these young suckers serve to conduct the young larvæ which have fallen on the ground back again to the trees, as their lower leaves are in close proximity to the ground and their upper leaves approach the foliage of the parent tree.

It has been asserted that the food of the earthworm consists entirely of earth. I am fully convinced that the earthworm is a great enemy to the young larvæ which fall: it is, however, very difficult to catch a worm in the act of destruction. On moist nights I have gone out to visit my Ailanthery with my lamp (which is possessed of great reflecting power), in order to observe whether any enemies were busy, and I have frequently noticed young larvæ lying on one side on the ground, and a worm hastily withdrawing into its hole. On examination the larva has been found pierced and partially sucked. This has so often been observed that I have no doubt that the earthworm is a great enemy to the fallen larvæ. And I was, therefore, always careful the last thing before dark to pick up and replace on the tree all fallen larvæ. On still days very few larvæ fall, but on windy days, from trees which are fully exposed, many worms are dislodged by the friction of the leaves against each other: hence it is very desirable to afford an artificial shelter from violent winds, as by planting Jerusalem artichokes, &c.

The times of feeding of the larvæ vary much with the temperature; I have observed them to feed at all hours of the day and night. With a high temperature, especially in sunshine, they are actively engaged moving about and feeding, but become torpid when the temperature falls below 55° F. They always keep on the under surface of the leaf, and do not leave one leaf till they have consumed it; they generally, when moving, ascend from a lower to a higher leaf, except when nearly full grown, when there is a great tendency exhibited to seek the lower leaves and spin up inside these. As far as I could observe they are partial to moisture, and have seemed, when very young and shrunken for want of succulent foliage, to be benefited by being sprinkled with water; so, too, on dewy nights and early in the morning they feed with great avidity on the moist leaves.

The most interesting period, in which all the hopes of the crop culminate, is the spinning time. When full fed, that is, about nine days after the last moult—during which time an enormous appetite has devastated the foliage and rendered it necessary, in all probability, to remove some of the larvæ to fresh trees—the tubes containing the silken gum have been filled, and a great increase of size has been obtained; the larva now ceases to eat, remains motionless for forty-eight hours, during which it empties its abdominal canal, the "frass" or *excreta* becoming moister and paler-coloured, longer and conically pointed; after this a viscid, clearer fluid issues from the anus, the last segments of the body being porrected for that purpose; the waxy powder is no longer secreted, the caterpillar assumes a yellower tinge, is slightly shrunken, and proceeds to find a site for its cocoon. Owing to the large size of the full-grown leaflet, one would serve for the purpose of several larvæ, so that we frequently find two or three cocoons on one leaf; generally, however, they choose a medium-sized leaflet, and commence their foundation (which subsequently becomes what is called the envelope) on the upper surface of the leaflet; frequently, however, they crawl to the end of the leaf, where several young and small leaflets are in close proximity, and there, commencing on the under surface of these, they connect several together. They seem especially partial to the very lowest leaves, and many cocoons were there spun, some close to and touching the ground. When the ground-work or outer envelope has been commenced and coarsely spun along the upper surface of the leaflet, the larva traverses the leaf-stalk towards the bough, spinning around it a silken tube six inches or more in length. Should it arrive thus at the stem of the bough it fastens around it the end of the tube and then returns to the ground-work, spinning as it goes back; this silken connection between the cocoon and the tree on which it hangs is common to many of the *Bombycidæ*, and is equally spun whether the cocoon is formed on the proper leaf, or on a leaf of a weed or Jerusalem artichoke or celery, or is formed in a paper bag, and is evidently spun by design, that when the time comes for the leaf-stalk to fall the cocoon may still hang secure on the tree, being suspended by the silken thread, and be there more safely protected from enemies, especially from mice, than if allowed to fall on the ground. Another purpose is gained by the insect in suspending its cocoon, viz., the imago is the better enabled to expand its wings after its exit from the cocoon, which, as I have before observed, is best effected when the moth creeps down to the base of the cocoon and there places itself with its wings folded downwards over its back, so that their own weight helps them to attain their full size.*

Having first made a ground-work on the upper surface of the leaf and completed his silken rope, the larva now returning to the envelope strengthens it by stronger threads or shrouds, fixing them across the leaf obliquely, so that when the gum dries the thread contracts, and the leaf is observed to be curled inwards; the larva

* Vide *supra*, p. 202.

is seen occasionally to take the edge of the leaf in his jaws at this stage, and pull it towards him, evidently to curl it the more. It then, as it were, lays another coat of a strong substantial nature on the envelope, and fills in with an open network the space between the curled edges of the leaf. That is the work of about twelve hours, and if we visit the larva early the next morning, we find the leaves still more curled, and the network more filled up, so that the larva can but just be seen at work within. At this stage the appearance is very beautiful; the silk is of a very pure white lace-like appearance, and sufficiently open to allow of the bluish-green workman to be seen within; soon, however, the covering thickens and we lose sight of him, though we hear his incessant movements for several days; in about thirty-six hours from the beginning the larva is hidden from sight, and the silk begins to turn brown, mainly, I think, from an exudation issuing from the anus of the larva, for the cocoon is now observed to become very soft and wet, especially at the base; this dries in twelve hours, leaving the cocoon of a browner colour but much harder; it may now be handled or even gathered without fear of injury to its inhabitant. It is this exudation which, valuable as a preservative to the cocoon, rendering it capable of transportation and contributing to its preservation from the attacks of enemies and from winter's cold, yet throws a difficulty in the way of reeling the silk. This gum must be got rid of before reeling can be done, and one of the difficulties is to find a solvent which will get rid of the gum without deteriorating the quality of the silk, and at the same time render the manipulation of the cocoon easy for reeling. For several days the larva may be heard at work lining and relining the interior of the cocoon, which in time becomes quite polished and hard, and when dissected the cocoon may be taken off in layers or skins, as if skin after skin was added inside till the work was done. These skins are sometimes seven in number.

During the process of spinning, we gain an insight into one of the purposes of the tubercles. Nature doubtless never constructs without a purpose, and often two or three ends are served by one construction; during the growth of the larvæ the spines and tubercles keep off the wet and prevent injury from external contact, and the tubercles likewise secrete a waxy powder which, besides keeping the insect dry, serves probably to deter its enemies; but during the formation of the cocoon the tubercles are seen to be of great use, in keeping the silken threads at some little distance from the body of the larva, thereby allowing necessary room for movement, for as the silken threads contract they would, were it not for the tubercles, close so tightly round the body of the larva as to prevent it from completing its work; but observation of the insect during this process shows that the tubercles not only keep the silken threads away from the body, but further promote movement by acting somewhat as feet; hence the larva obtains freedom of movement within its case, and is able to continue its work for nine or ten days, after which period it remains quiescent for a period and then slips its last skin over its body, much in the same way as it has done in the previous moultings, and becomes a pale yellow soft pupa, which soon hardens and turns brown. Before completing this last change but one, the larva assumes a curious and rather beautiful appearance; it seems shrivelled and contracted in length, the tubercles approach close together, and both extremities are somewhat recurved; the colour is of a vivid green, tipped on the tubercles and feet with a deep blue. So shrunken and lessened it seems as to suggest the idea of death, but the change into the pupa form soon assures us that all is according to nature.

It not unfrequently happens that after beginning a cocoon the work seems to proceed irregularly and unequally, and the cocoon is then either abandoned or after much labour and pains turns out an abortion; sometimes the larva has been disturbed by the approach of other larvæ, endeavouring to eat up the leaf which he has selected; sometimes he begins badly, either on the wrong surface of the leaf, or on too small a portion of a leaf. In such cases, where it is evident that a mistake has been made, if the work has not gone very far it is best to remove the larva to a fresh and suitable leaf, where he will again commence; if however much silk has been emitted, it will be better to take the larva away altogether, and place him in a paper cot, or piece of brown paper crumpled up, when he will generally spin a slender cocoon and go through his changes.

After the cocoons are hardened, so as to stand a considerable amount of pressure, they may be gathered if required; to do this it is only necessary to cut the cable which attaches the cocoon to the leaf-stalk, leaving a sufficient base of cable to permit the threading-needle to be passed through it without involving the cocoon; the cocoons may be placed in baskets and housed. They would hang in safety all through the winter on the trees, but as most people desire to house and secure a crop as early as possible that they may estimate its value, so probably Ailanthiculturists will seek an early moment to harvest their cocoons;

in such a case if the autumn temperature be warm, probably many of the early cocoons will produce moths in September and October, whose produce will be valueless, as the eggs cannot be kept alive through the winter.

The cocoon (see Pl. XV.) is of an elongated flask-shaped form, of a colour more or less pale grey, verging into light grey-brown, but occasionally of a rusty brown, especially in the earlier and later cocoons; of very close texture, from $1\frac{1}{2}$ inch to $2\frac{1}{4}$ inches long and about $\frac{3}{4}$ of an inch broad, in girth $2\frac{1}{4}$ inches, varying in size and weight according to the health and size of the larva; hanging pendent from the leaf-stalk they frequently measure 4 inches from the stalk to the lower extremity of the envelope.

There are two classes of cocoons which furnish silk: one the closed cocoon, of which the type is that of the *B. Mori*, spun equally all round, requiring to be unwound before the moth emerges; otherwise the moth emits a fluid from its mouth for the purpose of dissolving the gum which binds the silken threads together, and makes an exit between the diverging threads, and the cocoon, being left with a hole in it, becomes useless, as, in the common method of reeling, the hot water enters the cocoon at the hole, renders it too weighty to revolve, and the thread breaks during the process.

But the second class of cocoons, which is a very extensive one, and to which *B. Cynthia* belongs, has hitherto been much neglected by the reeler, because of his ignorance how to manipulate successfully cocoons with a hole in them. These cocoons are so constructed that an aperture is left at the apex for the exit of the moth, and are therefore bottle- or flask-shaped cocoons, "naturellement ouverts;" the threads at the apex, which form the exit hole, are not broken off by the larva in the process of spinning, but are doubled back in a continuous thread; the larva may be observed during the process stretching upwards the head, fastening a thread and retreating with it as far inside as he can stretch, thus doubling and redoubling the thread by a series of loops. These loops are set in layers, of which there are several formed at different periods of the work, corresponding to the different skins; they may be dissected out of the cocoon, when it will be found that being in a continuous thread, there is no real impossibility, but only a mechanical difficulty presented to the reeler who wishes to wind these cocoons. Further it will be noticed that these layers of looped threads are so grouped one inside another as to present a very great obstacle to the entrance of an enemy, *e. g.*, an earwig or a tomtit's beak; they are not only very strong, but being folded inwards and connected low down, they present a series of cul-de-sacs, in which any object penetrating would be at once involved and entangled; the silk too is very close and tough and requires considerable force and perseverance to rend it. Hence, though I have cocoons which have been attempted by tomtits, earwigs, *Carabi*, &c., I have not observed that they ever succeeded in gaining an entrance into a normal cocoon, though they might readily penetrate the slight cocoon of a weak and sickly larva. Lastly, these loops all presenting inwards are easily pushed back and opened outwards by the insect when making its exit, and they likewise prevent the pupa-case from following the newly-born imago. When the insect has emerged it is very easy to recognise the fact, as the cocoon is much lighter in weight, some of the flue from the body of the moth is retained at the exit hole, and the latter is considerably dilated and now admits the easy entrance of a pencil or probe, &c.

In about 10 or 12 days after commencing to spin, the larva changes into a pupa, and then the cocoons may be strung up in chaplets, care being taken, by shaking each cocoon, to test the presence or absence of parasites; those cocoons of a darker colour than usual, not a bright rusty brown but of a dingy hue, should be suspected and carefully examined. Some time during the autumn many of the parasites will emerge, but not all. But I recommend that all doubtful cocoons be at once boiled to kill the parasites, and then reeled.

The duration of life in the egg state varies from 10 to 18 days, according to the temperature; in the larva state from 30 to 60 days; in the pupa state from 3 to 4 weeks in autumn, or during the whole winter; in the imago state it is 8 days.

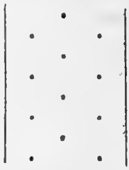
The finer the insect the longer time will it require for growth.

Introduced into France in 1856, the success of Ailanthiculture is now sufficiently attested by the experience of successive years. In England no one, so far as I am aware, except a Mr. Mongredien, who has an extensive young Ailanthery at Bratton Clovelly, North Devon, had on a large scale, prior to 1865, attempted Ailanthiculture "en plein air." It had been demonstrated by Lady Dorothy Nevill and others, that the tree and insect throve well in our climate, but it was feared that birds and other enemies would create such havoc as to render the crop precarious, and this seemed likely from experiments carried on in gardens on a small scale, a state of things manifestly very different from that under which Ailanthiculture must (if ever) be carried out in this country as an industry. Acres and acres will be planted with Ailanthus trees in the open air, away from woods, plantations or dwellings, either on extensive commons or wild heaths, surrounded by meadows or arable land, or on railway banks; these situations present a variety of external features totally dissimilar from those of garden Ailanthiculture. Hence it was felt that the latter could only be tentative as showing some of the difficulties likely to occur on a large scale; while again it was clear that losses from birds, wasps, &c, though fatal to the success of Ailanthiculture on a small scale, would be in considerably less proportion when larvæ might be counted by thousands and millions.

The experiences in 1865 of four Ailantheries will be recounted for the purpose of comparison and of affording some insight into the probabilities of success.

Lady Dorothy Nevill, of Dangstein, Petersfield, has about forty trees, of which three dozen are in full bearing, covered over with netting; here from 7,000 larvæ she obtained about 4,000 cocoons of the first brood, and the gardener expected there would be about 1,000 more cocoons of the second brood, many of which were spun-up by the last week in September. During the two preceding years I believe her ladyship has reared about 4,000 cocoons annually. Here we find that a tree will produce about 100 cocoons when in full bearing and planted in good soil; these trees are planted I believe a yard apart each way in three rows. Protection in the form of netting was rendered necessary in this garden owing to the numbers of tomtits which came from the plantations surrounding the house and garden, and which would even tear through the netting if a larva inside was near enough to be visible.

Lady Heathcote writes from Hursley Park near Winchester, as follows: "In 1865, the moths began to come out at the end of April, but I had no fertile eggs till May 26th. The caterpillars hatched on the 8th and 9th of June, and were put out on the 19th, altogether about 1,600; from which I gathered rather more than 800 cocoons. This shows I think a greater loss than ought to take place, but it arose in a great measure from the trees being young and unfit to keep so large a number, so that the caterpillars crawled off in search of food and many were lost. The second crop of moths began to come out August 15th, and the caterpillars were hatched the end of August, 2,000 or 3,000, and were put out from September 1st to 16th. The season was magnificent. The worms throve rapidly until the weather changed, just as they ought to have begun to spin up. About the 9th—10th October wet weather began; they seemed as if paralyzed and would neither eat nor spin, or at best wasted their silk by beginning a cocoon and leaving it unfinished. About thirty cocoons were gathered out of doors, and as many more were got from worms brought into the house as an experiment; most of those brought in revived and began to spin directly, but others were unable to do so. Most of these cocoons of the second crop are inferior in size and are darker in colour than those of the first crop. I think from the experience I now have had that it will not answer in this country to attempt to raise a second crop of worms; instead of trying to do so I should rather attempt to hatch the moths continuously, so as to keep up a succession of caterpillars through June, July and August; but I doubt that it will ever be safe to put any worms out later than the 20th or 25th of August. My first plantation of Ailanthus trees was made on a heathy sandy common, on a piece of land which had been rejected by the farmer as not worth cultivation from the great expense necessary to make it carry any kind of crop. It has however a hard loamy sub-soil, which, when trenched and pulverized, makes a better soil than might at first be expected. About an acre was trenched, a small portion only of which has as yet been planted with the Ailanthus. In December, 1862, I planted 250 trees about 18 inches high, in rows 12 inches apart; they grew slowly and were kept back by two very dry seasons, but this year they have made vigorous shoots, and appear to have taken satisfactorily to the soil, and I hope to extend the plantation considerably. I propose now planting the trees in hedges, leaving a clear space of full 6 feet between each hedge, and placing the trees about 18 inches apart, and enclosing each hedge with thick hurdles or wattles at the side, with a moveable top made of sparrow-proof wire netting, in lengths of 4 feet or 5 feet, made waggon-roof shape, so as to feed off the hedges in lengths as may be required. I have a second plantation in good garden ground, where the trees have grown much more rapidly and where I have reared the most of the cocoons I have got. It is circular, formerly a rosary, about 45 feet in diameter, entirely enclosed by sparrow-proof wire netting, 6 feet high at the outside, rising to 8 feet in the centre. Many of the plants in it were suckers thrown up by a large Ailanthus tree growing close by, these have sent up shoots 6 feet and 7 feet high; others were two-year old plants bought last winter, they have done very well, making shoots 3 or 4 feet high and were planted 18 inches apart."



Mr. Calvert, of East Bergholt, Suffolk, planted in the garden close to his house, in the spring of 1863, 1,000 Ailanthus trees from eighteen inches to two feet apart each way and some only one foot apart; the soil was good and light, and in 1864, the trees made good shoots, many of them five and six feet long; in 1865 some of the shoots were ten feet long, and the growth was so luxuriant as to astonish all that passed by. Early in the summer he netted over a portion, intending to place therein the young worms, but the luxuriant growth soon escaped from the netting, so that that method was abandoned, and the worms placed in the Ailanthery without protection. On the 18th of November I obtained his report; there were then still leaves on the summit of the trees, though in exposed places they had all fallen by the 10th November. Out of 1,700 eggs he obtained 458 cocoons; of these 120 larvæ were fed in-doors, the rest were fed on the trees. Robins were observed to be troublesome, and likewise ants. It should be borne in mind that, in estimating the number of cocoons as obtained from any number of eggs, regard should be paid to the proportion of eggs which do not hatch out, and likewise to the loss which happens in the first ten days of larval life, before the time arrives between the first and second moult, at which generally the young larvæ are counted and turned out for good, as was done by Lady Heathcote in the preceding experiments. I consider that as the eggs form a saleable object, and are the first origin of the crop, so we should, in estimating our crop, calculate from the number of eggs we operate with, rather than from the number of young larvæ which we place on the trees; for these give no clue to the number of eggs necessary to produce them, and therefore conceal the expenditure of the starting-point, viz. the number or weight of eggs operated upon.

In 1865 for the first time I commenced to experimentalize on a large scale entirely in the open air, having the two preceding summers operated on a small scale both out of doors with and without protection, and also in doors, in order to familiarize myself with the habits of the larva, and with some of the difficulties of its culture. I had about 600 cocoons to begin with, and about 2,300 Ailanthus trees planted in rows, containing from four to six trees in a row, along the margin of a railway as before described; (see p. 212). My plantation extended more or less interruptedly for half a mile; the soil was a deep tenacious loam, capital corn land. My first moth emerged May 22nd, my last July 27th, in all 563 moths emerged; of these 230 pairs were fertile, and laid in all 37,000 eggs. My first eggs were laid May 24th, the first larva was hatched June 11th: my first cocoon was spun July 15th, an interval of thirty-four days from June 11th; from this cocoon an imago emerged on August 20th, an interval of thirty-six days in pupa. My second batch of eggs were laid June 6th, 7th; these hatched out June 23rd, and commenced their cocoons July 30th, an interval of only twenty-eight days; from these the imagos appeared August 23rd, &c., an interval of thirty-four days in pupa. The fact of a larva feeding up in the short space of twenty-eight days from the egg to the cocoon is remarkable, and due to the facts that not only was the weather very warm, but the larvæ were kept under glass at a temperature of 90° to 100° for the purpose of hastening their changes and obtaining a second brood.

A hundred and one cocoons were obtained for the purpose of attempting a second brood; of these thirty-six pairs were fertile; the first hatched out August 21st, the last September 21st: eggs were laid August 23rd up to September 7th, in all 8,438: the first batch of larvæ hatched September 7th up to September 19th. Of these eggs about 8,000 were placed out on the trees in the nursery and remained there till after the second moult of the larvæ, when they were transferred to the larger Ailanthery by the railway side; out of the 8,000 about 3,250 were taken down; some were sent away as specimens, and of the youngest lot of 620 none were removed, as I wished to watch them at home; these larvæ throve well and grew rapidly till they approached their last moult, when on October 10th stormy and cold weather set in, heavy rains followed, and many of the larvæ were dashed down. Their growth seemed stopped, they became torpid and would not feed; and on the 20th seeing that the weather continued cold, windy and wet, and that many were likely to perish, I brought into the house the remainder of the larvæ. Of these very many never recovered; the rest were fed up to the 10th November with Ailanthus leaves, and subsequently with celery leaves: those which had not been knocked off the trees soon came round: they did not however thrive, the leaves soon withered and seemed devoid of juice, and it was quite plain that I was just from fourteen to twenty-one days behindhand. Up to a certain point all had gone well, but with the setting in of stormy autumnal weather all hope of a crop was lost. On the 24th October the first cocoons were commenced, and in all about 400 cocoons were obtained; these however are much smaller than and altogether inferior to those of the first crop, and worthless for reeling.

I gather from this experiment that it would be hazardous to depend for a crop upon eggs laid later than August 10th, but that there is a fair chance of success with all eggs laid up to that date: after the stormy weather set in on October 10th, the sap seemed to stagnate in the leaves and no longer to afford a proper nutriment. It may not be uninteresting to mark the ratio between the eggs placed on the trees in the nursery and the larvæ taken off when half-grown:

	Eggs.	Larvæ, 2nd moult passed.	
Lots 1, 2, 3	685	384	sent down to railway.
4	608	328	N.B.—The proportion sent down will be seen to decrease regularly as the season advanced; some were given away, and about 270 more sent down which could not be precisely allocated to any particular group.
5	315	185	
6	576	245	
7	805	420	
8	1,602	515	
9	1,017	406	
10	1,175	380	
11	600	120	
12	620	None.	
	8,003	2,983	
Deduct, not sent down	620	270	sent down but not allocated to any particular lot.
Total........	7,383	3,253	

Thus rather more than one-half perished.

The first and main crop was, however, a decided success; 18,678 eggs were reserved, beginning July 1st to 22nd; these were hatched out in the nursery, and the larvæ retained there till half-grown, and then transferred to the Ailanthery by the railway side; other eggs were placed on different trees in neighbours' gardens. The larvæ began to hatch out July 13th, 14th; the first cocoons were gathered August 24th, and continued to the end of September, but even up to the middle of December a few cocoons were newly observed and harvested: in all, 5,368 cocoons have been gathered from the railway bank, and 197 from the gardens, generally very large and fine: and from some there have already emerged moths of finer appearance and expanse than their parents. A boy was employed as conservator at 6*d*. per day to keep down weeds, transfer larvæ, pick up those on the ground, and keep birds off, if necessary; but the last work was superfluous, as, with the exception of a thrush once observed in the Ailanthery, no birds were seen to frequent it. In this experiment the great loss seemed, as I have before stated, to occur in the egg and young larval states, and again at the last moult; the former loss, which is necessarily the greatest, is the least in importance, it being always easy to provide many more eggs than are required for cocoons, and the amount of foliage consumed by the young worms is so trivial as not to be worth calculation, whereas the loss between the third moult and spinning is more serious, and one that does not (like the former) admit of repair; the time and foliage already consumed by worms of that age cannot, towards the close of the season, be replaced. Fortunately, however, the loss in the larger Ailanthery was very trivial, as compared with what might have been expected in a first experiment.

These are the only experiments on a large scale carried on in England with which I am acquainted, and they are sufficiently successful to encourage a hope that Ailanthiculture may prove a profitable industry in many parts of Great Britain. One especial advantage which it offers is, that it affords an intellectual and interesting occupation to women and children, the need of which is much felt in our agricultural districts. As bearing on this point I quote a paragraph from the Report of the Acclimatization Society for 1865, p. 42:—"I have introduced a notice of the *Bombyx Cynthia*, as a silk-producing insect, in some lectures recently delivered by me, and I am convinced that this branch of industry may be most profitably introduced into our union workhouses. There a large amount of labour is wasted because it has not been profitably applied. Plant, therefore, the Ailanthus shrub, and let the women and children attend to the worms. Pay them a per-centage on the result, and divide the inmates into sections, so that there may be honest rivalry. The sections would be stimulated to exertion by the personal interest each individual would have in the result, and section would soon compete with section for superiority. I see no reason why in reformatories, penitentiaries, and the like, some effort may not be made to rear these worms. In fact wherever there is unapplied child or female labour, it can be advantageously introduced. The ratepayers would not alone benefit; habits of industry and method would be insensibly taught, and with care the present pauper might become a silk grower, either for the capitalist, or on his own account."

Hitherto experience has been too brief to draw therefrom any calculations as to ultimate profit, but in France the following tables have been submitted to the Imperial Government by M. Guérin-Méneville, as an approximation to the truth. Variations in the cost of labour, in the quality of the soil, and in climate, must, however, produce corresponding variations in the net result.

Plan d'une culture d'Ailantes (ou faux vernis du Japon) pour faire des éducations du ver à soie chinois (Bombyx Cynthia *vrai) qui se nourrit des feuilles de cet arbre, et vit en grande partie en plein air.*

Calculs faits en prenant pour base le rendement connu des Mûriers, et dans la supposition que la direction serait gratuite (le propriétaire ou une mission) et que le terrain serait pris sur l'excédant d'une plus grande ferme, comme on va le faire dans le domaine impérial de Lamotte-Beuvron en 1862 *et les années suivantes, et chez plusieurs grands propriétaires.*

DÉPENSES.

1re année.	Plantation de 6 hectares. *(Voir la note A.)*....		3.000 fr.
2e —	Entretien. — Deux labours................		300
3e —	id.	id......................	300
	Frais de deux petites éducations. *(Note B.)*..		1.136
4e —	Entretien. — Deux labours		300
	Frais de deux petites éducations............		1.136
5e —	Deux labours et frais d'éducation augmentés de 170 francs..........................		1.606
6e —	Deux labours et frais augmentés...........		1.786
7e —	id.	id..................	2.146
8e —	id.	id..................	2.506
9e —	id.	id..................	2.866
10e —	id.	id..................	3.226
			20.308 fr.

RECETTES.

Pas de recettes.					
Id.					
Deux petites récoltes de cocons vendues à raison de 3 fr. le kil. de cocons vides *(V. la note C.)*, 1 kil. de feuilles par arbre, ou 30,000 kil.					3.372 fr.
Deux récoltes avec des arbres donnant chacun 1 kilogr. 1/2 de feuilles, ou 45,000 kilogr.....................					5.058
Deux récoltes, les arbres donnant 2 k. de flles ou 60,000 k.					6.744
Deux récoltes,	id.	3	id.	90,000 k.	10.116
Id.	id.	4	id.	120,000 k.	13.488
Id.	id.	5	id.	150,000 k.	16.860
Id.	id.	6	id.	180,000 k.	20.232
Id.	id.	7	id.	210,000 k.	23.604
En 10 ans, les recettes peuvent être de					99.474 fr.
Les dépenses de..........................					20.308
Reste en bénéfice net en 10 ans					79.166

Autre forme du même compte.

Année	DÉPENSES.		RECETTES.	
1re année.	Plantation de 6 hectares. *(Note A.)*	3.000 fr.	Pas de recettes.	
2e —	Entretien. — Deux labours	300	Id.	
3e —	id. id.	300	Deux petites récoltes *(Note C.)*	3.372 fr.
	Frais de deux petites éducations. *(Note B.)*	1.136		
4e —	Entretien. — Deux labours et frais de deux petites éducations	1.436	Deux petites récoltes	5.058
		6.172 fr.		
	Excédant des recettes sur les dépenses à la fin de la 4e année	2.258		
	Total	8 430 fr.		8.430 fr.
5e —	Deux labours et frais d'éducation augmentés de 170 francs	1.606 fr.	Deux récoltes	6.744 fr.
6e —	Deux labours et frais d'éducation augmentés	1.786	Id.	10.116
7e —	id. id.	2.146	Id.	13.488
8e —	id. id.	2.506	Id.	16.860
9e —	id. id.	2.866	Id.	20.232
10e —	id. id.	3.226	Id.	23.604
		14.136 fr.		
	Excédant des recettes sur les dépenses depuis la 5e année jusqu'à la 10e	76.908		
		91.044 fr.		91.044 fr.

Résumé des frais.			Résumé des recettes.	
4 premières années	6.172 fr.		4 premières années	8.430 fr.
6 dernières	14.136		6 dernières	91.044
	20.308 fr.			99.474 fr.
dont la moyenne est	2.030 fr. 80 c.		dont la moyenne est	9.947 fr. 40 c.

Ou bien, *en moyenne*, on aura dépensé chaque année 2,030 fr., et gagné net 7,916 fr. (beaucoup plus de 300 p. 0/0).

Si l'on réduit le bénéfice de moitié, sans diminuer la dépense, dans les pays où l'on ne pourra faire qu'une éducation chaque année, on aura encore une moyenne de dépense de 2,030 fr. pour un bénéfice de 3,958 fr. (ou près de 200 p. 0/0).

Si l'on réduit encore tout cela de moitié, en supposant de grands mécomptes, l'achat du sol, des frais de direction générale, etc., on aura encore, avec une dépense moyenne annuelle de 2,030 fr., un bénéfice net de 1,979 fr. (ou près de 100 p. 0/0).

Il résulte de ces calculs un bénéfice moyen par hectare de 1,319 fr. sur une période de dix ans; ou, en d'autres termes, en dépensant en moyenne 338 fr. sur un hectare, on aura, aussi en moyenne, sur une période de dix ans, un bénéfice annuel de 1,319 fr.

Réduisant ce bénéfice de moitié, il reste encore un rendement de 659 fr.

Si l'on réduit ce reste de moitié, l'on a encore 329 fr. produits par 338 fr. (près de 100 0/0 du capital) dans une période de dix ans.

Note A. Les arbres seront plantés en allées de deux mètres de large, pour que la charrue puisse y passer, et espacés entre eux d'un mètre. De cette manière, il en va 5,000 à l'hectare ou 30,000 dans les six hectares.

Achat des arbres d'un an, de 12 à 20 fr. le mille (à 20 fr.)	600 fr.
Mise en terre à 7 centimes par pied......	2.100
Deux labours *	300
Total...........	3.000 fr.

B. Main-d'œuvre pour l'éclosion et la pose des jeunes vers sur les taillis d'arbres : vingt journées de femmes à l'hectare, à 1 fr. 50 c. par jour. †

Pour six hectares	180 fr.
Une gardienne pendant quinze jours, à 1 fr. 50 c. par jour ‡	23

* Ces labours, destinés seulement à nettoyer le sol, ne seront nécessaires que pendant les deux ou trois premières années. Leur prix est très variable suivant les terres et les localités.

† Cette dépense sera très diminuée, si l'on met les jeunes vers sur les arbres aussitôt après leur naissance.

‡ Cette dépense peut être supprimée.

Récolte des cocons : quarante journées à l'hectare (très exagéré)	360
Première récolte..................	563 fr.
Deuxième récolte	563
Pour frais imprévus	10
Total des frais de deux éducations	1.146 fr.

C. Calculs en admettant qu'à la troisième année chaque arbre donnera seulement 1 kilogramme de feuilles,* ou, pour les six hectares.... 30.000 k. | 10 k. de feuilles pour avoir 1 kil. de cocons.†

3.000 kil. de cocons pleins ou *frais*. Il y en a de 400 à 500 au kilogramme.—En moyenne........ 450 cocons frais au kilogramme.‡

150000
12000

Total des cocons 1.350.000 § | 2.400 cocons au kil., cocons vides du papillon. ||
150.000
6.000
1.200

562 kilog. de cocons vides, d'une valeur de 3 francs le kilogramme,
à 3 francs le kilog.¶ Ce qui fait une somme totale produite par

la première récolte, de......	1.686 francs	Total ..	3.372 fr.
deuxième récolte	1.686 francs		

* On sait que les Mûriers mi-tiges ou nains de sept à huit ans, donnent chacun jusqu'à 20 kilog. de feuilles à chaque pousse ou sève.

M. de Gasparin a établi que la quantité moyenne de feuilles de Mûrier produite *par hectare*, s'élève à 13,900 kilog. (Peligot., *Ann. Soc. seric.*, t. XV, p. 320), ces arbres étant plantés à grandes distances.

Quant aux Ailantes, ils donneront certainement plus de feuilles que les Mûriers, car on sait qu'ils pullulent d'une manière extraordinaire. Dans peu d'années, chaque pied recépé produira une énorme touffe ou cépée.

† M. Hardy (*Bull. Soc. d'accl.*, t. II, p. 429) établit que 11 kilog. de feuilles de Ricin *donnés en magnanerie*, produisent *un* kilog. de cocons frais du Ricin. Mangée sur l'arbre, la feuille ne laissera pas de litière : il en sera employé

[*For notes* ‡ § || ¶ *see next page.*]

Total ..	3.372 fr.
Calcul pour la quatrième année, les arbres donnant 1 kil. 1/2, j'ajoute	1.686
la moitié du produit de 1 kil. de feuilles par arbre, et j'ai	5.058 fr.
La cinquième année, admettant 1/2 kilog. de plus par arbre, j'ajoute	1.686
produit de la moitié de la troisième année (ou 2 kilog. par arbre), et j'ai	6.744 fr.
La sixième année, les arbres donnent 1 kilog. de plus ou 3 kilog., j'ajoute le produit de 1 kilog. ou	3.372
et j'ai	10.116 fr.
La septième année, 1 kilog. de plus, donnant toujours	3.372
ou 4 kilog. par arbre, et j'ai	13.488 fr.

beaucoup moins, peut-être moins de 10 kilog., pour faire 1 kilog. de cocons *frais*.

‡ Des pesées exactes montrent que 100 cocons pleins ou *frais* pèsent 250 grammes (chaque cocon pèse, en moyenne, *frais*, 2 gr. 50 c.). Donc 400 cocons pèsent 1,000 grammes. [See also Méneville, Education des Vers-à-Soie de l'Ailante, p. 16, where the average of five trials, made October 19th, 1860, is stated as giving 413 cocoons to the kilogramme.]

§ Pour avoir 1,350,000 vers à soie, il faut avoir réservé de la récolte précédente 7,000 couples (ou 14,000 cocons mâles et femelles) qui donneront chacun de 250 à 200 œufs, ou 1,400,000 chenilles.—Il est évident que l'on gardera prudemment beaucoup plus de 7,000 couples, afin d'avoir plus de jeunes vers qu'il n'en faut, et d'être ainsi en mesure de supporter les pertes causées par les accidens imprévus, les oiseaux qui tromperont la surveillance, etc., etc. Dans quelques années, la pratique sera en mesure de savoir au juste toutes ces choses, comme on les connaît si bien pour le ver à soie du Mûrier.

‖ Des pesées faites à Alger, avec M. Hardy, sur des cocons vides provenant de l'éducation de M. de Lamote-Baracé, ont donné 2,390 cocons au kilog.—A Paris, les cocons de M. de Lamote et de M. de Cerisy, de Toulon, ont donné 2.440 cocons au kilogramme.—Chaque cocon vide pèse, en moyenne, 0 gr. 416 milligrammes ou moins d'un demigramme.

¶ Les calculs établissant le prix des cocons sont publiés dans les *Bulletins de la Société d'Acclimatation*, 1856, nº 6, p. 264, et leurs résultats ont aussi paru dans le *Moniteur des Comices*, t. V, p. 71, 20 novembre 1858. "Quant au prix des cocons vides, dit M. de Sacc, on pourrait le fixer à 3 fr. au minimum, et 4 fr. au maximum." Ces évaluations résultent d'un essai pratique fait par MM. Schlumberger et de Jongh, grands filateurs de Guebwiller, avec le concours de M. le Dr. Sacc, sur 26 kilog. de cocons du ver à soie du Ricin, analogues, mais inférieurs à ceux du ver de l'Ailante.

La huitième année, 1 kilog. de plus (ou 5 kilog. par arbre), donnant	3.372
et j'ai	16.860 fr.
La neuvième année, 1 kilog. de plus (ou 6 kilog. par arbre), donnant	3.372
et j'ai	20.232 fr.
La dixième année, 1 kilog. de plus, donnant toujours	3.372
ou 7 kilog. par arbre ou touffe, et j'ai	23.604 fr.

It must be observed that no account is taken of rent or of the cost of superintendence, and that the cost of planting the trees in this country would greatly exceed the estimate in Note A. Nevertheless it must also be observed that the trees are planted in single rows, 80 inches from row to row, and 40 inches from tree to tree; whereas by planting the rows from 30 to 36 inches apart, and each tree in the row 24 inches apart from the next, with an alley 6 feet wide between every 5 rows, rather more than $3\frac{1}{2}$ times as many trees may be planted on the same area. It is also more than probable that in our moister climate a greater luxuriance will be obtained by the tree, and it has been observed that the cocoons* and imagos are larger here than in France. Lastly, as a method has been arrived at of reeling the thread, the value of the cocoons will probably be doubled, 3 francs per kilogramme being the price offered for them for the purpose of carding.

Hitherto I have examined from a practical point of view the production of the raw material, the cocoon; and I am warranted, I think, in expressing an opinion from the experiences brought forward, and the knowledge attained of the habits of the insect, that it can easily be produced in quantities in England. But a very important question still remains untouched, viz., the price which these cocoons will bring to the producer, *i. e.*, What remuneration may be expected for a given weight of cocoons?

* As regards the weight of cocoons containing the chrysalis, an average of four trials which I made on 28th December, 1865, gave 185 cocoons to the pound, or 407 to the kilogramme. The cocoons were divested of their leafy envelope, but otherwise remained as they were gathered, with the cable or a portion of the cable attached; they were taken at random, and were not selected for their size. M. Méneville calculates 450 "cocons pleins" to the kilogramme (*ante*, p. 237), or according to the more accurate measurement, 400 or 413 to the kilogramme (n. ‡, p. 238), but this is taking the weight 10 days after the formation of the cocoon, when there would be more moisture present than during winter.

The reply to this question will indicate the amount of stimulus likely to be given to British Ailanthiculture. For no one without the probable certainty of a fair pecuniary reward would embark time and money in industrial Ailanthiculture. And here we are beset by the difficulties which inevitably attend the introduction of any new material. On the ultimate demand by the public for this silk depend both the venture of the manufacturer and of the producer, and the former will give scanty encouragement to the latter, unless he sees his way very clearly to a larger profit than usual when introducing a new fabric; and this is not all, for there are great difficulties attending the reeling of these cocoons, which, as yet, have only been surmounted by a few individuals in France and Italy, who have patented their methods. Time, therefore, and patience are necessary for the solution of this important question. Nevertheless there are not wanting facts which evidently indicate that the demand for this silk is on the increase, and, consequently, that the solution of the problem of Ailanthiculture is not far distant. First, it is well known that the silk produced in China and India from these cocoons is very durable and serviceable, though inferior in lustre to the silk of the mulberry worm; 2ndly, it is produced in Shan-tung and other provinces in China in large quantities, and the importation into Europe is greatly on the increase; 3rdly, owing to the great decrease in the production of mulberry silk, owing to "la gattine," there is a larger demand for inferior silks; vide "Journal of Society of Arts, 1863," p. 776; "la gattine" "has long led to a wish on the part of those interested, that a more hardy breed of silk-producing worms could be introduced into Europe, even though the produce was coarser and of a worse colour than the ordinary mulberry silk;" 4thly, our French neighbours, already in advance of us, have so far introduced the produce into commerce, that fabrics both from the carded and the reeled material (Ailanthine), as well as sewing silk, can be purchased in Paris, at the house of Messrs. de la Grave and Dechaud, Rue de la Croix Rouge; lastly, it being known from specimens of the silk (Ailanthine) reeled in one continuous thread imported from China, that a method of reeling these cocoons was familiar to the Chinese, French and Italian ingenuity devised methods whereby raw silk can be reeled in a continuous thread from the cocoons of *B. Cynthia;* these methods, but recently introduced, require time and practice to attain perfection; nevertheless, it is certain that the thing has been done, and the material made therefrom exhibited for sale in Paris at a moderate price. We are, therefore, far advanced in our treatment of these cocoons, and in proportion as the method of reeling is rendered simple and inexpensive, and the fabric produced is appreciated by the public, a demand will arise for cocoons, and the price rise considerably higher than that now quoted, 3 francs per kilogramme.

So far as I am aware, no one in England knows how to reel these cocoons. I, therefore, submit an account of the method invented by M. Forgemol, forming part of a report addressed to the Imperial Society of Acclimatization, in France,* "On the reeling of cocoons of *Bombyx Cynthia* and other species, naturally open, as brought to perfection by our peculiar method":—

"The success of the great question of the cultivation of the Ailanthus and other silkworms, whose cocoons are naturally open at one end, and which are capable of permanent naturalization, depends on the reeling of these cocoons into a continuous thread to produce raw silk (*soie grège*); without this there results but an inferior coarse flock of silk, of value doubtless, but unsatisfactory as a new material, because limited in its application to inferior purposes. The industrial and agricultural triumph would have been incomplete if these good and beautiful silks, now so familiar to you, had not been obtained from the cocoons from the Ailanthus tree. But the result is now obtained; these cocoons are now reeled off to perfection in one thread; and if the actual method of reeling still leaves something to desire, the path is so well marked out that complete success will doubtless soon follow. In reality the method of reeling the cocoons of the Ailanthus silkworm applies to all cocoons naturally open (as of *Arrindia, Aurota, Selene, Cecropia, Hesperus*, &c.).

"That being clear, permit me to remind you, gentlemen, that to you alone, and to an impulse received from you, is due the discovery of this mode of reeling. And without prejudging the future of these new productions, it seems right henceforth to proclaim that by this result your Society has rendered the most signal services to agriculture and to industry. Certainly silks, both raw and otherwise, obtained from open cocoons, will in future be one of the greatest honours of the Society of Acclimatization. By way of experiment, seeking to follow in your steps, I myself, a short time ago, exhibited before you a particular method of reeling open cocoons. This method has since been studied anew, and I have thought it right to bring before you the following

* Revue de Sériciculture comparée, 1864, No. 9, p. 243.

alterations. Let me remind you that the cocoons conveniently prepared were placed within linen or some other fabric permeable to water, were then passed through many waters in succession containing soap and potass in order to separate the different layers of silk which compose the cocoon, were placed not too dry nor yet too moist in a vessel of a cup-shape (either one or in compartments), and were then reeled when nearly dry—differing from the method of reeling closed cocoons, which is done on the surface of water more or less boiling.

"Such was our first method. The following are the modifications resulting from our experiences:—It seemed easier, and likely to save time, to have a plate divided into several cups, which might be removed at will, and to place therein the cocoons for reeling. This plate of any form should fit the bason of the ordinary winding machine, such as they use in the South of France. Each cup is pierced with little holes in its centre, for the admission (if desirable) of steam from the hot water in the bason, in order to supply the necessary amount of moisture which the cocoons may have lost. No change is made in preparing the cocoons and reeling them when nearly dry, but they are placed in the moveable cups pierced with holes fitting into the plate as described. These plates, with moveable cups, are well suited to reel cocoons naturally open, so long as they contain the chrysalis (*plein*), but seem no longer to answer when the cocoons are empty (*vides*), that is, when the moth has escaped.

"In fact, the force used to draw apart and collect the single threads (*brins*), no longer finds a counterpoise in the empty cocoons, which do not remain in the cups, but are drawn out. Hence it becomes necessary to give the empty cocoons a certain weight, a certain resistance, sufficient to retain them "in situ," but not so great as to rupture the threads. After considerable experience, I conceived an apparatus intended to retain the empty cocoons, and yet allow the reeling to proceed easily and rapidly. This apparatus is composed of several skewers (*broches*), carrying needles of varying height, and it is placed on a bason for the purpose, if necessary, of keeping the cocoons in a state of slight moisture, by means of steam from water beneath, more or less boiling in the bason. These empty cocoons are reeled, as we have already stated, when nearly dry, but yet they require a certain amount of moisture, which is indispensable for the perfect torsion of the several threads (*brins*) which go to form the one strand (*fil*). The needles have, 1st, an olive-shaped head, which is capped by the empty cocoon, suitably prepared beforehand and divested of its outer envelope; 2ndly, a middle portion sliding through a ring, secured by an upright (*guide parti sur les broches*) attached to the skewer; and 3rdly, a base, with a blunt point, which revolves in a little cup worked in the thickness of the skewer.

"The needles are very moveable on their pivot, and the cocoons being moveable also on the olive-shaped heads, turn on them in every direction, following the position and direction of the threads as they unwind. The head is olive-shaped to avoid making a hole in the base of the cocoon during the movement and rotation by the resulting friction, which must ensue were the head pointed. The needles are of different lengths to allow more cocoons than one to be reeled off at once, those of the first skewer being the smallest, those of the second bigger, and so on according to the number of the strands and the required thickness of the thread. The skewers, armed with needles of different height, after being capped with empty cocoons suitably prepared, are placed on the bason so that two or more may be used at once. So arranged, the skewers slide into a groove made in the frame of the machine. They are kept apart by a little bar of division fixed at either extremity. When the cocoons are reeled the skewers, whose needles are now free, are pushed forwards and removed; they are immediately replaced by others prepared beforehand, and placed ready at the end of the groove. There is no interruption in reeling; the mechanism of the skewers and needles is both simple and easy. These, as also the plate with moveable cups, are easily and without cost adapted to the well-known machine, which seems a great advantage since the old implement for reeling closed cocoons is now made available, almost without change, by the simple method which I have described."

Mr. Forgemol afterwards observes, that he has, by means of these needles, successfully reeled the cocoons of *B. Mori*, after the exit of the moth, and produced therefrom silk as handsome and durable as from cocoons reeled in the usual way.

I have now very feebly, and, I fear inadequately, attempted to delineate a leaflet as it were from the great book of nature, as yet undescribed in England. Numerous as are the benefits we reap from nature, there yet remain, even at our feet, many of her secrets uninvestigated, many undiscovered sources of industry and wealth. Pisciculture has to be applied to our river and sea fisheries. Ostreiculture is as yet in its infancy. Sericiculture, including various new species of silk-producing insects, awaits examination.

The great question of the return of sewage to the soil, the introduction and acclimatization of new species of plants, insects and animals, are problems presented to this age for solution. It is the duty of man, by patient investigation, to arrive at a correct interpretation of nature's laws, and apply them successfully to his own benefit. The process is a slow one, and many mistakes must be made before the truth can be elicited, but success in the end is certain.

In conclusion, it is worth while to note the remarkable events which have heralded the dawn of Ailanthiculture: 115 years ago the *Ailanthus glandulosa* was brought to Europe, and thenceforward acclimatized, but not for the purpose of Sericiculture: had the silkworms been then imported, they could not have been reared for many successive years for lack of foliage; time was required for the tree to become naturalized, and to spread over Europe, Canada, Australia, &c., to manifest its hardy and reproductive nature, and to become known to cultivators. Then came a severe epidemic disease affecting the varieties of the *Bombyx Mori* feeding on the mulberry tree, causing severe loss to the cultivators, and distress among the poor in the silk-producing districts. Hence arose a cry to revert to the original silk-producing countries, China and Japan, for new and healthier races, and also for new and hardier species. These views received practical encouragement from the Minister of Agriculture in France, and from the Emperor. But without the aid of missionaries, those pioneers of religion and civilization, neither the Ailanthus tree nor the silkworm that feeds on it would ever have reached Europe, and the efforts of the French Emperor and of the silk manufacturers would have been in vain. The missionary must first pierce and penetrate China before the merchant can extract her jewels. Various political movements, coincident in point of time, opened up more thoroughly the Oriental silk districts to European research. The employment of steam power shortened considerably the transit, and affording facilities of rapid movement, both threw open to investigation regions hitherto unexplored, and permitted the conveyance to Europe of living cocoons and eggs. The Ailanthus silkworm is in 1856 discovered and sent to Europe; its food plant, the Ailanthus tree, is already acclimatized, and awaiting in abundance its advent, so that the insect is easily multiplied and naturalized. Then comes a crisis in the cotton trade: owing to the American war the supply fails, and substitutes for cotton are eagerly sought after. Hence, Ailanthiculture at once assumes an important aspect, and not merely have the habits of the one species, *Bombyx Cynthia*, been carefully investigated, as susceptible of acclimatization and successful cultivation, but those also of other silk-producing insects of hardy nature, such as *Hesperus*, *Polyphemus*, *Cecropia*, *Yamamai*, &c.

Thus the dream of the 14th century, which James I., in the 17th, vainly strove to realize, is now actually on the point of fulfilment. Fortunate will it be for England,—fortunate, indeed, for Ireland, if land, hitherto valueless, can be so tended as to furnish with little care and slight cost a fabric warm and durable. Fortunate will it be for women and children (especially for workhouse habitués), if another health-giving industry be opened up for their nimble fingers.

I cannot but be deeply struck with the remarkable chain of events which have preceded these novel projects, and I feel confident that at no very distant period Ailanthiculture will take high rank amongst English industries.

EXPLANATION OF THE PLATES.

Plate XV.

Bombyx Cynthia, imago and cocoons.

Plate XVI.

Bombyx Cynthia, egg, natural size and magnified ; and larvæ in four stages, on leaf of *Ailanthus glandulosa*.

PRIZE ESSAYS

OF

THE ENTOMOLOGICAL SOCIETY.

As an inducement to the study of Economic Entomology, and with a view to increase the practical utility of the Entomological Society, the Council offers Two Prizes of the value of Five Guineas each to be awarded to the authors of Essays or Memoirs, of sufficient merit and drawn up from personal observation, on the anatomy, economy, or habits of any insect or group of insects which is in any way especially serviceable or obnoxious to mankind. The Essays should be illustrated by figures of the insects in their different states, and (if the species be noxious) must show the results of actual experiments made for the prevention of their attacks or the destruction of the insects themselves.

One of the Prizes offered for 1865 was awarded to Alexander Wallace, Esq., M.D., M.R.C.P., of Colchester, for his Essay on "Ailanthiculture."

On some former occasions the Council has selected a definite subject, as *e. g.*, the *Coccus* of the Pine Apple, the larva of *Agrotis Segetum* (the large caterpillar of the turnip), &c. On the present occasion, the selection is left to the candidates themselves, provided only that the subject be one fairly belonging to the Economic branch of Entomology.

The Essays must be sent to the Secretary at No. 12, Bedford Row, indorsed with mottoes, on or before the 30th of November, 1866, when they will be referred to a Committee to decide upon their merits; each must be accompanied by a sealed letter indorsed with the motto adopted by its author, and inclosing his name and address.

The Prize Essays shall be the property of, and will be published by, the Society.

LONDON:
PRINTED BY C. ROWORTH AND SONS,
BELL YARD, TEMPLE BAR.

III. *Descriptions of new or little-known Genera and Species of Exotic* Trichoptera; *with Observations on certain Species described by* Mr. F. Walker. *By* Robert M'Lachlan, F.L.S.

[Read 2nd October, 1865.]

The greater number of the exotic caddis-flies described in this paper were collected in the islands of the Malayan Archipelago by Mr. A. R. Wallace, and are contained in the collection of Mr. W. Wilson Saunders; others are in the British Museum or in my own collection. The paper may be considered as pretty well exhaustive of the new species existing in collections in this country, excepting a few of which there are only solitary and much damaged examples. I cannot but regret that in many instances the descriptions have of necessity been drawn up from single specimens. The number of new genera, compared with that of new species, is very considerable.

The more I become acquainted with the value of generic characters in the *Trichoptera*, the more am I convinced that, as in *Hymenoptera*, the neuration of the wings (combined with the leg-spurs and palpi) furnishes the safest starting-point for the formation of generic divisions. The wing system is not absolutely infallible, and is to a certain extent arbitrary, as indeed is the case with all schemes devised to facilitate the classification of natural objects, but it affords easily-seizable characters; care must, however, always be taken to avoid mistaking sexual for generic differences. In the family *Limnephilidæ* alone the wing-system appears to fail, the neuration of all the genera being almost identical; here too the palpi are of small value for generic diagnosis; and we are compelled to fall back upon the tibial spurs and other characters.

With respect to the abundance or paucity of tropical and southern *Trichoptera*, there are scarcely sufficient data to generalize upon. The number of known South American species is very small, yet Mr. Bates informs me that on the Amazons they were sometimes so abundant as to extinguish the lamps; in the

Malayan Archipelago, however, Mr. Wallace says that he only occasionally met with insects of this Order. The number of hitherto described extra-European species is about 260; of which 150 are from North America, and about 30 from Ceylon, leaving only 80 for the greater part of the Asiatic continent and islands, Australia, New Zealand, Africa and South America.

Fam. PHRYGANIDÆ.

Genus Phryganea, Linn.

1. *Phryganea japonica*, n. sp.

P. antennis nigricantibus, ad apicem ochraceis; capite dense griseo-piloso; mesothorace rufo-ochraceo, utrinque nigricante; alis anticis ad apicem sinuato-excisis, griseo-cinereis, griseo-reticulatis, vittis duabus vel tribus nigricantibus in cellulis apicalibus positis, punctoque ad thyridium albido; posticis pallide aurantiacis, ad apicem late nigricante-fuscis; pedibus griseo-ochraceis; tarsorum articulorum apicibus, tibiis anticis et intermediis ad apicem, posticisque totis, externe fuscis; abdomine rufo-ochraceo. ♂ margine superiori segmenti ultimi longe rufo-aurantiaco fimbriato; appendicibus superioribus brevibus, subtriangularibus; intermediis rectis, aciculatis, testaceis; inferioribus subrotundatis, spina brevi incurvata instructis; lamina ventrali ad marginem late rotundata. (♂ et ♀.)

Var. ♀. Alis anticis vitta lata nigricante.

Long. corp. 9—11 lin.; exp. alar. 26—32 lin.

Habitat in Japonia.

In Muss. Brit. et mihi.

Antennæ blackish, becoming ochraceous at the tips. Head thickly clothed with greyish pubescence. Palpi blackish. Mesothorax reddish-ocherous, blackish at the sides. Anterior wings with the apical margin sinuated and excised; yellowish cinereous, reticulated with grey, and with a short black streak in some of the apical cells; a whitish indistinct spot at the thyridium. Posterior wings pale orange, the apex broadly blackish-fuscous, in which portion the veins appear darker. Legs greyish-ochreous; the apices of the anterior and intermediate tibiæ and of the tarsal joints blackish-fuscous externally, as is the whole of the external side of the posterior tarsi; tibiæ with black spines. Abdomen reddish-ochreous. In the male the upper margin of the last abdominal segment is fringed with long reddish-orange hairs; app. sup. short and subtriangular; app. intermed. very long. straight and needle-shaped, deep testaceous; app. inf. in the form of a rounded basal piece, whence proceeds a short, curved and acute spine; ventral lamina broadly rounded. In the female the inferior valves are elongated, subtriangular, and somewhat acute.

Variety of the female: a broad, blackish fuscous band runs through the middle of the anterior wings from the base to the apex, enclosing a conspicuous pale spot at the thyridium.

This beautiful species in form and structure agrees with the European *P. grandis*, excepting in the excised apical margin of the anterior wings. In coloration it bears a remarkable resemblance to *Colpomera sinensis* (Trans. Ent. Soc. 3rd ser. i. 302) from North China, but the latter species differs in its narrow and subfalcate anterior wings and in the produced apex of the posterior. The discovery of *P. japonica* has convinced me that *Colpomera* can, at the utmost, be considered only as a section of *Phryganea*, because in *P. japonica* there is clearly to be seen an approach towards the alar formation of *Colpomera* in the excised apical margin of the anterior wing, and the similarity of coloration is so striking as to suggest the idea of the one being remotely descended from the other.

2. *Phryganea Maclachlani*, White (Pl. XVII. fig. 1, ♀).

Holostomis Maclachlani, White, Proc. Ent. Soc. 1861, p. 26.

P. antennis nigris, ♂ ad apicem brunneis; capite et thorace supra nigris, infra ochraceis; alis anticis rufo-aurantiacis, confertim nigricante-reticulatis, maculis duabus albidis, quarum una in cellula thyridii, altera in cellula apicali sexta; alis posticis purpureo-fuscis, fascia latissima subapicali aurantiaca; femoribus aurantiacis; tibiis, tarsis, abdomineque nigris. (♂ et ♀.)

Long. corp. 9—12 lin.; exp. alar. 30—34 lin.

Habitat in India orientali.

In Muss. Brit., Saundersiano, et mihi.

Antennæ black, brownish towards the apex in the male. Head and thorax dull black above, clothed with strong blackish hairs; beneath entirely reddish-ochreous. Palpi fuscous, the terminal joint darker. Anterior wings reddish-orange, thickly reticulated with blackish-fuscous; with two dull whitish spots, one in the cellula thyridii, the other in the sixth apical cell. Posterior wings purplish-fuscous, a very broad orange-coloured band occupying almost the entire apical third; the extreme apex fuscous, with orange-coloured veins running through it. Legs with orange-coloured femora, and black tibiæ and tarsi. Abdomen dull blackish, the segments narrowly margined with greyish. In the male the superior appendices are very small and nearly concealed by the lateral margins of the last segment; app. inf. up-curved, triangular, acute and black; penis furnished with an enormously swollen testaceous apex.

This species was insufficiently characterized by Mr. Adam White; having recently received some remarkably fine specimens, I have drawn up the foregoing description. I have removed the species from the genus in which it was placed by Mr. White, because the neuration differs in the sexes, as in *Phryganea grandis* (that is to say, the female has an additional apical fork), whereas in *Holostomis phalænoides*, &c., the neuration is alike in both sexes. The antennæ are finer and shorter than in *P. grandis*, and the bright coloration of the wings contrasts strongly with our dull-looking species; the pubescence is also much less marked; the neuration, however, proves that it should be located in *Phryganea*.

Fam. LIMNEPHILIDÆ.

Genus Limnephilus, Leach.

1. *Limnephilus* (*Glyphotælius*) *admorsus*, n. sp.

L. magnitudine et facie omnino *L. punctatolineati;* sed alarum anticarum margine apicali profundius exciso. (Appendicibus analibus defectis.) ♀.

Habitat in Japonia.

In Mus. Brit.

In size and coloration entirely similar to the European *L. punctatolineatus*, De Geer (*umbraculum*, Kolenati), but differs remarkably in the apex of the anterior wings, which is more produced in the costal portion, and afterwards much more deeply and irregularly excised; these wings have the two rows of dots or streaks precisely as in the European species. The single example is a female in good condition, excepting the apex of the abdomen, which has been destroyed, and hence I am unable to make a comparison of the anal appendices.

Fam. SERICOSTOMIDÆ.

Genus PYCNOCENTRIA, nov. gen.

Antennæ graciles, alis longitudine fere æquales; articulo basali robusto, hirsuto, quam capite longiori. Caput transverse-subquadratum, utrinque tuberculo elongato instructum. Palpi maxillares (♂) bisarticulati; articulo basali brevi, 2° elongato, robusto, sursum incurvato, pilis longioribus dense vestito; (♀) 5-articulati; articulo basali brevi; 2° elongato, robusto; 3° secundo æquali, crassiori; 4° et 5° æqualibus, brevioribus. Alæ anticæ apicem versus dilatatæ; (♂) plica longitudinali apicem fere attingente et cellulam discoidalem obliterante; alæ posticæ anticis breviores, latitudine æquales, apice obtusæ, (♂) plica fere ut in anterioribus. Pedes hirsutiusculi. Calcaria 2-2-4; paribus duobus tibiarum posticarum juxtim positis. (♂ et ♀.)

Antennæ slender, about the length of the wings; basal joint thick and strong, nearly straight, longer than the head. Head transversely subquadrate; an oblique, elongated, oval tubercle on each side, placed close to the eye, and fringed with long hairs. Maxillary palpi of the male two-jointed; the basal joint very small and concealed; the second joint long and thick, curved up in front of the face between the basal joints of the antennæ, and furnished with long and strong hairs: of the female five-jointed; the basal joint short; the second long and stout; the third equal in length to the second, but much thinner; the fourth and fifth shorter and still thinner, nearly equal. Labial palpi small. Mesothorax smooth and polished, elevated in the middle. Anterior wings clothed with short and dense pubescence, dilated before the elliptical apex; in the male there is a longitudinal fold furnished with coarse hairs, extending nearly the whole length of the wing, and obliterating the discoidal cell, which is probably closed; the apical veins radiating. In the female this fold is absent, and there is a long and narrow, closed discoidal cell. Posterior wings shorter than the anterior, and scarcely so broad as the broadest portion of the latter; obtuse at the apex; in the male with a longitudinal fold extending obliquely from near the base to near the apex of the costal margin, obliterating the subcosta and radius; the discoidal cell closed; apical forks four. Legs moderately long and slightly hairy; spurs 2-2-4; anterior and intermediate tibiæ furnished each with a pair of moderately long and unequal apical spurs; posterior tibiæ with two pairs of nearly equal spurs, the first pair placed close up to the apical. Abdomen short.

A well-marked and distinct genus of *Sericostomidæ*, with somewhat the *facies* of the European genus *Silo* of Curtis, to which it has some analogy in the presence of the longitudinal folds in the wings of the male, but in *Silo* it is only the posterior wings that are thus provided. The two pairs of spurs on the posterior tibiæ are placed closer together than in any other genus with which I am acquainted.

1. *Pycnocentria funerea*, n. sp. (Pl. XVIII. fig. 1.)

P. antennis nigricante-fuscis; capite et thorace castaneis, nigricante-hirtis; alis anticis posticisque nigro-fuscis, plicis distincte saturatioribus, illis macula ad angulum analem albida; pedibus anticis griseo-ochraceis, intermediis et posticis fuscis, tibiis ochraceis; abdomine nigro-fusco; apice superiore lamina elongata, depressa, obtusa, appendices intermedias præter apices incurvatos celante, instructo; appendicibus inferioribus duplicibus, ramo superiore quam inferiore breviori et obtusiori; segmento antepenultimo ventrali (♀) lamina obtusa instructo. (♂ et ♀.)

Long. corp. 2 lin.; exp. alar. 6—6½ lin.

Habitat in Nova Zealandia.

In Mus. Brit.

Antennæ blackish-fuscous. Head and thorax dark chestnut-brown, clothed with blackish hairs. Palpi thickly clothed with blackish hairs. Anterior and posterior wings dark smoky-fuscous, almost black, the folds in the male conspicuously darker; in the former there is a small whitish spot at the anal angle. Anterior legs wholly greyish-ochreous; intermediate and posterior legs with fuscous femora and tibiæ, and ochreous tarsi. Abdomen blackish-fuscous, the divisions of the segments paler. In the male the upper margin of the last abdominal segment is produced in the middle into a long flattened lobe, dilated at the base, but afterwards attenuated, and obtuse at the apex; from under this lobe project the curved points of the app. intermed.; app. sup. not apparent, perhaps concealed under the lobe; app. inf. double, consisting of two branches, the upper long, flattened, hairy and somewhat obtuse, the lower longer, and ending in an acute point; penis long and exserted, perhaps provided with upper and under sheaths. The female possesses a short obtuse lobe on the ventral surface of the antepenultimate segment.

Fam. LEPTOCERIDÆ.

Genus GANONEMA, nov. gen.

Antennæ longiores, tenuiores; articulo primo inflato. Caput fere quadratum, inter antennas productum. Ocelli nulli. Palpi maxillares hirsuti; articulo primo brevi; 2° quam 1° longiori; 3° quam 2° vix breviori; 4° quam 3° breviori; 5° tenui, 3° æquali. Alæ anticæ pube brevi sparse vestitæ, apicem versus valde dilatatæ; margine costali arcuato, apicali oblique rotundato; radio et sectore apicali primo confluentibus; cellula discoidali elongata, angustata, occlusa; alæ posticæ fere dimidio breviores; cellula discoidali aperta. Calcaria 2-4-4. Abdomen robustum. (♀.)

Antennæ very long and slender, more than twice the length of the wings; basal joint bulbous, scarcely so long as the head. Head nearly quadrate, produced into a broadly triangular prolongation between the antennæ, and with a deep excavation near the eyes, below the basal joints of the antennæ. Eyes large. Ocelli none. Maxillary palpi very hairy; the basal joint short; the second very long; the third slightly shorter than the second; the fourth much shorter than the third; the fifth about the length of the third, thinner and flexible. Prothorax scarcely evident. Mesothorax ovate, convex, sulcated in the middle above, scarcely hairy. Anterior wings rather broad, much dilated towards the apex; the hairy clothing slight, most dense along the costal margin; apical fringes very short; costa arched; apical margin obliquely rounded, nearly elliptical; dorsal margin concave; radius straight, confluent with the first apical sector shortly before its termination; discoidal cell long and narrow, closed, the apical half deeply excised on the upper margin from the point where the first apical sector branches off; first apical cell much longer than the succeeding ones; the inferior branch of the ramus discoidalis ending in three apical sectors; cellula thyridii long and narrow, closed by one transverse vein, and united to the lower edge of the discoidal cell by another. Posterior wings short, scarcely half the length of the anterior, broad, the costal margin slightly rounded; radius confluent with the first apical sector, as in the anterior wings; discoidal cell open; apical forks four. Legs very slender. Spurs 2-4-4; anterior tibiæ with a pair of minute apical spurs; intermediate and posterior tibiæ each with two pairs of rather long and unequal spurs. Abdomen robust.

The neuration of the male probably differs in the inferior branch of the ramus discoidalis being simply furcate, and thus ending in only two apical sectors.

It seems to me probable that, notwithstanding the great dissimilarity in the shape of the anterior wings, the example from which I have drawn up this generic description may be only a female of the next genus (*Asotocerus*), and that the form of the wings may be only a specific character. The neuration presents many points of resemblance (excepting differences that are perhaps only sexual), and the form of the antennæ, head, palpi, &c., is identical. However the materials at my disposal are so slight, and the example on which I have founded *Asotocerus* is so much mutilated, that I think it best to place them in separate genera, rather than to run the risk of associating two forms which may in reality be distinct, especially as there are sufficient *primâ facie* reasons for separating them. Both genera are easily recognisable by the peculiar character in the neuration, viz., the termination of the radius in the first apical sector, and not, as is usual, in the costal margin.

1. *Ganonema pallicorne*, n. sp. (Pl. XIX. fig. 1.)

G. antennis albidis, basin versus indistincte griseo-annulatis; palpis griseo-fusco-hirsutis; capite mesothoraceque fuscis; alis fuligineo-fuscis, anticis margine costali nigricante, purpureo-iridescente, venis distinctis, nigricantibus; pedibus albidis. (♀.)

Long. antenn. 16 lin.; corp. 5 lin.; exp. alar. 17 lin.

Habitat in insula Sumatra (Wallace).

In Mus. Saundersiano.

Antennæ whitish, finely and indistinctly annulated with grey towards the base. Head and mesothorax fuscous. Palpi clothed with long greyish-fuscous pubescence. Anterior and posterior wings dark smoky-fuscous, entirely without markings; the costal margin, especially in the anterior wing, broadly blackish, with a purple reflexion in certain lights; neuration strong and distinct, blackish. Legs whitish. Abdomen greyish-fuscous. The last abdominal segment (♀) ends above in two large flat confluent triangular plates, the edges of which are hairy; beneath, these plates appear as a concave projecting cover.

Genus Asotocerus, nov. gen.

Antennæ graciliores, alis triplo longiores. Ocelli nulli. Palpi maxillares hirsutiores; articulo basali brevi; 2° longissimo;

3° quam 2° paulo breviori ; 4° etiam breviori ; 5° 3° æquali, tenuiori. Alæ anticæ sparse pilosæ ; medio dilatatæ, basin versus angustæ ; costa gradatim rotundata ; margine apicali abrupte truncato et inde margine dorsali oblique juncto ; radio ut in *Ganonema ;* alæ posticæ anticis multo breviores, subtriangulares ; cellula discoidali aperta. Pedes tenuiores. Calcaria 2-4-4. (♂ ?.)

Antennæ very long and slender, about three times the length of the wings ; basal joint bulbous, not so long as the head. Head nearly quadrate, prolonged in front between the antennæ, and excavated below the basal joints of the latter. Eyes rather small. Ocelli none. Maxillary palpi very hairy ; the basal joint short ; the second very long ; the third somewhat shorter ; the fourth still shorter ; the fifth as long as the third, thin and flexible. Mesothorax ovate, convex, sulcated in the middle above. Anterior wings with slight hairy clothing, which is thickest on the costal margin ; narrow at the base, much dilated in the middle ; costa gradually rounded ; apical margin at first abruptly and straightly truncated, and then very obliquely uniting with the dorsal margin about the middle of the wing ; or perhaps it should rather be said that the costal margin is abruptly bent down, forming a nearly right angle at the point of junction with the apical margin ; dorsal margin nearly straight ; neuration as in *Ganonema,* excepting that the two branches of the ramus discoidalis are simply furcate. Posterior wings much shorter than the anterior, subtriangular ; discoidal cell open ; fringes short, longer at the anal angle. Legs very slender. Spurs 2-4-4. (Abdomen wanting.)

It will be seen that *Asotocerus* agrees in almost all its characters with *Ganonema ;* even the form of the wings may be only a specific difference. The character of the neuration, and the small size of the eyes, render it almost sure that the specimen from which the above generic description has been drawn up is a male, although the absence of the abdomen prevents absolute certainty on this point.

1. *Asotocerus ochraceellus,* n. sp.

(Pl. XVII. fig. 2 ; Pl. XIX. fig. 2.)

A. antennis pallide ochraceis, nigro-annulatis ; palpis griseo-ochraceis ; capite mesothoraceque ochraceis ; alis anticis pallide ochraceis, marginem costalem versus læte ochraceis ;

alis posticis ochraceo-hyalinis, venis fuscis; pedibus ochraceis. (Mas?.)

Long. antenn. 20 lin.; corp. ?; exp. alar. 17 lin.

Habitat apud Sarawak, in insula Borneo (Wallace).

In Mus. Saundersiano.

Antennæ pale ochreous, all the articulations narrowly ringed with black. Head and thorax ochreous. Palpi greyish-ochreous. Anterior wings pale ochreous, the costal margin and the neuration bright ochreous. Posterior wings hyaline, thinly clothed with ochreous pubescence; neuration fuscescent. Legs ochreous.

Genus Notanatolica, nov. gen.

Antennæ graciliores, alis fere triplo longiores, in ♂ quam in ♀ longiores. Palpi maxillares hirsutiores; articulis 1° et 4° longis, fere æqualibus; 2°, 3° et 5° æqualibus et singulis 4° duplo longioribus. Alæ anticæ elongatæ, angustæ, sparse pilosæ; marginibus costali et dorsali fere parallelis; cellula discoidali occlusa; ramulo superiore rami thyriferi ♂ furcato, ♀ bifurcato; alæ posticæ latæ, anterioribus breviores, subtriangulares. Pedes longi. Calcaria 2-2-2. Abdomen robustum, in ♀ subdepressum. Appendices inferiores in ♂ bisarticulatæ. (Mas et Fœm.)

Antennæ nearly thrice the length of the wings, longer in the male than in the female, very fine; basal joint swollen, scarcely so long as the head. Head transverse, hairy. Maxillary palpi very hairy; the first and fourth joints moderately long, nearly equal; the second, third and fifth equal, each about thrice the length of the fourth. Mesothorax long, the sides nearly parallel. Anterior wings very long and narrow, slightly hairy, most so in the female; costal and dorsal margins nearly parallel, the apex slightly dilated and elliptical; neuration strong; discoidal cell closed, dilated and angular at the apical end; in the female there is one more apical cell than in the male, owing to the upper branch of the superior branch of the ramus thyrifer being twice forked in that sex, and only simply forked in the male; the radius is united to the discoidal cell by a transverse vein; another transverse vein unites the discoidal cell to the cellula thyridii; and there are three others placed nearly in a straight line below it, one of them closing the cell. Posterior wings broad, subtriangular, shorter than the anterior; neuration alike in both sexes;

discoidal cell closed; apical forks four, the first very small. Legs long. Spurs 2-2-2, each tibia being provided with two small and equal apical spurs. Abdomen robust, depressed in the female; anal appendices well developed in the male, the inferior pair bisarticulate; in the female the apex of the abdomen is obtuse, with two rounded superior valves.

A genus with the *facies* of *Leptocerus*, and formed to receive the species described as *Leptocerus magnus*, Walker, *L. oppositus*, Walker, *L. canescens*, M'Lachlan, &c., together with some hitherto-undescribed species, which do not agree with *Leptocerus* in the neuration. The group appears to be peculiar to Australia, New Zealand, and the neighbouring islands of the Eastern Archipelago.

I am now inclined to consider my *L. canescens* as merely the female of *L. magnus*. I have received numerous examples from Mr. Edwards of Melbourne, and in all cases the specimens of the one are males, and of the other females. *L. oppositus* and *L. cognatus* are also nearly related to these, and may be only varieties, but the difference of locality favours the suspicion that they are distinct. *L. cephalotes*, Walker, from New Zealand, probably also belongs to this genus, but the type is scarcely recognisable, and *L. exiguus*, M'Lachlan, should, perhaps, be added, but I await the opportunity of further investigation.

The species will therefore stand as follows:—

1. *Notanatolica magna*, Walker. (Pl. XIX. fig. 3.)

Leptocerus magnus, Walk., Brit. Mus. Cat. Neurop., pt. 1, p. 73, 69, ♂; *L. canescens*, M'Lach., Trans. Ent. Soc., 3rd series, i. 306, ♀.

I subjoin a description of the anal appendices. In the male there is a broad rounded lobe from the middle of the upper margin of the last abdominal segment; on each side of this are placed the app. sup., which are small, elongated, obtuse, yellow, and furnished with long hairs at the apex; app. inf. bisarticulate, the first joint broad and obliquely truncated at the apex, the second joint double, the upper portion long and curved, the lower portion shorter; at the base of the app. inf. there is an additional appendage, curved upwards, and fringed with long and strong hairs; interiorly is to be seen a boat-shaped upper penis-cover including the small penis. The female is furnished with a broad rounded lobe, and two small obtuse superior valves.

2. *Notanatolica opposita*, Walker.

Leptocerus oppositus, Walk., *op. cit.*, p. 73, 68.

3. *Notanatolica cognata*, M'Lachlan.

Leptocerus cognatus, M'Lach. *loc. cit.* ♀.

4. *Notanatolica* (?) *cephalotes*, Walker.

Leptocerus cephalotes, Walk., *op. cit.* p. 73, 67.

5. *Notanatolica gilolensis*, n. sp.

N. antennis pallide albido-griseis, basin versus indistincte pallide annulatis; capite et thorace fuscis; palpis saturate fuscis, griseo-pilosis; alis anticis griseo-brunneis, griseo- et brunneo-pilosis; posticis fuligineo-fuscis, venis fuscis; pedibus pallide griseo-brunneis; abdomine fusco, lineis utrinque ochraceis. (Fœm.)

Long. antenn. 22 lin.; corp. $4\frac{1}{2}$ lin.; exp. alar. 16 lin.

Habitat in insula Gilolo (Wallace).

In Mus. Saundersiano.

Antennæ pale whitish-grey, with very indistinct paler annulations towards the base; the basal joint fuscous. Head and thorax fuscous. Palpi dark fuscous, clothed with grey hairs. Anterior wings greyish-brown, with grey and brown pubescence intermixed; a whitish spot at the thyridium. Posterior wings smoky-grey, subhyaline; the neuration dark fuscous. Legs pale greyish-brown. Abdomen dark fuscous, with broad greyish-ochreous lateral lines. In the female the superior valves are somewhat elongated and obtuse.

In Mr. Saunders' Collection is a male from New Guinea, which I think belongs to this species, but it is smaller than the female described above (exp. alar. 14 lin.), whereas in *N. magna* the female is considerably smaller than the male. It differs in the antennæ being dark brown, with distinct white annulations (in *N. magna* the coloration of the antennæ differs in the sexes) and in the darker colour of the legs. The anal appendices are not in a condition to be satisfactorily described, but they appear to be arranged similarly to those of *N. magna*.

Genus Setodes, Rambur.

The limits of this genus are at present ill-defined. The species included in it by Rambur are discordant, and he places some species in his genus *Mystacida* which should more properly belong to this. In my "*Trichoptera Britannica*" (*ante*, p. 116) I have shown that *Setodes* may be divided into two sections according to the neuration, and this seems to me the best character. The species vary in the length of the joints of the palpi, and also in the spurs of the anterior tibiæ ; this latter variation is of grave importance in this Order, in consequence of the character being considered of primary value. Rambur describes the anterior tibiæ as spurless, and this is apparently the case in some European species, but I do not feel sure that this is really so, because I can detect two very minute and almost microscopic apical spurs on those tibiæ in some species; in others there is evidently one rather long apical spur, with no visible sign of a second.

1. *Setodes hemerobiöides*, n. sp.

S. antennarum articulo basali, capite, thorace, pedibusque griseo-albis; alis nudis, latis, ad apicem obtusis, hyalinis; anticis fusco-nebulosis, præcipue ad basin marginis costalis; venis nigro-fusco striatis; ramulo superiore rami thyriferi haud furcato; alis posticis hyalinis; pedibus albidis; tibiis anticis unicalcaratis; abdomine viridescente; appendicibus inferioribus longis, sursum incurvatis. (Mas.)

Long. corp. $2\frac{1}{2}$ lin.; exp. alar. 7 lin.

Habitat ad Macassar, in insula Celebes (Wallace).

In Mus. Saundersiano.

Antennæ (broken) with the basal joint whitish. Head naked, whitish, with grey streaks and a black mark externally at the insertion of the basal joint of each antenna. Eyes whitish-ochreous. Maxillary palpi whitish, the three first joints very long, the second fuscous at the apex. Mesothorax greyish-white. Anterior wings devoid of hairy clothing, broad, the apex obtuse; whitish-hyaline, with greyish-fuscous clouds, of which there is a large one placed at the base of the costal margin, which is dilated; another is placed about the middle of this margin, and smaller ones round the apex and about the anastomosis; neuration scarcely darker than the membrane, but marked with blackish-fuscous streaks at the base, apex and anastomosis; the upper branch of the ramus thyrifer is not forked; the three transverse veins, forming the anastomosis, are straight, the first and third nearly opposite, the second placed a little within the others towards the base. Posterior wings hyaline, the veins slightly coloured. Legs whitish: the anterior tibiæ furnished with one rather long apical spur. Abdomen greenish. In the male the superior appendices appear to be wanting, but there are two rounded lobes, from between which arises a curved and pointed spine; inferior appendices long, curved upwards, a little concave internally.

The single specimen is mutilated, having lost its antennæ, excepting the basal joints. In its broad, hyaline and naked anterior wings it bears a not remote resemblance to a species of *Hemerobius;* hence the specific name.

NOTE. *Setodes sexpunctata*, Kolenati, from India (Gen. et Spec. Trichop. pt. 2, p. 266, 3, tab. 3, fig. 28), cannot possibly pertain to *Setodes*, or even to an allied genus. According to the neuration of the figure, it should probably form a new genus. The arrangement of the nervures in the posterior wings is not unlike that of *Polymorphanisus*, Walker, but the veins of the anterior wings are too different, supposing the figure to be correct.

Genus ANISOCENTROPUS, M'Lachlan.

Trans. Ent. Soc. 3rd series, i. 492.

1. *Anisocentropus flavicaput*, n. sp.

A. antennis fuscis, dimidio basali flavido-annulatis, articulo basali flavido-ochraceo; capite et palpis flavido-ochraceis, his articulo ultimo fusco-terminato; thorace supra et infra rufo-ochraceo; alis anticis et posticis totis fuscis, his pallidioribus, venis saturatioribus; pedibus ochraceis, tibiis et tarsis posterioribus fuscescentibus, fusco-pilosis; abdomine intense fusco. (♂.)

Long. antenn. 7 lin.; corp. 3 lin.; exp. alar. 9 lin.

Habitat in Australia boreali (Damel).

In Mus. mihi.

Antennæ dark blackish-fuscous, annulated with yellowish on the basal half; basal joint bright yellowish-ochreous. Head and palpi bright yellowish-ochreous, the terminal joint of the latter tipped with fuscous. Eyes black. Thorax reddish-ochreous both above and below. Anterior and posterior wings uniformly fuscous; the latter paler, subhyaline, and with dark fuscous veins. Legs bright ochreous; the posterior tibiæ and tarsi fuscescent, with fuscous hairs. Abdomen dark blackish-fuscous, ochreous at the apex, and with ochreous appendices.

A well marked species of *Anisocentropus;* the anterior wings possess a rather strong pubescence, and in this respect it bears more resemblance to the North-American, than to the Eastern representatives of the genus.

The British Museum possesses yet two species, which agree with *Anisocentropus* in the neuration, tibial spurs, and general appearance, but differ somewhat in the maxillary palpi; these have the terminal joint strongly fringed with long hairs, and several of the joints have the appearance of being somewhat dilated; but the differences seem scarcely sufficient to warrant their generic separation. The single example of each species is not in sufficiently good condition to enable me to draw up a satisfactory description. They are from the Philippine Islands and New Guinea respectively.

Fam. HYDROPSYCHIDÆ.

Genus Macronema, Pictet.

1. *Macronema Saundersii*, n. sp.

(Pl. XVII. fig. 3, ♂; Pl. XIX. fig. 4.)

M. antennis fuscis, articulo basali et spatio longo in medio flavis; capite purpureo-fusco, linea mediana flava; palpis flavis; mesothorace purpureo-fusco; alis nitente-fuscis, albo-signatis, anticis vittis tribus, duabus basalibus, una apicali, et maculis triangularibus magnis, tribus ad costam, una ad marginem dorsalem; alis posticis maculis costalibus albis; pedibus flavis, tibiis extrorsum obscurioribus; abdomine flavo; appendicibus superioribus rectis, angustis, acutis; inferioribus longis, sursum incurvatis; pene ad apicem inciso. (♂.)

Long. antenn. 11 lin.; corp. 4 lin.; exp. alar. 11 lin.
Habitat in insula Mysol (Wallace).
In Mus. Saundersiano.

Antennæ fuscous, the basal joint and a long space in the middle yellow. Head purplish-fuscous, with an impressed yellow line in the middle. Palpi yellow, somewhat fuscescent. Mesothorax purplish-fuscous. Anterior wings shining fuscous; three large triangular spots on the costa and one on the dorsal margin, white; two white basal vittæ, the upper one short, the lower one longer and uniting with the dorsal spot; in the apex a white vitta, the basal end of which is slightly produced downwards; neuration dark fuscous. Posterior wings shining fuscous, with three large white costal spots. Legs yellowish, the tibiæ somewhat fuscescent externally. Abdomen yellow. The superior appendices form two broad and divergent blades; inferior appendices very long, the joints nearly equal, the first straight, dilated towards the apex, the second curved and also dilated towards the obtuse apex; penis broad and obtuse, the apex slightly notched.

A very pretty and distinct species, belonging to the group of *M. hyalinum*, &c., in the character of its coloration.

2. *Macronema Wallacei*, n. sp. (Pl. XVII. fig. 4, ♀.)

M. antennis fuscis, ad basim flavo-ochraceis; capite, palpis, mesothorace, pedibus, abdomineque flavo-ochraceis; alis fuscis, nitidis; anticis ad basim flavo-albido striatis et maculis magnis in medio albidis; posticis macula costali magna albida. (♀.)

Long. antenn. 11 lin.; corp. $4\frac{1}{2}$ lin.; exp. alar. $11\frac{1}{2}$ lin.

Habitat in Nova Guinea (Wallace).

In Mus. Saundersiano.

Antennæ fuscous, yellowish-ochreous at the base. The whole of the body, palpi and legs yellowish-ochreous. Eyes blackish. Anterior wings shining fuscous; at the base there are several yellowish-white longitudinal lines, which are confluent and form one large pale space at the extreme base; in the middle of the wing are two very large white opposite blotches, one on the costa, the other on the dorsal margin, each produced towards the apex; these blotches form a nearly entire broad band across the wing, being separated by a very narrow line of the dark ground colour; the veins traversing them are yellowish; neuration (except in the pale spaces) dark fuscous. Posterior wings shining fuscous, with a large white blotch on the middle of the costal margin reaching more than half across the wing.

3. *Macronema dulce*, n. sp.

M. antennis flavis, basim versus vix fusco-annulatis, articulo primo fuscescente; capite saturate fusco, maculis tribus in fronte flavis; prothorace flavo-fusco; mesothorace antice nigro, postice castaneo; palpis et pedibus flavis; alis pallide fuscis, aurantiaco-iridescentibus, anticis vittis brevibus ad basim albis, et fascia lata media, fere interrupta, alba; posticis spatio longo costali albo; abdomine ochraceo. (♀.)

Long. antenn. 10 lin.; corp. $3\frac{1}{2}$ lin.; exp. alar. 9 lin.

Habitat in insula Mysol (Wallace).

In Mus. Saundersiano.

Antennæ yellow, finely annulated with fuscous at the divisions of the joints towards the base; basal joint fuscescent externally. Head rich dark brown, with three yellow spots in front. Palpi yellow. Prothorax fuscous, somewhat ochraceous. Mesothorax black in front, chestnut brown behind. Anterior wings pale fuscous, with a brilliant golden reflexion; two short whitish lines at the base, one along the costa, the other in the middle; a broad white fascia in the middle, nearly interrupted on the apical side by a narrow prolongation of the dark ground colour. Posterior wings similar in colour to the anterior; a long white space along the costal margin; neuration in all the wings fuscous, except in the pale spots, where it is yellow. Legs yellow. Abdomen dull ochreous.

This species somewhat resembles the last, but may be instantly separated by the coloration of the body.

The genus *Macronema*, as it now stands, may be at once recognized by the remarkably small discoidal cell of the anterior wings; the neuration does not seem to offer any important variation in the numerous species, but I am convinced that much remains to be done in the way of subdividing the genus according to the number or form of the spurs on the anterior tibiæ. This has been partially done by Kolenati (Gen. et Spec. Trichop. pt. 2, p. 239), who forms the genus *Macrostemum* of a section which he says is characterized by the absence of anterior tibial spurs. I have lately examined about twenty-seven species with a view to ascertain if these could be arranged in any well-defined limits, but the results are unsatisfactory, owing to their having been, for the most part, obtained from single individuals of each species, in some of which the spurs may have been accidentally broken. Moreover, I am sure that in some species the anterior spurs vary in the sexes; as examples of this I will cite *M. capensis*, Walker, and *M. fastosa*, Walker. Again, some possess two long and equal spurs on these tibiæ, and others two very unequal spurs; in some there appears to be only one spur, and I think that others will surely bear out Kolenati when he denies the existence of any anterior spurs; yet appearances are sometimes deceptive, for on examining three examples of *M. apicalis*, Walker, two of them certainly appeared to have spurless anterior tibiæ, whilst a third exhibited two very minute spurs.

The following notes on the synonymy of this genus may be useful:—

M. albovirens, Walker, and *M. agraphum*, Kolenati. Both these species are referred to *Leptonema pallida* of Guérin, by Dr. Hagen in his "Synopsis Synonymica." I have examined individuals that appear to pertain to the one and the other respectively, and I am inclined to think that *M. albovirens* is a good and distinct species, but that *M. agraphum* is identical with *L. pallida*. *M. albovirens*, of which I have seen several examples, may be distinguished by the green colour of the veins and the perfectly colourless membrane of the wings; in *M. agraphum* (*L. pallida*) the veins are somewhat testaceous and the membrane distinctly coloured in the areas mentioned by Kolenati.

M. signata, Walker, *M. inscripta*, Walker, and *M. pulcherrima*, Walker, all from Sierra Leone, are possibly only varieties of one species; the two last, I think, are certainly identical.

Hydropsyche multifaria, Walker, has already been justly transferred to *Macronema* by Dr. Hagen.

H. vicaria, Walker, is also placed in *Macronema* and perhaps justly, but the dense hairy clothing of the wings renders an examination of the neuration difficult without injuring the type.

Hydropsyche transversa, Walker, is certainly a *Macronema*, but of a peculiar *facies*.

Leptocerus niveistigma, Walker, *L. abjurans*, Walker, and *L. quadrifurca*, Walker (Trans. Ent. Soc. 2nd ser. vol. 5, pp. 176, 177), must form a section of *Macronema*. See the observations at the end of this paper.

Genus Stenopsyche, nov. gen.

Antennæ graciles, alis longiores, intus inconspicue serratæ. Caput subquadratum, postice dilatatum, pilosum. Ocelli magni. Palpi maxillares articulis duobus basalibus brevibus, 3° longissimo; 4° vix 2^{do} longiori; 5° præcedentibus in unum æquali. Alæ anticæ elongatæ, angustæ, lanceolatæ, ad apicem acutæ, sparse pilosæ; cellula discoidali parva, occlusa; furcis apicalibus 1^a, 2^a, 3^a, 4^a et 5^a instructæ; posticæ valde breviores, opacæ, furcis apicalibus 3^a et 5^a instructæ. Pedes modice longi. Calcaria 3-4-4. (♂.)

Antennæ longer than the wings, fine, indistinctly serrated within, the basal joint short. Head subquadrate, widened posteriorly, hairy. Eyes very large, subglobose. Ocelli large and distinct, oval. Maxillary palpi slightly hairy; the first and second joints short; the third very long; the fourth rather longer than the second; the fifth about the length of the others united. Labial palpi small; the first and second joints short, the latter the longer; the third equal in length to the others united. Mesothorax large, hairy, somewhat truncated in front. Anterior wings long and narrow, the apical portion slightly dilated, the apex rather acute; hairy clothing slight; discoidal cell small, closed; cellula thyridii long; apical forks 1, 2, 3, 4 and 5 all present.* Posterior wings much shorter than the anterior, and more than twice as broad, opaque; costal margin arched; apex obtuse; anal portion largely developed; discoidal cell small, closed; apical neuration irregular; forks 3 and 5 present; a transverse vein below the discoidal cell, another below the first and more towards the apex, and a long curved one from the base of fork 5 to the first of the costulæ. Legs moderately long and slender. Spurs 3-4-4; anterior tibiæ with two short and nearly-equal apical spurs, and one short median; intermediate and posterior tibiæ each with two long median and apical spurs, the inner spur of each pair being the longer. Abdomen long and moderately robust; anal appendices well developed and complicated.

Stenopsyche differs widely from any described genus of *Hydropsychidæ*. The combined characters of the long and narrow wings, the neuration, and the tricalcarate anterior tibiæ, will enable it to be readily recognized. At present I know of only one species, and of that only the male sex. It is probable, judging from analogy, that the female may possess dilated intermediate legs.

1. *Stenopsyche griseipennis*, n. sp. (Pl. XVII. fig. 5.)

S. antennis grisescentibus, ad basim indistincte annulatis; capite et thorace brunneis, griseo-pilosis; oculis intense brunneis; ocellis flavis; alis anticis pallide griseis, confertim griseo-fusco reticulatis et maculatis; posticis totis sordide albidis; pedibus testaceis, tibiis anterioribus et intermediis late fusco-annulatis; abdomine brunneo. (♂.)

Long. antenn. 14 lin.; corp. 7 lin.; exp. alar. 20 lin.

Habitat in India orientali.

In Mus. mihi.

Antennæ greyish, darker towards the apex, the basal portion with indistinct darker annulations. Head and thorax brown, with grey pubescence. Palpi brown. Eyes dark brown. Ocelli bright yellow. Anterior wings pale grey, thickly reticulated and

* The numbering of the apical forks in the neuration of the wings of the *Hydropsychidæ* is fully explained, *ante*, p. 123.

blotched with dark greyish-fuscous; the blotches are largest towards the base and on the apex; costal margin with numerous short transverse streaks. Posterior wings uniformly dull whitish, opaque, the veins scarcely darker. Legs pale testaceous; the anterior and intermediate tibiæ and tarsi broadly annulated with fuscous. Abdomen brownish-testaceous. In the male a broad elongated lobe proceeds from the middle of the upper margin of the last abdominal segment, and is truncated and notched at its apex; on each side of this lobe proceed the long, filiform, hairy and slightly-curved superior appendices, and from beneath on each side arises a fine cylindrical intermediate appendage, curved strongly outwards at the tip; app. inf. broad and triangular at the base, but ending in an elongated point; immediately below the app. inf. are seen two thickened straight pieces, which I regard as the lower penis-sheaths; the penis is not apparent in my example.

The coloration of the anterior wings somewhat resembles that of a faded example of *Phryganea varia.*

Genus Leptopsyche, nov. gen.

Antennæ graciliores, alis triplo longiores; articulo basali inflato. Ocelli nulli. Palpi maxillares longi; articulo basali brevissimo; 2° longiore, gracili; 3° et 4° brevibus, crassioribus, fere æqualibus; 5° gracillimo, præcedentibus in unum æquali. Alæ fere nudæ; anticæ elongatæ, angustæ, ad apicem rotundatæ; venula transversa obliqua medium versus inter costam et subcostam; cellula discoidali aperta; furcis apicalibus 1ª, 2ª, 3ª, 4ª et 5ª instructæ; posticæ latæ, breves, margine costali exciso; furcis apicalibus 2ª, 3ª et 5ª instructæ. Pedes graciles. Calcaria 2-4-4. Abdomen breve. Appendices inferiores longæ, graciliores. (Mas.)

Antennæ very slender, about three times the length of the wings; basal joint bulbous, scarcely so long as the head. Head transversely subquadrate above, with a small tubercle between the basal joints of the antennæ; sides prominent, obliquely truncated. Eyes small. Ocelli none. Maxillary palpi long and slender, slightly hairy; basal joint very short; second long and slender; third and fourth each about half the length of the second and stouter; fifth very slender, thong-shaped, as long as, or longer than, all the others united. Labial palpi small, the terminal joint long. Prothorax forming a narrow collar. Mesothorax obovate, with a rounded tubercle at each shoulder. Anterior wings shining, with very short and slight pubescence, narrow, the apex elliptical; neuration fine; two oblique transverse veins uniting the costa and subcosta, one before the middle of the costa, and another near the termination of the subcosta; discoidal cell open; cellula thyridii small, closed by a transverse vein; another transverse vein at the base of this cell, and yet another below it towards the base of the wing; apical forks 1, 2, 3, 4 and 5 all present, fork 5 rudimentary. Posterior wings much shorter and broader than the anterior; anal portion well developed; costal margin excised before the apex; no discoidal cell; apical forks 2, 3 and 5 present, fork 3 very small. Legs slender. Spurs 2-4-4; anterior tibiæ with two minute apical spurs; intermediate with two pairs of long and very unequal apical spurs; posterior tibiæ with two pairs of long and nearly equal spurs. Abdomen short and stout; inferior appendices long and slender.

There is not any described genus of *Hydropsychidæ* which approaches this, either in general form, or in the arrangement of the nervures; the open discoidal cell of the anterior wings is peculiar, as it is generally closed in this family.

1. *Leptopsyche gracilis*, n. sp.* (Pl. XIX. fig. 8.)

L. antennis fusco-ochraceis, ad basim ochraceis; capite, palpis thoraceque ochraceis; oculis nigris; alis anticis nitente-flavis; posticis flavo-hyalinis, iridescentibus, venis flavo-ochraceis; pedibus flavo-albidis, tarsis ochraceis; abdomine ochraceo; appendicibus superioribus parvis, quadratis; inferioribus longis, gracilibus, sursum incurvatis, forsitan bisarticulatis. (♂.)

Long. antenn. 19 lin.; corp. 4 lin.; exp. alar. 13 lin.
Habitat in insula Dorey (Wallace).
In Mus. Saundersiano.

Antennæ ochraceous, somewhat fuscous, at the base wholly ochraceous. Head, palpi and thorax ochreous. Anterior wings shining, semi-transparent, yellow, the apex slightly brownish-ochreous. Posterior wings hyaline, tinged with yellowish, beautifully iridescent; neuration yellowish-ochreous. Legs pale yellowish; all the tarsi ochreous. Abdomen ochreous; superior appendices very small, quadrate; inferior appendices long and slender, curved upwards and approximating at the tips, apparently bisarticulate, but the first joint is short and nearly concealed; penis thick.

Genus Nesopsyche, nov. gen.

Antennæ graciles (alis longiores?), articulo basali brevissimo. Caput planum, fronte magna. Ocelli nulli. Palpi maxillares articulo basali brevi; 2° et 3° fere æqualibus, dilatatis; 4° tenui, brevi; 5° gracili, 3° æquali. Palpi labiales articulo basali brevi; 2° longissimo, incurvato, subtus fimbriato; 3° gracili. Alæ anticæ ad basin angustæ, apicem versus dilatatæ, apice obliquo, pilis brevibus vestitæ; cellula discoidali occlusa; furcis apicalibus 1ª, 2ª, 3ª, 4ª et 5ª instructæ; posticæ breves, fere latæ; cellula discoidali occlusa; furcis apicalibus 2ª et 5ª instructæ. Pedes modice longi; tibiis intermediis (♀) haud dilatatis. Calcaria 3-4-3; calcaribus apicalibus tibiarum posticarum valde inæqualibus, uno modice elongato, incurvato, altero longissimo, robusto, torquato. (Fœm.)

Antennæ slender, probably longer than the wings (broken); the basal joint very short, scarcely thicker than the following. Head smooth, subquadrate above, the front large and convex. Ocelli none. Maxillary palpi with the basal joint short; the second and third joints nearly equal, broad and dilated, obliquely truncated at the apex; the fourth shorter and much thinner than the third; the fifth still thinner, not longer than the third. Labial palpi with the basal joint short and small; the second very long, curved, furnished beneath with a short and thick fringe of hairs; the third slender, not longer than the second. Prothorax well developed. Mesothorax smooth, convex, obovate. Anterior wings narrow at the base, dilated towards the very oblique apex; hairy clothing very slight; discoidal cell short and broad, closed; a transverse vein unites the discoidal cell to the radius; there are two others below this cell, and two placed towards the base of the wing; forks 1, 2, 3, 4 and 5 all present, fork 1 very small. Posterior wings much shorter than the anterior, and slightly broader, rounded at the apex; discoidal cell closed; forks 2 and 5 present. Legs moderately long; the intermediate tibiæ and tarsi not dilated in the female. Spurs 3-4-3; anterior tibiæ with two moderately long and equal apical spurs, and one short spur placed near the base; intermediate tibiæ with two pairs of long spurs; posterior tibiæ with one short median spur, placed nearer the apex than is usual, and two very unequal apical spurs, the outer moderately long and of the ordinary form, the inner very long, nearly reaching the apex of the first tarsal joint, and much bent in a somewhat spiral manner. Abdomen slender.

I know of no genus approaching this in the peculiar structure of the labial palpi, or in the extraordinary form and arrangement of the tibial spurs; on the posterior tibiæ, I cannot detect any sign of a second median spur, and the form of the inner apical one is very singular.

1. *Nesopsyche flavisignata*, n. sp.
(Pl. XVII. fig. 6; Pl. XIX. fig. 6.)

N. antennis nigro-fuscis; capite nigro, inter antennas flavo; palpis maxillaribus, mesothorace, abdomineque nigris; palpis labialibus flavis; alis anticis saturate fuscis, maculis magnis flavis et macula subocellata ad apicem albida; posticis fuscis, ad apicem albido-nebulosis; pedibus fuscis, testaceo-variis; tarsis omnibus testaceo-ochraceis. (♀.)

Long. antenn.?; corp. $4\frac{1}{2}$ lin.; exp. alar. 11 lin.

Habitat ad Macassar, in insula Celebes (Wallace).

In Mus. Saundersiano.

Antennæ blackish-fuscous, the basal joint yellow. Head black, yellow between the antennæ. Maxillary palpi black. Labial palpi yellow. Mesothorax and abdomen black. Anterior wings dark fuscous, with large yellow spots, of which a triangular one on the dorsal margin, with a prolongation towards the base, is the most conspicuous; in the apex there is a large, almost circular, whitish spot, enclosing a large pupil of the ground colour. Posterior wings fuscous, slightly and narrowly yellowish about the middle of the costal margin, and with an indistinct whitish cloud in the apex. Legs with all the coxæ blackish-fuscous; anterior femora testaceous at the tips; intermediate and posterior femora testaceous, fuscous at the base; posterior tibiæ wholly fuscous; all the tarsi testaceous.

Genus Hydropsyche, Pictet.

1. *Hydropsyche Edwardsii*, n. sp. (Pl. XVII. fig. 7.)

H. antennis albido-ochraceis, apicem versus fuscis, articulorum apicibus fusco-annulatis; capite et thorace fuscis, albo-pilosis; palpis griseo-fuscis; alis anticis albis, margine costali griseo, stria obliqua subapicali intense grisea; posticis margaritaceis, longe albo-fimbriatis; pedibus griseo-ochraceis, tibiis et tarsis posterioribus albis, albo-pilosis; abdomine griseo-albo, infra obscuriori; appendicibus inferioribus bisarticulatis, articulo primo brevi, 2° longo, pallide viridi-albis; pene ad apicem testaceo, sub apicem haud tuberculato. (Mas.)

Long. corp. 3 lin.; exp. alar. 8 lin.

Habitat ad Melbourne in Australia (Edwards).

In Mus. mihi.

Antennæ whitish-ochreous, fuscous towards the apex, and with the tips of the joints annulated with fuscous. Head and thorax fuscous, clothed with white pubescence. Palpi greyish-fuscous. Anterior wings white, the costal margin greyish, and with a dark-grey oblique transverse streak, extending from near the apex of the costal margin half-across the wing; apical cilia greyish. Posterior wings pure pearly-white, without any trace of darker markings, and furnished with long white cilia. Legs greyish-ochreous, the posterior tibiæ and tarsi white, with long white hairs. Abdomen greyish-white, darker beneath. In the male the inferior appendices are long and forcipated, the first joint very short, the second extremely long, pale greenish-white; penis testaceous at the apex, without any apparent subapical projection.

An extremely delicate species, agreeing in all its most important characters with the European representatives of the genus, but differing in certain minor respects; the posterior wings being broader, with the apical portion more strongly developed, the cilia longer, and the posterior legs more hairy. The second joint of the inferior appendices is usually small in European forms, the first being the longer.

Genus Sciops, nov. gen.

Antennæ alis longiores, intus obsolete serratæ. Caput quadratum, supra politum. Ocelli nulli. Palpi maxillares hirsuti; articulo primo brevissimo; 2° longiori; 3° vel 2° longiori; 4° 2° æquali; 5° tenuiori, præcedentibus in unum æquali. Alæ fere glabræ, latæ; anticæ apicem versus dilatatæ, sub apicem vix excisæ, sed apice oblique truncato; cellula discoidali occlusa; furcis apicalibus 1ª, 2ª, 3ª, 4ª et 5ª instructæ; posticæ anticis latitudine æquales, vix breviores; cellula discoidali occlusa; furcis apicalibus 1ª, 2ª, 3ª et 5ª instructæ. Pedes breves; tibiis intermediis (♀) haud dilatatis.

Calcaria 2-4-4. Abdomen robustum; appendicibus inferioribus (♂) forcipatis, triarticulatis. (♂ et ♀.)

Antennæ longer than the wings, slender, obsoletely serrated within; basal joint very short. Head nearly quadrate above, the disk smooth and polished. Ocelli none. Maxillary palpi long and hairy; the basal joint short; the second and fourth equal; the third nearly twice the length of the second; the fifth very slender, thong-shaped, as long as the others united. Labial palpi small; the basal joint short; the second longer; the third very slender, much longer than the two others united. Prothorax rather distinct. Mesothorax subquadrate. Anterior wings narrow at the base, but broad at the apex; the apical margin obliquely truncated, and very slightly excised just below the apex; hairy clothing very slight, whence the wings appear smooth and polished; neuration strong and distinct; discoidal cell closed, rather large; a transverse vein below this cell, another closing the cellula thyridii, and two others towards the base; apical forks 1, 2, 3, 4 and 5 all present, forks 1 and 3 short. Posterior wings as broad as the anterior, and but slightly shorter; fringes very short; discoidal cell closed; apical forks 1, 2, 3 and 5 present. Legs rather short; the intermediate tibiæ not dilated in the female. Spurs 2-4-4; anterior tibiæ with two long and equal apical spurs; intermediate and posterior tibiæ each with two pairs of long and equal median and apical spurs. Abdomen robust; the apex obliquely truncated in the female; the male provided with pincer-like triarticulate inferior appendices.

This genus bears a certain amount of resemblance to *Hydropsyche*, but differs in the nearly-smooth and polished head and wings, in the obsoletely serrated antennæ, and in the form of the palpi, &c.

1. *Sciops unicolor*, n. sp. (Pl. XIX. fig. 7.)

S. antennis nigro-fuscis, ad medium ochraceis; capite polito, nigro; palpis nigro-fuscis; mesothorace nigro; alis anticis et posticis totis fuscis, nitidis, venis nigricantibus; pedibus et abdomine nigro-fuscis. (♀.)

Long. antenn. ?; corp. $4\frac{1}{2}$ lin.; exp. alar. 13 lin.

Habitat ad Tondano in insula Celebes (Wallace).

In Mus. Saundersiano.

Antennæ bright fuscous, the middle portion bright ochreous. Head shining black. Eyes, palpi, legs and abdomen dull blackish-fuscous. Mesothorax dull black. Wings totally shining-fuscous, with a purple reflexion in certain lights; the veins strong and blackish.

2. *Sciops octomaculata*, n. sp. (Pl. XVII. fig. 8.)

S. antennis flavo-ochraceis, ad basin et ad apicem obscurioribus; capite, thorace, abdomineque nigris; palpis ochraceo-fuscis; alis nigro-fuscis, nitidis, anticis albo-octomaculatis; pedibus fuscis, tarsis ochraceis; appendicibus superioribus parvis, inferioribus longis, forcipatis, triarticulatis, nigris; pene valde exserto. (♂.)

Long. antenn. ?; corp. 3 lin.; exp. alar. $6\frac{1}{2}$ lin.

Habitat in insula Borneo (Wallace).

In Mus. Saundersiano.

Antennæ bright yellowish-ochreous, somewhat fuscescent at the base and apex. Head shining black. Eyes blackish-fuscous. Palpi fuscous, somewhat ochreous. Mesothorax dull black. All the wings shining blackish-fuscous, with a purplish reflexion in certain lights; neuration scarcely darker; on the anterior wings there are about eight small whitish spots, regularly disposed. Legs fuscous; all the tarsi ochreous, the anterior tibiæ also somewhat ochreous. Abdomen dull black; superior appendices small; inferior appendices long, black, pincer-like, the tips approximating, triarticulate, the apical joint thinner; penis much exserted, and bent downwards.

Genus Polycentropus, Curtis.

1. *Polycentropus orientalis*, n. sp.

P. antennis et palpis pallide flavidis; capite thoraceque fuscis; alis anticis pallide griseo-fuscis, aureo-maculatis, margine costali longitudinaliter fusco-striato; alis posticis griseo-hyalinis, cellula discoidali aperta, costulis duabus primis non anastomosantibus; pedibus griseo-ochraceis; abdomine supra fusco, infra ochraceo; appendicibus superioribus parvis, plano-pyriformibus; inferioribus longioribus, subcylindricis, testaceis, ad apicem truncatis, nigricantibus. (Mas.)

Long. corp. 2 lin.; exp. alar. $6\frac{1}{2}$ lin.

Habitat ad Macassar, in insula Celebes (Wallace).

In Mus. Saundersiano.

Antennæ and palpi pale yellowish. Head and thorax fuscous. Anterior wings pale greyish-fuscous, with golden yellow spots, most conspicuous on the costa; costal margin with longitudinal streaks of dark fuscous; neuration slightly darker. Posterior wings hyaline, with a greyish tinge, iridescent. Legs greyish-ochreous. Abdomen fuscous above, ochreous beneath. In the male the superior appendices are small, flattened, pyriform, testaceous, and fringed with long hairs; inferior appendices longer, subcylindrical, testaceous, the apex truncated, with the corners rather produced and blackish.

The single example is not in good condition, the wings being much rubbed. In the neuration it agrees entirely with the group of *P. flavomaculatus*, Pictet (vide "The Entomologists' Monthly Magazine," vol. i., page 27; "Trichoptera Britannica," *ante*, p. 144), except that the two first costulæ do not anastomose in the middle.

Genus Psilochorema, nov. gen.

Antennæ graciles, alis vix longiores. Caput transversum, inter antennas productum. Ocelli valde conspicui. Palpi maxillares graciles; articulis duobus basalibus brevibus, latis; 3° elongato; 4° vix 3° breviori; 5° quam 3° longiori. Mesothorax ovatus, in ♂ penicillo medio instructus. Alæ anticæ in quiete fere planæ, angustæ, breviter et dense pilosæ; marginibus costali et dorsali fere parallelis; apice vix dilatato, obtuso; basin versus spatiis nudis; cellula discoidali occlusa, (et in *P. mimico* cellula parva abnormali infra instructa); cellulis apicalibus longis, fere pariter angustis; furcis apicalibus 1ª, 2ª, 3ª, 4ª et 5ª instructæ; alæ posticæ breviores, latiores; cellula discoidali aperta; furcis apicalibus 1ª, 2ª, 3ª et 5ª instructæ. Pedes modici. Calcaria 2-4-4. Abdomen modice robustum. (Mas et Fœm.)

Antennæ very slender, slightly longer than the wings; basal joint thick, shorter than the head. Head broadly transverse, produced in front between the antennæ, rugose, the hinder portion forming a kind of raised collar. Ocelli very distinct, round. Maxillary palpi slender, slightly hairy; the two basal joints short and broad; the third longer and slender; the fourth shorter than the third; the fifth thong-shaped, longer than the third. Labial palpi with a slender terminal joint. Mesothorax ovate, with a a raised tuft of hairs in the middle, in the male. Anterior wings lying nearly flat when in repose, narrow, the margins nearly parallel; the apex somewhat dilated, obtuse and elliptical; hairy clothing short and dense; on the cubital veins, in the male, are tufts of raised hairs; before the middle of the wing there are several cell-like spaces which are entirely glabrous; neuration of the disk irregular; discoidal cell closed (in *P. mimicum*), with an additional smaller cell placed below it, formed by the presence of a transverse vein between the two prongs of the lower fork of the ramus discoidalis); the apical veins long and parallel, forming long narrow apical cells; apical forks 1, 2, 3, 4 and 5 all present. Posterior wings scarcely so long as the anterior and rather broader; pubescence scanty; fringes moderate; neuration irregular; forks 1, 2, 3 and 5 present. Legs moderately long, alike in both sexes. Spurs 2-4-4. Abdomen moderately robust.

This singular genus differs from anything with which I am acquainted, especially in the abnormal arrangement of the neuration, and in the position of the wings in repose; in this latter condition the single species known to me bears a striking resemblance to a Micro-Lepidopterous insect of the genus *Depressaria*.

1. *Psilochorema mimicum*, n. sp. (Pl. XVIII. fig. 4.)

P. antennis fuscis, flavo-annulatis, ad apicem totis fuscis; capite et thorace castaneis; palpis brunneis; alis anticis fuligineo-fuscis, aureo- et albo-signatis, fascia ante apicem indentata albida, basin versus penicillis pluribus nigricantibus; alis posticis griseo-hyalinis; pedibus griseo-ochraceis, tarsorum articulorum apicibus pallide flavo-annulatis; abdomine nigricante-fusco; appendicibus superioribus (♂) minimis, ad apicem clavatis, pilosis; inferioribus maximis, latissimis, vix galeatis, intus concavis et dentibus parvis multis nigris, margine exteriore late emarginato. (♂ et ♀.)

Long. corp. 3 lin.; exp. alar. $7\frac{1}{2}$ lin.

Habitat in Nova Zealandia.

In Mus. Brit.

Antennæ fuscous, annulated with yellow, the apical portion wholly fuscous. Head and mesothorax dark chestnut-brown. Palpi brown. Metathorax polished chestnut-brown. Anterior wings smoky-fuscous, with pale golden and whitish markings, most plentiful on the dorsal half; a whitish indentated fascia a little before the apex; several raised tufts of blackish hairs along the dorsal margin towards the base. Posterior wings greyish-hyaline. Legs greyish-ochreous, the tips of the tarsal joints annulated with pale yellowish. Abdomen blackish-fuscous, the appendices testaceous. In the male the superior appendices are very small, slender at the base and clavate at the apex, hairy; inferior appendices very large and broad, concave, and furnished with numerous minute blackish teeth internally, the outer margin broadly emarginate; between the app. inf., on the superior portion, arises a long flattened and obtuse piece, which I regard as the upper penis-cover.

Observations on the Species of Trichoptera described by Mr. Walker, in Vol. V. of the 2nd Series of the Trans. Ent. Soc., pp. 176—180.

Phryganea divulsa. The type is a female, not a male as is represented by Mr. Walker. It is very closely allied to *P. cinerea*, Walker, from Hudson's Bay, and perhaps identical therewith. Nevertheless the locality (Haiti*) renders its distinctness possible, and one should see the male to be able to speak with certainty.

Limnophilus griseus, from Haiti, does not differ from the ordinary European form of that species. The specimen is a male, without abdomen.

Leptocerus niveistigma, *L. abjurans* and *L. quadrifurca*, have no resemblance to *Leptocerus* save the long antennæ and the narrow wings, and do not even belong to the *Leptoceridæ*. The neuration is identical with that of *Macronema*, and I consider them as forming a section of that genus characterized by the narrow and elongate anterior wings. In all three species the anterior tibiæ appear to be spurless, but the apex of the tibiæ is very obliquely truncated, and drawn out into a point, which might be mistaken for a spur, only that it is above, instead of below, the insertion of the first tarsal joint. The type of *L. quadrifurca* is a female, not a male as described.

* I suppose always that the locality "Haiti" is correct; but both this insect and *Limnephilus griseus* are forms that one would scarcely expect to find within the tropics.

Macronema percitans is a good species of that genus, with possibly two very minute anterior spurs in the male.

Genus *Musarna*. This genus belongs to the *Sericostomidæ* and not to the *Leptoceridæ*. It is in part identical with *Barypenthus*, Burmeister, as has already been noticed by Hagen in his "Synopsis Synonymica." The single type of each of the three species is a male and not a female as described; by some error the words "*Mas* et *Fœm*." and "*Male* and *Female*" are inserted at the head of the generic diagnosis and description. The three species are large and conspicuous insects, remarkable for their very broad wings, those of *M. claudens* being shorter than in the others; they bear considerable resemblance to each other, but according to recognized rules they must be placed in two genera. In all three the maxillary palpi of the males are ascending, the joints of nearly equal thickness and sparsely hairy; but in *M. aperiens* (Pl. XVIII. fig. 3) and *M. interclusa*, these palpi are four-jointed, whereas in *M. claudens* (Pl. XVIII. fig. 2) they are only three-jointed; the terminal joint in the first two species is small. The neuration of the wings is arranged in much the same manner in all three, but again there is a striking difference, for in *M. aperiens* and *M. interclusa* there is one more apical cell in both pairs of wings than in *M. claudens*, the lower branch of the ramus thyrifer in the anterior wings being bifurcate in the two former and simply furcate in the latter, with a corresponding difference in the forks of the posterior wings.*

M. claudens (Pl. XVIII. fig. 2) is identical with *Barypenthus rufipes*, of Burmeister (Handb. Ent. ii. p. 929, 2); the diagnosis of the latter is short and unsatisfactory, but the figure by Kolenati (Gen. et Spec. Trichop. pt. 2, tab. iv. fig. 48) leaves no doubt on the subject. It seems probable, however, that Burmeister, and it is certain that Kolenati, included one of the other species of *Musarna* of Walker under the generic term *Barypenthus*, for I think that *B. concolor* of Burmeister is identical with *M. aperiens* of Walker; and Kolenati, in his description of the genus *Barypenthus*, says that the maxillary palpi are four-jointed, although Burmeister in his generic description states that the maxillary palpi of the males are distinctly three-jointed; this agrees with *B. rufipes*, which must therefore be considered as the type of the genus.

* In the type of *M. aperiens* the sixth apical cell in the right anterior wing is divided by a transverse vein, placed not far from the base of the cell; this is wanting in the left wing, and is simply an aberrant variation. This vein is indicated by a dotted line in Plate XVIII. fig. 3.

The two genera, *Barypenthus* and *Musarna*, may therefore be advantageously retained; *M. claudens* being transferred to *Barypenthus*, as identical with *B. rufipes*, and *M. aperiens* and *M. interclusa* remaining under *Musarna*, the former, however, being probably identical with *B. concolor*. *M. interclusa* appears to be distinct from *M. aperiens* from its universally darker colour, of which even the legs and the underside of the abdomen partake.

Genus *Curgia*. This is possibly a good new genus, but the type of *C. braconoides* bears extreme resemblance to *Chimarra*. The description is very faulty. The second joint of the maxillary palpi does not present "a spine at its tip," as mentioned by Mr. Walker; but at that spot there is a tuft of long bristle-like hairs, quite analogous to what is found in *Chimarra marginata*. In the diagnosis we find the words "tibiæ posteriores calcaribus duobus longis apicalibus," and lower down, "tibiæ posticæ calcaribus duobus mediis;" similarly in the description we find the words "posterior tibiæ with two long apical spurs," and lower down "hind tibiæ with two middle spurs;" the natural supposition is that the words "posteriores" and "posterior" were written by mistake for "anteriores" and "anterior," and this view Dr. Hagen appears to have taken, and has thereby been misled into describing the spurs, in his "Synopsis Synonymica," as 2-3-4. In reality the anterior tibiæ are without spurs, and the intermediate tibiæ have four spurs, instead of three. It is true that in the type-specimen, one of the median spurs is broken off from one of the intermediate tibiæ, and on the other one spur is closely pressed against the tibia itself, and is difficult to see; but there it is, without doubt, and as long as the others. Hence the spurs of *Curgia* (♀) are 0-4-4. The neuration is very similar to that of *Chimarra marginata*, but the cell-like spaces on the disk of the wing of that genus are not represented in *Curgia*; the apical veins are quite the same. I am not sure that *Chimarra* possesses a closed discoidal cell in the anterior wings, which is the case in *Curgia*, although here the transverse veins are transparent, and not seen well, except from the underside. The type is a female.

I repeat that *Curgia* and *Chimarra* are very closely allied, and it is possible that if the former be really distinct, some (or all) of the described exotic species of the latter should be transferred to it.

No locality is mentioned for *Curgia braconoides*; the type is labelled "St. Domingo."

EXPLANATION OF THE PLATES.

Plate XVII.

Fig. 1. *Phryganea Maclachlani*, ♀.
„ 2. *Asotocerus ochraceellus*, ♂ ?.
„ 3. *Macronema Saundersii*, ♂.
„ 4. *Macronema Wallacei*, ♀.
„ 5. *Stenopsyche griseipennis*, ♂.
„ 6. *Nesopsyche flavisignata*, ♀; 6^a posterior leg.
„ 7. *Hydropsyche Edwardsii*, ♂.
„ 8. *Sciops octomaculata*, ♂.

Plate XVIII.

Fig. 1. Neuration of *Pycnocentria funerea*, ♂; 1^a head and palpi, 1^b posterior leg, 1^c anal appendices (above), 1^d ditto (side), 1^e neuration of ♀, 1^f maxillary palpus of ♀.
„ 2. Neuration of *Barypenthus rufipes*, ♂; 2^a maxillary palpus, 2^b labial palpus, 2^d anal appendices (above), 2^e ditto (side).
„ 3. Neuration of *Musarna aperiens*, ♂; 3^a maxillary palpus, 3^b anal appendices (above), 3^c ditto (side.)
„ 4. Neuration of apical portion of anterior wing, and of the whole of the posterior wing of *Psilochorema mimicum*; 4^a maxillary palpus, 4^b anal appendices of ♂ (side), 4^c ditto of ♀ (side).

Plate XIX.

Fig. 1. Neuration of *Ganonema pallicorne*, ♀; 1^a maxillary palpus, 1^b anal appendices (above), 1^c ditto (beneath).
„ 2. Neuration of *Asotocerus ochraceellus*; 2^a maxillary palpus.
„ 3. Neuration of *Notanatolica magna*, ♀; 3^a maxillary palpus, 3^b anal appendices (above), 3^c neuration of apical portion of anterior wings of ♂, 3^d anal appendices (above), 3^e ditto (side).
„ 4. Neuration of *Macronema Saundersii*; 4^a anal appendices, ♂ (side).
„ 5. Neuration of *Stenopsyche griseipennis*, ♂; 5^a maxillary palpus, 5^b labial palpus, 5^c anal appendices (above), 5^d ditto (side), 5^e ditto (beneath).
„ 6. Neuration of *Nesopsyche flavisignata*, ♀; 6^a maxillary palpus, 6^b labial palpus.
„ 7. Neuration of *Sciops unicolor*, ♀; 7^a maxillary palpus, 7^b labial palpus.
„ 8. Neuration of *Leptopsyche gracilis*, ♂; 8^a maxillary palpus, 8^b anal appendices.

IV. *List of the* Longicornia *collected by the late Mr. P. Bouchard, at Santa Marta.* By Francis P. Pascoe, F.L.S., &c.

[Read January 1st, 1866.]

During the few months that the late Mr. Peter Bouchard spent at Santa Marta, in the state of New Grenada, he made and sent to this country two collections of insects. They were perhaps more interesting than extensive, but, had he lived, he would probably have more fully justified the anticipations that were entertained regarding the insect Fauna of that part of South America. More devoted to the Lepidoptera than to the Coleoptera, his collections of the latter were less numerous than might have been expected; nevertheless they contained fifty-three species of Longicorns, and as twenty-five of these are new or not previously described, I have thought that a list of them would be acceptable to the Society.

The fifty-three species belong to no less than forty-five genera; of these forty are already characterized, four are hereinafter described (two of them being of entirely novel form), and the remaining one will be defined by Mr. Bates in the valuable account which he is publishing of the species collected by himself on the Amazons.

Acanthoderes circumflexus, Duval.

Steirastoma* histrionicum, White.

Steirastoma lycaon, n. sp.

S. nigrum, nitidum, interrupte griseo-pubescens; prothoracis spina bifida laterali vix producta, dente antico fere obsoleto; tarsis totis nigris.

Black, shining, strongly carinated above, the interstices covered with a brownish-grey pubescence; head with a raised line in front, not on the vertex; antennæ about half as long again as the body in the male, the scape smooth; prothorax with the anterior marginal tooth at the side almost obsolete, the bifid lateral spine

* Serville, Ann. Soc. Ent. Fr. iv. p. 24.

only slightly produced, the anterior part of it very small, disk quadri-tuberculate, the central line replaced by a broad flattish callus anteriorly; scutellum triangular; elytra short, ovate, the dorsal keel very strongly marked and sending forth anteriorly a short branch directed towards the apex of the scutellum, the intermediate keel interrupted in the middle, and having at that point a whitish spot, apices rounded; body beneath and legs black, shining.

Length 6 lines.

Differs from *S. histrionicum* in the more feeble armature of the prothorax, the ovate outline of the elytra, their prominent carinæ and rounded apices, the smoothness of the scape, and other characters. There was only one specimen of this species. Very little stress can therefore be laid on its size, otherwise it is the smallest species of the genus.

Steirastoma stellio (Dej.).

S. pubescens, albidum, fuscescente nebulosum; spina bifida laterali valde producta, dente antico minuto; tarsis anticis nigris, cæteris albidis, articulis duobus ultimis exceptis.

Covered with a short dense whitish pubescence; the mesial line confined to the vertex, cheeks below the eyes glabrous, black; prothorax with the anterior marginal tooth short, the bifid lateral spine strongly produced, especially the anterior part of it, and pointing forwards; disk dark brownish, with thin strongly-raised smooth lines; scutellum rounded behind; elytra short, ovate, the dorsal keel not strongly marked, crowned with a line of small granules at the base, the intermediate and lateral keels still less strongly marked, all covered by the pubescence, sides brownish, between the base and middle a short oblique black line, behind the middle an angular line forming with its fellow, though not quite meeting on the suture, a W-shaped mark, along the suture a few black spots, apices obliquely truncate; body beneath black, the sides with a whitish pile; antennæ a little longer than the body in the male, covered with a short greyish tomentum; legs greyish, the tibiæ and tarsi varied with dark brown; the anterior tarsi black.

Length 7 lines.

This is, I believe, the *Steirastoma stellio* of Dejean, and, so far as I am aware, it has not been published. The elytral carinæ are much less prominent than usual, forming in fact little more than angular lines, while those on the prothorax, and the bifid lateral tooth, are strongly developed.

LAGOCHEIRUS ARANEIFORMIS, Linn.

ÆTHOMERUS* VERRUCOSUS, n. sp.

Æ. fusco-brunneus, tenuiter squamulosus; elytris inæqualibus, basi elevatis, cristatis, lineis verruciferis duabus posticis

* Thomson, Essai, &c., p. 338 (*Macromerus*, Dej.) Two unpublished *Æthomeri* in my collection may here be described:—

1. *Æthomerus cretatus.*

Æ. fuscus, tenuiter squamulosus; elytris cervino-variegatis, basi cristatis, pone cristam oblique excavatis et cretato-notatis, apicem versus haud depressis, linea cretata signatis; femoribus anticis cretato-variegatis.

Much stouter than *M. verrucosus*, chocolate-brown, varied with dark fawn-colour, and covered more or less with a minute scaly pubescence; cheeks, side of the prothorax and anterior femora, except on the inner surface, with close-set chalky scales; disk of the prothorax with a few coarse punctures and two luteous tubercles, behind each of which is a black triangular patch; scutellum subquadrate, fawn, the sides dark brown; elytra irregular, raised at the base, a narrow straight tuberculate crest on each side, space between the crests and middle of the elytra fawn-coloured, with transverse pale lines, behind the crest an oblong oblique excavation, marked with chalky white; the apex not depressed, dark brown, with an oblique chalky line; body beneath dark brown; sides of the abdomen with white spots; coxæ testaceous; legs greyish-testaceous, varied with brown; antennæ greyish-testaceous, the scape with a brown ring.

Length 5½ lines.

Well distinguished by the chalky lines on the elytra and unicolorous antennæ. This species is sometimes found under the Fabrician name of *antennator*. It is not, however, the one recently described by Mr. Bates as that species.

2. *Æthomerus analis.*

Æ. fusco-griseus, tenuiter squamulosus; prothorace albido, vittis duabus nigris; elytris variegatis, apice subito depressis, albidis.

Fulvous-brown, with a pale-greyish squamosity; head varied with greyish; prothorax tuberculate as in the last, the middle greyish, the sides clouded with brown; scutellum nearly semicircular; elytra irregular, a short curved tubercular ridge on each side at the base, the interspace and sutural region to beyond the middle fulvous-brown, this colour more or less varied with brown on the rest of the elytra, except the apical portion, which is snowy-white, behind the middle two curved tubercular lines, and a straight tubercular line along the side; body beneath and legs varied with fulvous-brown and dark brown, the latter with whitish rings on the femora and tibiæ; antennæ five times as long as the body, fulvous-grey, the scape and extremity darker.

Length 5½ lines.

Resembles to a certain extent *Æ. Lacordairei* in colour, but is less robust: it is remarkable for the excessive length of the antennæ.

spatium includente, lateribus rugoso-punctatis et verrucosis, apicem versus subito depressis; antennis, basi excepta, omnino pallidis.

Dark reddish-brown, with thin scaly pubescence; head with a white spot behind each eye; antennæ very slender, about five times as long as the body, very pale-yellowish, darker at the base; prothorax strongly bituberculate, the sides behind the lateral tooth greyish; scutellum semi-circular; elytra very irregular, raised at the base, a narrow tuberculate crest on each side, two warty lines beginning a little before the middle and passing backwards to the apex, inclosing a comparatively smooth space between them, posteriorly the elytra are rather suddenly depressed towards the apex, the sides from the shoulders roughly punctured and furnished with several prominent warty tubercles; body beneath reddish-chesnut; legs brownish, varied, especially the femora, with darker.

Length 5 lines.

Nearly allied to *Æ. asperulus*, White, but more uniformly coloured, the tubercles at the sides slender and prominent, and the spaces between the lines of tubercles on the disc more excavated. This member of the group is also found at Rio.

ONYCHOCERUS SCORPIO, Oliv.

ALPHUS* ASELLUS, n. sp.

A. fuscus, pube grisea albido-varia tectus; prothorace transverso, disco regulari, utrinque tuberculato; elytris apicem versus attenuato-rotundatis.

Dark brown, covered with a dense grey pile, varied on the elytra with whitish; head with a broad elevated line on the vertex; prothorax transverse, disk nearly regular, with a few course punctures at the base, and a short broad tubercle on each side; scutellum triangular; elytra gradually tapering from the base to the apex, the approach to the latter, therefore, gradually attenuated, not suddenly rounded; body beneath, legs and antennæ with a short, slightly silky pubescence.

Length 6 lines.

An obscure species as regards colour, but distinguished by the regular prothorax and tapering elytra. I owe the determination of the genera of this and of the next species to Mr. Bates.

* J. Thomson, Essai, &c., p. 10.

ALCIDION* PRIVATUM, n. sp.

A. breve, brunneum, pube griseo-ochracea tectum; prothorace in medio depresso, immaculato; elytris obscure griseo-fasciatis, apicem versus fusco- et griseo-strigosis, apicibus oblique subtruncatis.

Reddish-brown, with a greyish-ochraceous pubescence; eyes approximating on the vertex; prothorax depressed in the middle, a small callus posteriorly, a few coarse punctures at the base and apex; scutellum triangular, rounded at the apex; elytra subovate, the centro-basal ridges well marked and clothed with short semi-erect hairs, a broad but very indistinct band across the middle, behind this a few streaky spots of dark brown and greyish, apices slightly truncate, the inner angle rounded; body beneath reddish-chesnut, pubescent at the sides; legs and antennæ greyish, annulated with dark brown.

Length $4\frac{1}{2}$ lines.

Similar in colour to *A. triangulare*, Bates, but much stouter. *Alcidion* is distinguished from the allied genera by the absence of the lateral spine or tooth of the prothorax.

LEPTURGES† AMABILIS, Bates.

LEPTURGES FIGURATUS, n. sp.

L. testaceus, pube grisea tectus; capite inter antennas valde concavo; elytris rufo-castaneo-plagiatis, plagis plerumque lateralibus et irregularibus, apicibus rotundato-obliquis; antennis pedibusque testaceis, illis articulorum apicibus nigricantibus.

Fawn-coloured, caused by the dark testaceous derm blending with the thin grey pubescence; head deeply excavated between the antennæ; prothorax sparingly punctured; scutellum triangular; elytra with reddish-chesnut patches, one forming an oblique streak at the base, the shoulder entirely chesnut, behind this and connected with it at the side a large squarish patch, a larger one behind the middle almost meeting at the suture, and a smaller spot toward the apex, the apices obliquely rounded; body beneath and legs testaceous, the tips of the intermediate and posterior femora and tibiæ blackish; antennæ nearly twice as long as the body, slender, testaceous, the tips of the joints blackish.

Length 3 lines.

* J. Thomson, Essai, &c., p. 12.

† Bates, Ann. & Mag. Nat. Hist. ser. 3, xii. p. 367.

Very distinct from all the numerous species described by Mr. Bates. *Lepturges* is well distinguished from *Leiopus* by the trapezoidal form of the prothorax, and the lateral spine placed at its posterior angle, or rather it may be said that the lateral spine is absent and the posterior angle produced.

Colobothea* distincta, n. sp.

C. cervina, ochraceo- et fusco-varia, præsertim prothorace plagis duabus discoideis, extus flavo-marginatis; elytris apicibus spina externa productis.

Densely pubescent, fawn-coloured, varied with buff-yellow and dark brown; head fawn in front, two lines on the vertex and the cheeks buff; antennæ fawn, the fourth to the last joints, except the seventh and ninth, pale at the bases; prothorax with two brown oblong patches on the disk, each bordered externally with a buffish-yellow stripe; scutellum triangular; elytra with two principal buff spots, one nearly transverse behind the middle, the other smaller and præ-apical, both bordered with dark brown, a few spots towards the base, one especially near the apex of the scutellum, behind the shoulder also a large dark spot anteriorly bordered with buff, apices emarginate, the outer angle terminating in a strong spine; body beneath and legs fawn, varied with buff.

Length 4—4½ lines.

This well-marked species is found also in Guatemala and Costa Rica.

Colobothea nævia, Bates.

Eutrypanus assula, Bates.

Carterica† optata, n. sp.

C. nigra, et pallide flava; elytris subsulcatis.

Densely pubescent; head pale yellow, the vertex black; antennæ twice as long as the body, dark brown, the scape black; prothorax transverse, contracted at the base, yellow, a broad central stripe and a narrower lateral one just above the acetabulum black; scutellum semicircular, black; elytra black, a broad band behind the middle, and the shoulders, pale yellow; apices rounded

* Serville, Ann. Soc. Ent. Fr. iv. p. 69.

† Thomson, Essai, &c., p. 19.

at the suture, and shortly angulated externally; body beneath yellowish, the abdomen smoky-black; legs black, covered with a short greyish-white pile, the under part of the anterior femora yellowish.

Length 5 lines.

In this species the elytra are only very slightly sulcated, and the interspaces can scarcely be said to be raised into lines as in *C. cinctipennis*. The disposition of the colours is nearly the same in both, but the yellow is very pale.

Onciderес Bouchardi, Bates.

Cydros, n. g.

Caput magnum, antice quadratum, clypeo bisinuato, tuberibus antenniferis remotis. *Oculi* tenue granulati, late emarginati. *Antennæ* breves, lineares; *scapo* subelongato, curvato, apicem versus incrassato; articulo tertio scapo æquali; quarto breviore, cæteris perbrevibus. *Prothorax* cylindricus, muticus, capite haud latior, antice paulo armatus. *Elytra* prothorace multo latiora, fere parallela, brevia, basi callosa, apice subito declivia. *Pedes* breves; *femora* incrassata; *tarsi* æquales. *Coxæ* anticæ subglobosæ. *Pro-* et *meso-sterna* subelevata.

This genus, I think, will take its place near *Eudesmus*, Serv., notwithstanding its unarmed prothorax. It will readily be distinguished among the shorter and more compact *Apomecyninæ* by its abruptly declivous elytra, and their basal callosities.

Cydros leucurus, n. sp. (Pl. XX. fig. 5.)

C. fuscus, pubescens; capitis prothoracisque lateribus, elytrorum apice, et corpore subtus, albis.

Dark brown, with a somewhat paler pubescence; head irregularly punctured, varied with dark brown, grey and reddish-brown, the cheeks behind the eyes white; prothorax irregularly impressed with two or three curved transverse lines on each side, a median stripe and the sides below white; scutellum rounded behind; elytra nearly impunctate and paler in the middle, the sides coarsely pitted with shallow punctures, the intervals thrown into transverse irregular folds, the declivous portion of the apex white and nearly impunctate, callosity at the base with a stout tooth-like spine anteriorly, *i. e.* on each side of the scutellum; body beneath with a close whitish pubescence; legs and antennæ brown, varied with white, the latter about half the length of the body.

Length 6 lines.

STYGNESIS, n. g.

Caput rotundatum, convexum, tuberibus antenniferis obsoletis. *Oculi* grosse granulati, parvi, in medio emarginati. *Antennæ* breves, lineares, basi distantes ; *scapo* obconico ; articulo tertio duplo longiore ; cæteris brevioribus et gradatim decrescentibus. *Prothorax* cylindricus, capite haud latior. *Elytra* parallela, elongata, prothorace paulo latiora. *Pedes* brevissimi ; *femora* antica crassiora, *tarsi* breves, æquales, articulis tribus basalibus sub-latis. *Coxæ* anticæ subconicæ. *Pro-* et *mesosterna* simplicia, declivia.

In the South American series of *Apomecyninæ* this genus may be placed near *Agennopsis*, Thoms., from which it differs in the simple mesosternum, more cylindrical form, and shorter legs, the hinder pair being placed nearly midway between the apex of the prothorax and the end of the elytra.

STYGNESIS PUNCTIGER, n. sp.

S. fuscus ; prothorace confertim, elytris seriatim fortiter punctatis, illo lateribus griseo-pubescentibus.

Nearly cylindrical, brown ; head remotely punctured ; eye nearly equally divided by the sinus ; prothorax coarsely and closely punctured, the disk nearly glabrous, the sides with a close dull greyish pubescence ; scutellum triangular ; elytra coarsely seriate-punctate, somewhat irregular posteriorly, the intervals thinly pubescent, the apices rounded ; body beneath, legs and antennæ with a sparse greyish pile, the latter rather longer than half the length of the body.

Length 3 lines.

TESSARECPHORA ARACHNOIDES, J. Thoms.

TÆNIOTES SCALARIS, Fab.

PTYCHODES TRILINEATUS, Lin.

AMILLARUS APICALIS, J. Thoms.

The female has the elytra entirely black ; the four posterior legs and the antennæ are also black.

ZEALE, n. g.

Caput antice subquadratum, convexum. *Antennæ* basi distantes, fimbriatæ, elongatæ; *scapo* cylindrico; articulo tertio longiore; cæteris gradatim decrescentibus. *Prothorax* breviter cylindricus, basi paulo constrictus. *Elytra* breviuscula, apicem versus sensim angustiora, lateribus haud carinato-declivibus. *Femora* subincrassata; *tarsi* mediocres, æquales; *ungues* bifidæ. *Pro-* et *meso-sterna* simplicia.

The absence of the carina on the line where the declivous portion of the elytron commences is, I am inclined to think, one of the main distinctions between the *Amphionychinæ* and the *Phytæciinæ*, and consequently the present genus will belong to the latter. The affinities are not very obvious, but it is evidently not to be placed in any genus hitherto described.

ZEALE SCALARIS, n. sp. (Pl. XX. fig. 1.)

Z. nivea; antennis basi, capite inter oculos, prothoraceque maculis nigris; elytrorum marginibus, apice, fasciisque tribus ad suturam interruptis, nigris.

Pubescent, snowy white, barred and spotted with black; head white, a black band between the eyes, and two black spots in front; antennæ twice as long as the body, the scape black, the rest of the joints brownish-yellow tipped with black; prothorax with four black spots, a central, an anterior, and two lateral; scutellum white; elytra white, the sides and four bands (not meeting at the suture, and the last nearly apical) black, apices emarginate; body beneath dark brown on the breast, the abdomen yellowish, the sides white; legs yellow, the claws black.

Length 4 lines.

ISOMERIDA* AMICTA, n. sp. (Pl. XX. fig. 2.)

I. fulvo-grisea; prothorace utrinque macula magna læte cruenta ornato.

Covered with a yellowish-grey pubescence, with longer hairs intermixed; head yellowish; antennæ longer than the body, fimbriated, black, the bases of all the joints from the third inclusive white; prothorax transverse, the central line black, sides bright

* This genus will be defined by Mr. Bates in an early number of the Ann. & Mag. Nat. Hist. The type is *Amphionycha albicollis* (Dej.)

blood-red; scutellum brown; elytra parallel, subtruncate at the apices, yellowish-grey, the sides, end, and apex shading into dark brown, a central yellowish stripe on each not extending to the apex or base; body beneath yellowish, shaded with brown, the third and fourth abdominal segments lemon-yellow, the last segment black; legs yellowish; the tarsi brown.

Length 5 lines.

Resembles *I. albicollis* (Dej.) in everything but colour, which, however, is very marked. It may be, possibly, only a variety of that variable species.

HEMILOPHUS? MURINUS, n. sp.

H. fusco-griseus; vertice, vittis duabus obliquis prothoracis, et articulo quarto antennarum, albis.

Thinly pubescent, greyish-brown; head brownish-yellow, very convex in front, greatly depressed between the bases of the antennæ; lip and mandibles black; palpi testaceous; eyes prominent, distant on the vertex; prothorax transverse, scarcely as broad as the head, brownish-yellow, darker at the base, the sides with an oblique scaly whitish stripe; scutellum dark brown; elytra nearly parallel, strongly angulato-deflexed at the sides, the apices rounded, brownish-grey, paler at the shoulders; body beneath dark brown, shining, the sterna pale pitchy; legs testaceous, darker towards the tarsi; antennæ brownish, sparingly pilose, half as long again as the body, the third joint as long as the fourth and fifth together.

Length 4 lines.

This species is only provisionally placed with *Hemilophus.*

PHÆA* CROCATA, n. sp. (Pl. XX. fig. 3.)

P. flava, nitida; prothorace croceo; capite, antennis, fascia elytrorum, et segmento ultimo abdominis, nigris.

Loosely pilose; head black, sparingly punctured; prothorax reddish-yellow, with a few scattered punctures; scutellum transverse; elytra lemon-yellow, irregularly punctured, a broad black band a little behind the middle; body beneath pale yellowish, the last abdominal segment glossy black; legs yellowish; antennæ about as long as the body, black.

Length 4 lines.

* Newman, Entom. i. p. 13.

A very distinct species. The central callus of the prothorax is not nearly so elevated as is in the following.

Phæa astatheoides, n. sp.

P. rubra, nitida; elytris antennisque nigris.

Loosely and rather shortly pilose, reddish-orange, the elytra, eyes and antennæ only, black; head finely punctured; tips of the mandibles brown; antennæ shorter than the body, the scape punctured and shining; prothorax with small distant punctures, the central callus very prominent; scutellum triangular; elytra shining, coarsely and rather irregularly punctured; body beneath and legs impunctate, glossy, with a few scattered lines.

Length 3—6 lines.

Also very distinct, but in colour approaching *P. acromela*, Pasc., which, however, *inter alia*, has the body beneath, tibiæ and tarsi black.

Euryptera* ruficollis, n. sp.

E. nigra; capite, prothorace, femoribusque anticis rufis; elytrorum apicibus rotundatis.

Coarsely pubescent, black; head and prothorax orange-red, space between the eyes dark brown; scutellum triangular; elytra narrow, parallel at the sides, the apices rounded, the whole surface closely punctured; body beneath black, the propectus and anterior coxæ yellowish; antennæ nearly linear, more than half the length of the body; anterior and intermediate tarsi subequal, rather short, *i. e.* not longer than the basal joint of the posterior; claw-joint small.

Length 4½ lines.

The different proportions of the tarsi, the smallness of the claw-joint, and the narrow elytra, separate this species from the typical form of *Euryptera*.

Euryptera? lyciformis, n. sp.

E. sericea, pubescens; antennis, tibiis tarsisque pro parte, et fasciis duabus elytrorum, nigris.

Silky, tawny-yellowish; antennæ, tibiæ except at the base, the last three joints of the tarsi, and two bands on the elytra, black; scutellum narrowly triangular; elytra gradually expanding from the

* Serville, Ann. Soc. Ent. Fr. iv. p. 222.

shoulders to near the apex, which is rather abruptly rounded, first band directly before the middle, the second considerably behind it and continued to the apex; body beneath and legs yellowish, slightly nitid, varied or clouded with black; antennæ fusiform, hairy; all the tarsi much shorter than the tibiæ, the anterior shortest, claw-joint small.

Length 4½ lines.

The form of the antennæ, and shorter tarsi with small claw-joints, are also at variance with the ordinary characters of *Euryptera;* but as the genus appears to be a large one it will require to be more thoroughly examined than has yet been done before it can be decided how far the characters mentioned will afford sufficient grounds for the establishment of new genera.

ACYPHODERES BRACHYPTERUS, Chev.

CHARIS* CORINNA, n. sp.

C. nigra, fronte et fasciis tribus prothoracis flavis; elytris infuscatis; pedibus fulvescentibus, tibiis posticis fusco-fasciculatis.

Black; head with a bright yellow pubescence in front; antennæ less than half the length of the body, fulvous, darker towards the apex, and beyond the middle fusiform, with the joints scarcely dilated; prothorax black, with three bright yellow bands; scutellum narrowly oblong, its apex and the base of the elytra with bright yellow hairs, the rest of the elytra nearly glabrous, clouded with brown, and having each a pale-yellowish spot towards the apex, which is slightly rounded externally; body beneath brownish, an oblique pale yellow line on each side of the metasternum, the first abdominal segment pale ochreous; legs fulvescent, the posterior tibiæ clothed on the apical half with long brown hairs, their tarsi pale straw-colour.

Length 5 lines.

The limitations between the three genera *Charis*, *Odontocera* and *Acyphoderes* are anything but well defined. Excellent generic characters may be drawn from the types of each, almost as a matter of course, but the characters, as usual, shade off until nothing reliable remains. In a rough kind of way, but one of those which, I am sure, will be found in a multitude of cases, the only conscientious course that can be pursued, *Charis* is

* Newman, Entom. i. p 21.

distinguished by the greater length of its hind legs, and globular prothorax; *Odontocera* by the globular prothorax but shorter posterior legs—this excludes *O. gracilis* of Klug and its allies, which Serville has formed into a "subdivision;" and *Acyphoderes* by its flattish irregular prothorax, and its disk marked with three elevated ridges—this excludes *A. crinitus*, Klug. Our collections contain numerous forms which it will be necessary to separate, and this has been done already to a certain extent by M. J. Thomson. The present species resembles *Odontocera fasciata*, Oliv., in its banded prothorax.

Cometes flavipennis, Buq.

Listroptera atra, Chev.

Cosmisoma plumicornis, Drury.

Described and figured by Drury, under the name of *Leptura plumicornis*, Illustr., &c. iii. p. 74, pl. xlix. fig. 3. In the Stett. Ent. Zeit. 1865, pp. 170, 171, four well-marked species of *Cosmisoma* from the Argentine Republic have been described by Prof. Burmeister.

Rhopalophora* intincta, n. sp.

R. æneo-nigra, subnitida; prothorace confertim punctato, rufo, marginibus anticis et posticis exceptis; elytrorum apicibus sub-acutis; antennis nigris.

Dark brassy-black, subnitid; head rather closely punctured; prothorax very closely punctured, the disk equal, without any depressions, constricted anteriorly, and suddenly contracted at the sides posteriorly, dark red except at the constricted margins; scutellum broadly triangular; elytra closely punctured, flattish, scarcely broader than the prothorax, each ending in a subacute angle; body beneath brassy-green, the anterior pectus dark red; legs with scattered long black hairs, tarsi short, the first and second pairs subequal; antennæ about half as long again as the body, black, the fourth joint rather more than half the length of the third, and considerably thicker than the following, fimbriated beneath.

Length 5 lines.

* Serville, Ann. Soc. Ent. Fr. iii. p. 100.

This species and the following are only provisionally referred to *Rhopalophora*,* the prothorax being differently formed, and the tarsi, especially the second and third pairs, being much shorter. The genus wants a revision notwithstanding M. Chevrolat's monograph.

RHOPALOPHORA MÆSTULA, n. sp.

R. chalybeata, subnitida; prothorace confertim punctato, nigro; elytrorum apicibus acute productis.

Generally resembling the last species, but smaller and slenderer, more of a blueish than a greenish hue; the prothorax black, and the apices of the elytra prolonged into a short mucro; the underside is bright steel-blue, the breast darker; antennæ and tarsi the same in form and proportion.

Length 3 lines.

CALLICHROMA† SCITULUM (Dej.).

C. aureo-viride; elytris vittis duabus nigro-viridibus; antennis, tibiis, tarsisque nigris, femoribus luteis.

Bright golden-green; head brilliant metallic green, mandibles iridescent at the tips; prothorax metallic green, slightly corrugated in the centre, with four dark green stripes; scutellum triangular, grooved in the middle; elytra bright green, each with two dark stripes, one central, the other along the exterior margin; body beneath brilliant green; femora luteous; tibiæ and tarsi black; antennæ rather longer than the body, black.

Length 6--8 lines.

A well-known species under the name of *C. Cayennensis* (Dup.) Having an antipathy to geographical names, I have preferred to adopt Dejean's, relying on the authority of the British Museum Catalogue. It will not come into any of M. J. Thomson's new genera.

CHRYSOPRASIS‡ BOUCHARDI, n. sp.

C. aureo-viridis, pilis brevibus suberectis instructa; antennis nigris, scapo subviride; elytrorum lateribus cuprescentibus, apicibus subtruncatis, angulo exteriori haud producto.

Bright golden-green, with a short stiff sub-erect pubescence,

* That is, the genus as represented by *R. collaris*, Germ. (*R. sanguinicollis*, Serv.)

† Latreille, Règne An. v. p. 113. ‡ Serville, Ann. Soc. Ent. Fr. iii. p. 5.

and everywhere closely punctured, except on the abdomen and antennæ; elytra with a coppery tint at the sides, the apices subtruncate, with the outer angle not produced but rather slightly rounded; abdomen luteous, impunctate; femora bright green; tibiæ and tarsi black; antennæ black, the scape with a slight tint of green.

Length 5 lines.

Closely allied to an undescribed species known in collections as *Chrysoprasis pubescens*, but differing essentially in the form of the apices of the elytra and in the short stiff pubescence.

Orthostoma abdominale, Gyll.

Ceragenia bicornis, Fab.

Phœnidnus, n. g.

Caput breve, antice paulo productum. *Antennæ* ♂ corpore fere duplo longiores, serratæ; ♀ breviusculæ, 11-articulatæ; *scapo* subpyriformi; articulo tertio vix scapo longiore, apice paulo dilatato; cæteris brevioribus et bilateraliter dilatatis. *Prothorax* lævigatus, utrinque pone medium angulato-dentatus, postice fortiter constrictus. *Scutellum* angustè triangulare. *Elytra* subtrigonata, humeris prominulis, rotundatis. *Pedes* mediocres, antici breviores; *femora* clavata. *Prosternum* elevatum, sub-latum. *Mesosternum* declive, in medio dentatum.

In some of its characters this genus is intermediate between *Lissonotus* and *Charinotes*, differing from the former in the lateral prothoracic spine and declivous mesosternum, from the latter in its smooth prothorax and 11-jointed antennæ—at least in the female—while from both it differs in its elongated muzzle. The only male in the collection has but ten joints to its antennæ, the last or perhaps two last having been lost. In this and the allied genera forming the sub-family *Trachyderinæ*, the form of the scutellum appears to have a real *generic* value; in this genus it has that of a long narrow triangle. The species described below bears a marked general resemblance to *Lissonotus corallinus*, especially in its coloration.

Phœnidnus lissonotoides, n. sp. (Pl. XX. fig. 6.)

P. niger, subnitidus; elytrorum parte anteriori, abdomine, pedibusque, tarsis exceptis, obscure rubris.

Black, glabrous, subnitid; head very slightly punctured; prothorax nearly impunctate; elytra with small scattered punctures, shoulders and posterior part black, the rest dull red, apex rounded; body beneath black; abdomen, femora and tibiæ dull red; tarsi black.

Length 7 lines.

Lissonotus corallinus, Dup.

Lissonotus flavocinctus, Dup.

Trachyderes intermedius, Dup.

Ancylosternus scutellaris, Oliv.

Oxymerus Lebasii, Dup.

Pteroplatus variabilis, Sallé.

Eburia didyma, Oliv.

Mecometopus lætus, Fab.

Neoclytus* scenicus, n. sp. (Pl. XX. fig. 7.)

N. fuscescens; prothorace disco carinis tribus asperis; elytris basi cervinis, lineis tribus fuscis in triangulum (apice versus scutellum) dispositis, in medio linea cervina literam V. simulante, pone medium fascia flava subtriangulari.

Finely pubescent; head and prothorax dark brown, covered with pale-greyish hairs, the latter with three dorsal ridges, each marked with several transverse prominent tubercles; scutellum triangular; elytra fawn-coloured at the base, marked by two oblique brown lines proceeding from near the apex of the scutellum and joined posteriorly by a transverse line; behind this line and almost in the middle of the elytra, a narrow V-shaped band, behind the middle on each elytron a lemon-yellow patch, the two forming a band of a broadly triangular shape, apices truncate with a prolonged spine at the external angle; body beneath chesnut-red, with a reversed V-shaped yellowish mark on the metasternum; the base of the femora, tibiæ and tarsi chesnut-red, the clavate portion of the femora dark brown; antennæ reddish-brown, darker towards the tips.

Length 5—6 lines.

* J. Thomson, Mus. Scient., p. 57; replacing *Rhopalomerus*, Chev. (Ann. Soc. Ent. Fr. 1860, p. 457), a name pre-occupied in the *Diptera*.

Allied to *N. impar*, Germ., but the coloration at the base of the elytra is totally different. I have retained the MS. name it bears in M. Chevrolat's Collection, now in the British Museum.

APILOCERA* POSTICA, n. sp. (Pl. XX. fig. 4.)

A. rubida, tertia parte apicali elytrorum griseo-sericea; prothorace oblongo-globoso, convexo, longitudinaliter plicato; antennis rubidis, apicem versus infuscatis.

Brownish-red, with erect scattered white hairs; head flattish in front, thinly pubescent; eyes nearly completely divided; antennæ reddish, the terminal joints dark brown, the spine of the third joint as long as the scape; prothorax oblong-globose, very convex, finely grooved or wrinkled longitudinally; scutellum large, subcordate; elytra with an oblong callosity on each side at the base, before the middle a transverse narrow ivory line, not extending to the suture, behind the middle a black glabrous band; the posterior third covered with a greyish silky pubescence; abdomen beneath black, breast and legs reddish, the tibiæ and tarsi darker.

Length 3 lines.

Four or five species of *Apilocera* have been described by M. Chevrolat. The form of the prothorax and its longitudinal grooves will serve, *inter alia,* to distinguish this new member of the group.

This genus has been long known in collections under the name of *Eplophorus*, given to it by M. Chevrolat himself many years ago. He places it near *Tillomorpha,* Bl., but in reality it is very closely allied to *Euderces,* Lec., and, excepting the *longer* spine at the apex of the third antennal joint, I scarcely see how it is to be distinguished from the latter. Both have fusiform intermediate and posterior femora, which differentiate them from *Cyrtophorus. Homœmota,* Pasc., an Australian genus, is also closely connected with the above, but there is not any spine to any of the joints of its antennæ.

PSALIDOGNATHUS MODESTUS, Fries.

I refer with some doubt the specimens sent by Mr. Bouchard

* Chevrolat, Ann. Soc. Ent. de Fr., ser. 4, t. ii. p. 61. M. Chevrolat writes *Apelocera* and *Apilocera* indifferently. The latter appears to be the more correct.

to this species, which is described in the Stockholm Kongl. Vet. Akad. Handl., 1833, p. 327, tab. ix. fig. 1 ♀, fig. 3 ♂. The description is in Swedish, with a Latin diagnosis of five words.

It is a black shining insect with a short bifid lower lip, but differs from M. Fries' figures, which are exceedingly well executed, in the obtuse not-pointed spine behind the eye, and the well-marked apiculus terminating the sutural line; there are also two rather prominent raised lines on each elytron, which are not shown on the plate. The members of the genus *Psalidognathus*, judging from the common *P. Friendii*, are very variable in size, colour, and even in form, according to the sex; and when this is the case it is difficult to arrive at a satisfactory conclusion as to specific distinctness without a large number of specimens. The males differ from the females, *inter alia*, in the fore-tibiæ being thickened and to a certain extent fusiform, with the inner margin clothed with short closely-set hairs.

Macrodontia cervicornis, Linn.

EXPLANATION OF THE PLATE.

Plate XX.

Fig. 1. *Zeale scalaris.*
„ 2. *Isomerida amicta.*
„ 3. *Phæa crocata.*
„ 4. *Apilocera postica.*
„ 5. *Cydros leucurus.*
„ 6. *Phœnidnus lissonotoides.*
„ 7. *Neoclytus scenicus.*

V. *Catalogue of* Buprestidæ *collected by the late M. Mouhot, in Siam, &c., with Descriptions of New Species.* By Edward Saunders.

[Read 5th March, 1866.]

But little was known of the Entomological Fauna of the East Indian Isles until Mr. Wallace sent over his large and valuable collections, the study of which has given Entomologists a good, though of course a far from perfect, knowledge of the insects of those productive regions.

The Entomology of Siam is at present in a less advanced state, but the collections sent home by the late M. Mouhot afford at least an idea of the fine insects to be found there, and of which we should doubtless have received a far greater number had not M. Mouhot succumbed to the evil effects of the climate in the midst of his entomological labours. Amongst the many beautiful insects he collected the *Buprestidæ* stand in a prominent position, and I have chosen these to form the subject of the present paper, as being a family in which I am especially interested; and I think that, as the *Buprestidæ* collected by Mr. Wallace have been so ably described by M. H. Deyrolle, a list of the species obtained by M. Mouhot in Siam may tend to increase the knowledge of this family, and of the geographical distribution of its genera and its species.

Altogether I find in his collections forty-four species, of which I believe thirty-three to be new; of the remainder, six are specifically identical with insects collected in the East Indian Islands by Mr. Wallace. There are three forms for which I propose to create new genera, the first of which, *Cardiaspis*, should be placed next to *Dicercomorpha* of H. Deyrolle, the second, *Engycera*, next to *Melobasis*, and the third, *Oncomœa*, between *Brachys* and *Pachyscelus*.

On the whole the species seem, as one might expect, to belong more to the Indian Fauna than to that of the oriental islands.

All the species described in this paper are from my own collection.

Genus Sternocera, Eschs.

Sternocera æquisignata (H. Deyr. MS.), n. sp.

S. viridi-cuprea; thorace largissime ac valde punctato; elytris basi albifoveatis; pectoris lateribus abdominisque segmentis utrinque albimaculatis.

Shining green, with golden reflexions. Antennæ bluish-black. Head depressed, punctured, the punctures very large and deep in front, so as to give it a somewhat rugose appearance; forehead with a slight median furrow. Thorax at the base almost twice as broad as long; sides rounded and gradually diverging to the posterior angles; disk very smooth and brilliant, covered with large remote punctures, the punctures becoming closer together and in many cases confluent on the sides, giving them a rugose appearance; on the base at each side, midway between the dorsal line and the margin, is a deep small pit, formed as it were of two or three of the discal punctures. Elytra finely punctured, a little wider than the thorax, almost straight for about three-fifths of their length, then gradually converging to the apex, which is trispinous; on the margin behind the shoulder on either side is a carina, which extends about one-fifth of the entire length of the elytra, it then turns inwards and becomes lost in an obsolete ridge; on each side of the base is a fovea, filled with a white pubescence. Abdomen punctured, the upper edge covered with a whitish pubescence, which extends on to the under side of the first segment; an oblong longitudinal spot on each side of the breast, and two spots on each of the four latter segments of the abdomen, covered with similar pubescence; posterior margin of each segment cyaneous; tip of the sternum blue-black. Legs punctured; tarsi bronzy.

Length 16—18 lines; breadth 6½—7½.
Pachbon.

Sternocera punctatofoveata, n. sp.?

A. sp. præcedente differt elytrorum disco foveis minutis sparso.

A variety of the preceding species?
Differs by the elytra being scattered over with numerous faint

depressions formed by the accumulation of minute punctures; the punctuation of the thorax not so coarse; in other respects similar to *S. æquisignata*.

Length $18\frac{1}{2}$ lines; breadth 7.

Siam.

Sternocera ruficornis, n. sp.

S. viridis; capite dense punctato; thorace valde largeque punctato; elytris *S. æquisignatæ* similibus; abdominis marginibus anticis aureo-pubescentibus; antennis pedibusque testaceis.

Green, with blue reflexions. Antennæ and legs testaceous, the latter with a bronzy tint. Head with a slight dorsal furrow, closely and deeply punctured, becoming rugose between the eyes. Thorax at the base once and a-half as broad as long; anterior margin rounded and finely ciliated, sides widening till beyond the middle, then nearly straight to the posterior angles; base slightly sinuate; disk covered with large remote punctures, becoming slightly larger at the sides; at the base on each side is a faint oblong impression. Elytra nearly twice as long as broad, sides rounded, widest a little behind the middle; apex with three spines, the exterior ones the longest; disk finely punctured, covered sparsely with very short white hairs, the punctures arranged in very irregular longitudinal striæ; near the posterior margin of each elytron are two rows of very minute pubescent white spots; base with two foveæ filled with white pubescence. Beneath punctured, the sides of the breast, the upper edge of the abdomen, two transverse spots on the anterior margin of the two middle segments (almost uniting in the middle), and a triangular spot on each side of the apical segment, covered with golden pubescence.

Length 17 lines; breadth 7.

Pachbon.

Closely allied to *S. æquisignata*, from which it differs by its more closely punctured head; by its thorax, of which the punctures are smaller and less deep; by the margins of the abdomen being covered with a golden pubescence, instead of having a white spot on each side; and by its yellow antennæ and tarsi.

Genus Catoxantha, Solier.

Catoxantha gigantea, Linn.

Chrysochroa bicolor, C. & G. Monog. Bupr. i. Gen. Chrysochroa, p. 3, pl. i. fig. 1.

Siam.

Var. *brunnea* (Pl. XXI. fig. 1). Differs from the ordinary form by having the whole upper surface purplish-brown, except the tubercles on the thorax, which are of the ordinary colour; and the yellow spots on the elytra are represented by dull-green spots

Siam

Genus Chrysochroa, Solier.

Chrysochroa rugicollis, n. sp. (Pl. XXI. fig. 2.)

C. capite thoraceque igneo-cupreis, rugosis, nitentibus; elytris testaceis, fasciâ cyaneâ in medio, apiceque ejusdem coloris: Subtus cyanea, pubescens, thorace pectorisque lateribus igneo-cupreis.

Head coppery-red, brilliant and rugose; deeply and widely furrowed between the eyes. Antennæ bluish-black. Thorax transverse, trapeziform, brilliant fiery copper, in some lights purplish; anterior margin almost straight, sides slightly incurved, posterior angles largely rounded and somewhat swollen, base broadly and deeply lobed; disk smooth and brilliant, with a faint dorsal ridge covered with large irregular punctures, sides impressed and very rugose. Elytra yellowish-white, much wider than the thorax, about twice as long as broad, with four longitudinal ridges; sides slightly swollen beyond the middle, then gradually rounded to the apex, which is somewhat truncate, and has a small sutural spine; the margin, the apical third, and an interrupted band midway between it and the base, forming two somewhat triangularly oval spots, the exterior sides of which are prolonged so as almost to reach the shoulder, cyaneous. Underside of thorax and sides of breast red-copper, pubescent; abdomen, centre of breast and legs blue; centre of abdominal segments green.

Length 23 lines; breadth $8\frac{1}{2}$.

Laas.

This species differs from *C. Buquetii* in having the thorax entirely rugose and red, instead of the disk being blue and shining, as it is in that species.

Chrysochroa Saundersii (H. Deyr. MS.), n. sp.

C. capite viridi, punctato; thorace purpureo-brunneo, lateribus aureo-cupreis; elytris thorace concoloribus, fasciâ testaceâ in medio ornatis.

Head green on the vertex, golden in front, deeply punctured, slightly furrowed on the top, deeply excavated and very rugose between the eyes. Antennæ blue-black. Thorax transverse, a little more than once and a-half as broad as long at the base; anterior margin almost straight, very slightly emarginate in the centre, the angles inclining forwards; sides nearly straight; base slightly sinuate, forming a broad and very shallow lobe; disk with a slight central ridge, covered with remote punctures, brown-purple, sides brilliantly golden-copper and rugose, posterior angles green, the angles themselves smooth and brilliant. Elytra finely punctured, about a-fifth wider than the thorax, and three and a-half times as long as the head and thorax together; shoulders largely rounded, sides slightly curved inwards as far as the centre, where they bulge out very little, and then gradually converge to the apex, which is rounded and multidentate, the sutural spine longest; suture and four ridges on each elytron, approaching each other at the apex, somewhat elevated; elytra brown-purple with greenish reflexions, each traversed by a broad central testaceous band, which scarcely touches the suture, and the margins of which are broadly edged with blackish-blue. Beneath punctured, brilliant coppery; each segment of the abdomen posteriorly margined with green; sides of the breast and a spot on the anterior margin of each segment of the abdomen covered with a shining golden pubescence; two small spots on the anterior margin of the 1st, 3rd and 4th segments shining black; apical segment deeply notched. Legs punctured, green; tarsi greenish purple.

Length 24—19 lines; breadth 8—5½.

Siam.

Differs from *C. Edwardsii*, Hope, by the sides of the abdomen beneath being covered with a golden sericeous pubescence, by its more elongate form, and by the shape of the band on the elytra.

Chrysochroa Mniszechii, H. Deyr.

Ann. Soc. Ent. Franc. 1861, pl. xvi. fig. 1.

Siam.

My specimen differs from M. H. Deyrolle's figure by being of a bright green.

Chrysochroa Chinensis, C. & G.

Cast. & Gory, Monog. Bupr. i. Gen. Chrysochroa, p. 7, pl. ii. fig. 5.

Siam, Pachbon.

Genus Chrysodema, Cast. & Gory.

Chrysodema aurostriata, n. sp. (Pl. XXI. fig. 8.)

C. cupreo-viridis; thorace aureo-punctato, lateribus rugose foveatis; elytris punctatis, utrisque lineis tribus elevatis et viridibus, interstitiis aureo-cupreis: Subtus viridis.

Coppery, with greenish reflexions. Antennæ blue-black. Head green, punctured; deeply and widely excavated between the eyes. Thorax one-third broader than long at the base; anterior margin almost straight, sides straight, gradually widening posteriorly, base slightly sinuate; disk covered with golden punctures, having a rather broad smooth dorsal line impressed at the base; sides rugose, each with a curved longitudinal rugose fovea, reaching from the base almost to the anterior margin, coppery red; the disk on each side of the dorsal line tinged with the same colour. Scutellum brilliant coppery. Elytra strongly punctured, sides subparallel for two-thirds of their length, then gradually rounding to the apex; the posterior margin denticulated for about one-third of its entire length; suture, margin, and three somewhat elevated ridges on each elytron, green; the interstices golden-copper; two impressions on each elytron, one below the shoulder extending from the second to the third ridge, and the other situate about a third of the entire length of the elytron from the apex between the third and fourth, coppery red. Beneath punctured, green, with coppery reflexions. Legs punctured, green.

Length 14 lines; breadth 5.

Laas.

Genus Iridotænia, H. Deyr.

Iridotænia igniceps, n. sp.

I. capite cupreo; thorace viridi, remote punctato, lateribus rugosis; elytris thorace latioribus, basi impressis, margine posteriore denticulato: Subtus punctata.

Green, with golden reflexions; head coppery red; antennæ black blue. Head punctured, deeply excavated and furrowed in front between the eyes, the excavation having on each side near the vertex a somewhat polished elevation. Thorax once and a-half as broad as long, anterior margin straight; sides rather sinuous, gradually diverging posteriorly, base straight; disk remotely punctured, with a faint coppery dorsal line, met at the base by a deep puncture; sides very deeply and rugosely punctured, with a rugose fovea almost touching the lateral margin about one-third of the entire length of the thorax from the base (this character appears to be very variable, as in some specimens it hardly exists at all). Scutellum small and brilliant. Elytra a little broader than the thorax, irregularly impressed at the base; sides rather sinuate as far as the centre, then converging to the apex, which is obtuse; posterior margin denticulated; disk punctured, the punctures becoming larger and closer together as they approach the sides; just above the margin is a well-marked carina, which extends from the shoulder to the apex. Beneath punctured, covered with remote hairs. Legs punctured, hairy.

Length 17—14 lines; breadth $5\frac{1}{4}$—$4\frac{1}{2}$.

Camboja, Siam, Laas, Pachbon.

Allied to *I. aurolimbata*, H. Deyr., but differs by its deeply punctured elytra, its much longer thorax, and its coppery head.

Genus Lampetis, Dejean.

Lampetis puncticollis, n. sp.

L. æreo-viridis; capite rugoso; thorace rugose punctato, lineâ dorsali lævi, basi duabus impressionibus notatâ; elytris punctato-striatis, interstitiis foveis aureis numerosis minutis interruptis: Subtus punctata.

Dark bronzy-green, with coppery reflexions. Head rugose and flat in front; margins of the eyes ciliated. Thorax twice as broad as long; anterior margin nearly straight and somewhat elevated, especially at the sides; sides gradually rounded and diverging posteriorly; base almost straight, posterior angles slightly enclosing the base of the elytra; disk remotely punctured, with a broad smooth dorsal line, met at the base by two deep punctures; sides deeply and largely punctured. Scutellum smooth and small. Elytra scarcely broader than the thorax, gradually converging to the apex, which is faintly ciliated; each is armed at the apex with two spines, the sutural ones obtuse; disk punctate-striate, somewhat rugose on the sides, the interstices interrupted by numbers of small golden foveæ filled with cream-coloured pubescence, those on the margin much larger; margins green. Beneath punctured, covered with grey hairs; prosternum quite smooth and very brilliant; on each segment of the abdomen are two longitudinal hairy bands, running parallel to the margins. Legs punctured, hairy; tarsi green.

Length $14\frac{1}{2}$ lines; breadth 6.

Pachbon.

Lampetis psilopteroides, n. sp. (Pl. XXI. fig. 10.)

L. capite viridi, rugoso; thorace brunneo, viridi-punctato, lateribus rugosis; elytris punctato-striatis, interstitiis maculis auratis multis interruptis; prosterno bisulcato.

Green; antennæ greenish-black. Head green, rugose, with two carinæ, one on each side, running parallel to the eyes, strongly marked in front, less so behind, uniting posteriorly so as to form a heart-shaped enclosure. Thorax almost twice as broad as long; anterior margin straight, sides straight, gradually diverging towards the base, which is slightly rounded, with a small central smooth space, somewhat triangular, just above the scutellum; disk brown, deeply punctured, punctures very irregular and golden, sides rugose and green. Scutellum small and smooth. Elytra at the base wider than the thorax, twice as long as broad; shoulders much enlarged, somewhat angulose; sides gradually converging to the apex, a little swollen behind the middle; each elytron armed with two spines, the sutural ones obtuse; disk punctate-striate, rugose behind the shoulders, the interstices interrupted by numerous golden spots, formed of small clusters of punctures; margins, suture and apex of elytra green; posterior margin carinated. Beneath rugose, golden-green on the sides, red-purple in the centre; prosternum bisulcate, punctured. Legs green, punctured; tarsi blue.

Length 15 lines; breadth 6.

Siam.

Lampetis viridicuprea, n. sp.

L. psilopteroidi similis, sed ab illâ differt thoracis lateribus plus rotundatis ac minus rugosis, elytris minus acuminatis, et prosterno trisulcato.

Golden-coppery, punctured. Closely allied to *L. psilopteroides*, but shorter and of a more oval form; the rugosities on the head are somewhat similar, but the lateral carinæ do not unite behind. Thorax more quadrate; the punctures more regular on the disk; sides less rugose and rounded. Scutellum slightly larger. Elytra scarcely wider than the thorax; shoulders not enlarged; sides less attenuated behind, subparallel for about two-thirds of their entire length, then converging to the apex; apical spines more obtuse than in the preceding species. Elytra scarcely twice as long as broad, the ground colour of the disk being lighter than in the preceding, and the golden spots do not show so brightly against it. Beneath similar; prosternum trisulcate.

Length 14 lines; breadth $5\frac{1}{4}$.

Siam.

Lampetis affinis, n. sp.

L. speciebus duabus præcedentibus affinis. A *L. psilopteroide* differt mensurâ minore et humeris non prominentibus. A *L. viridicupreâ* formâ angustiore, capite minus rugoso, prosternoque bisulcato.

Closely allied to the two preceding species, between which it almost forms a link. Smaller than *L. psilopteroides*, from which it differs by the want of the prominent shoulders, by the much closer punctuation of the thorax, by the carinæ on the head not uniting at the vertex, and by the denser punctuation of the prosternum. From *L. viridicuprea* it differs by its narrower form, by the rugosities of the head being less strongly marked, and especially by its bisulcate prosternum.

Length 12 lines; breadth $4\frac{1}{2}$.

Camboja, Pachbon.

Obs. These three species are probably but varieties of one another; but having only a very few specimens, I have been obliged to keep them as species; they are very variable in punctuation, and probably more specimens would show similar modifications of form.

Lampetis fastuosa, Fab.

Var. B.—I have one specimen of a small narrow form of *Lampetis*, which I believe to belong to this species; it differs from the typical form in size only.

Length 9 lines; breadth 3.

Pachbon.

Genus Dicercomorpha, H. Deyr.

Dicercomorpha cupreomaculata, n. sp. (Pl. XXI. fig. 7.)

D. capite rugoso; thorace purpureo-nigro, rugoso, foveis flavo-pubescentibus; elytris cupreo-maculatis, apice bispinoso: Subtus aurea, nigro-maculata, punctata.

Dark purplish-black, covered with golden coppery spots; the spots clothed with a yellow deciduous pubescence. Head rugose, with a faint irregular raised line on each side between the eyes; the rugosities filled with a yellow pubescence. Thorax nearly twice as broad as long; anterior margin and base almost straight; sides diverging to the middle, then nearly straight; disk remotely punctured, with a punctured dorsal furrow; sides rugose, the elevated portions black and glabrous, the foveolets themselves filled with whitish powdery pubescence; near the posterior angle on each side is a very deep pit; posterior angles green. Scutellum smooth and brilliant. Elytra little wider than the thorax, parallel for about two-thirds of their length, then rapidly converging to the apex, which is somewhat truncate and ciliate; each elytron armed with two spines; disk punctate-striate, black-blue, covered with coppery foveolets, which in fresh examples are filled with yellowish powdery pubescence; the shoulders and two or three ridges on the elytra are slightly raised, especially near the apex; apex and suture green. Beneath golden, punctured, with a deciduous pubescence, spotted with black-blue. Legs punctured, slightly hairy, green; tarsi rather darker.

Length 12—9 lines; breadth 4—3.

Laas.

Cardiaspis,* n. g.

Caput parvum; oculi magni, in vertice approximati; antennarum caveæ magnæ, ab epistomate infra marginatæ. *Thorax* postice latissimus. *Elytra* ad humeros latissima, apice sexdentato. *Scutellum* magnum, cordiforme. *Tarsi* dilatati.

Head small; eyes large, very little prominent, approximate on the vertex; epistome slightly emarginate and elevated, forming the inferior margins of the antennary cavities, which are very large; their lateral margins are formed by two carinæ branching from the epistome, which are produced along the edges of the eyes without touching them. Antennæ with the five basal joints rounded, the remaining portion serrate; first joint pyriform, second short,

* Καρδία, heart; ἀσπίς, shield (scutellum).

third scarcely longer than the second, the second and third together about equal in length to the first, the fourth and fifth longer, the remainder about equal in length, dilated. Thorax widest behind, very short. Scutellum very large, cordiform, slightly carinated on each side. Elytra widest at the shoulders, sides somewhat sinuate, apex sexspinose. Prosternum flat. Tarsi somewhat dilated.

Differs from *Dicercomorpha*, H. Deyr., by its large cordiform scutellum, its general facies, and especially by the epistome being carinated and produced on either side, so as to form the inferior margins of the antennary cavities.

Cardiaspis Mouhotii, n. sp. (Pl. XXI. fig. 9.)

C. viridis, punctata; thoracis disco elevato; elytrorum apice sexspinoso ac ciliato.

Bright green, punctured. Head deeply punctured on the vertex, with a deep ovate fovea between the eyes in front, the margins of which are elevated, irregular, quite smooth and brilliant. Thorax much enlarged behind, twice as broad at the base as long; the anterior margin only half as wide as the base, almost straight, smooth, lined with fine cilia of white hairs; sides gradually rounded, elevated and smooth, base largely lobed, disk deeply punctured and somewhat rugose, slightly elevated posteriorly, the posterior angles of the elevation forming two bright spaces on the base, each placed midway between the centre and the lateral margin; sides rugose, foveated irregularly along the margin, and a slight fovea on each side of the discal elevation. Scutellum very large, transversely cordate; with a depression in the centre and a deeply cut straight line on each side of it. Elytra striate, wider than the thorax; humeral angles much enlarged, sides somewhat converging behind the shoulders, then swelling out as far as the centre, whence they gradually converge to the apex, which is truncate and armed with six strong spines, the two external ones broad and pointing outwards; the apex is also finely ciliated; striæ somewhat punctuated, the interstices more deeply, punctures increasing in size and depth as they approach the sides. Beneath punctured, covered with sparing white hairs; apical segment more densely clothed, carinated along the centre, and bidentate at the apex. Legs punctured, slightly hairy; tarsi bluish-green.

Length $12\frac{1}{2}$ lines; breadth $5\frac{1}{2}$.

Laas.

Genus Castalia, Cast. & Gory.

Castalia bipustulata, Boisd.

Cast. & Gory, Monog. Bupr. ii. Gen. Castalia, p. 3, pl. i. fig. 2.

Pachbon and Laas.

I have a variety of this species from Laas in which the spots are almost obliterated, and the rest of the insect bright green instead of blue.

Genus Engycera,* n. g.

Caput latum; oculi minuti, remoti, prominentes; antennarum caveæ minutæ, super epistoma positæ; epistoma emarginatum. *Elytra* margine posteriori denticulato.

Head swollen, large; eyes small, prominent, very remote; epistome emarginate; antennary cavities small, situated rather close together, just above the epistome; antennæ with the four basal joints rounded, the remaining portion serrate; first joint very long, second and third short, fourth longer, the rest about equal in length, rather shorter than the fourth, dilated. Thorax narrower than the head, widest behind. Elytra depressed at the base, posterior margins denticulate, apex slightly rounded. Abdomen large. Tarsi slightly dilated.

This genus in general form resembles *Melobasis*, but differs essentially on comparison, especially in the position of the antennary cavities.

Engycera rufimarginata, n. sp. (Pl. XXI. fig. 4.)

E. capite viridi, punctato; thorace quam capite angustiori, viridi, punctato, transverseque striato; elytris viridibus marginibus rubro-cupreis, striatis, interstitiis ipsis transverse et rugose striatis: Subtus ænea, punctata.

Head green, large, swollen, deeply and largely punctured, very slightly furrowed on the vertex; eyes remote, prominent. Thorax green, narrower than the head, at the base once and a-half as broad as long; anterior margin rounded; sides straight, widening to the base; posterior angles produced and acute; base nearly straight; disk punctured, the punctures large, deep and regular,

* Ἐγγύς, near; κέρας, horn.

forming transverse lines posteriorly. Scutellum smooth and green. Elytra wider than the thorax, not quite twice as long as broad; sides denticulate, parallel for two-thirds of their entire length, then converging to the apex, which is rounded; disk green, striate, interstices punctured and rugosely striated transversely; sides bright coppery, the colour extending almost halfway across each elytron. Beneath dull bronzy, punctured, with a few scattered fine whitish hairs. Legs punctured, green.

Length $4\frac{1}{4}$ lines; breadth $1\frac{3}{4}$.

Pachbon.

Engycera purpuriceps, n. sp.

E. viridis, capite purpureo, punctato; thorace quam capite angustiori, antice punctato, postice transversim striato, angulis posticis acutis; elytris basi depressis, punctatis: Subtus punctata.

Green; head purple; beneath bronzy. Head large, deeply and closely punctured, purple in front, green on the vertex, which is slightly furrowed; eyes large, prominent, extending considerably beyond the thorax on either side. Thorax at the base once and a-half as broad as long; anterior margin rounded; sides straight, diverging considerably posteriorly; posterior angles acute; disk deeply punctured in front, the punctures forming transverse striæ behind. Elytra broader than the thorax, twice as long as broad; sides parallel for two-thirds of their length, then converging to the apex, which is slightly rounded; each elytron with a deep transverse furrow situated a little below the base, the space between the base and the furrow being raised and rounded; shoulders prominent; disk striate, the interstices rugosely striated transversely. Beneath punctured, clothed with a scattered white pubescence. Legs punctured, slightly hairy.

Length $3\frac{1}{2}$—3 lines; breadth $1\frac{1}{2}-1$.

Pachbon, Laas.

Engycera ænea, n. sp.

E. ænea; thorace quam capite non angustiori, punctato, transversim striato; elytris thorace latioribus, basi impressis, punctatis, transversim rugosis: Subtus punctata.

Dull bronzy. Head small, deeply punctured; eyes scarcely projecting beyond the thorax on either side. Thorax nearly twice as broad as long; anterior margin almost straight; sides rounded, slightly widening at the base; posterior angles acute; base straight; disk deeply punctured and transversely ridged. Elytra broader than the thorax, almost twice as long as broad; sides straight for about two-thirds of their entire length, then converging to the apex, which is slightly rounded; base with an irregular transverse fovea; basal margin rounded and elevated; disk striate and transversely rugose. Beneath and legs punctured, remotely hairy.

Length 4 lines; breadth $1\frac{1}{2}$.

Pachbon.

Genus Belionota, Eschs.

Belionota scutellaris, Fabr.

Fabr. Syst. Eleut. ii. 203, 94.

Laas.

Belionota fallaciosa, H. Deyr.

Ann. Soc. Ent. Belge, viii. 84.

Laas.

Genus Chrysobothris, Eschs.

Chrysobothris bistripunctata, H. Deyr.

Ann. Soc. Ent. Belge, viii. 111.

Pachbon.

M. H. Deyrolle gives Timor as the locality for this species; but as I have a specimen (sent me by the late M. A. Deyrolle) from Celebes, there is no reason why its geographical range should not extend to the Malay Peninsula.

Genus Acmæodera, Eschs.

Acmæodera stictipennis, C. & G.

Cast. & Gory, Monog. Bupr. i. Gen. Acmæodera, p. 26, pl. viii. fig. 45.

Pachbon.

Genus Discoderes, Chevr.

Discoderes tricolor, n. sp. (Pl. XXI. fig. 5.)

D. capite punctato, aureo-pubescente; thoracis lateribus lineâque dorsali aureis; elytris dimidio basali rufo-cupreo, apice nigro, fasciis duabus aureis transversis: Subtus nigro-cæruleus, aureo-pubescens.

Head swollen, widely furrowed, bronzy, covered with a golden pubescence. Thorax once and a-half as broad as long; anterior margin produced; angles largely rounded; sides somewhat straight; posterior angles cut off; lateral carinæ very strongly marked and arcuate; base sinuate; disk transversely striate, the striæ forming arcs of circles; margins and dorsal line brilliantly golden, leaving two black spots, one on either side of the dorsal line. Scutellum golden. Elytra almost three times as long as broad, sides parallel for two-thirds of their length, then converging to the apex, which is largely rounded; basal half dull coppery-red, very deeply punctured, the punctures arranged in flexuose transverse striæ; apical half blue-black, simply punctured and pubescent, traversed by two bands of golden pubescence, one forming its upper margin and extending over about one-sixth of its length, the second about the same breadth near the apex; just above the first band are two small spots of golden pubescence, situated near the suture. Beneath blue-black, with a scattered golden pubescence, anterior margin of each abdominal segment thickly fringed with the same. Legs black, slightly hairy.

Length $4\frac{1}{2}$ lines; breadth $1\frac{1}{2}$.

Laas.

Genus Cryptodactylus, H. Deyr.

Cryptodactylus tristis, H. Deyr.

Ann. Soc. Ent. Belge, viii. 132.

Pachbon.

My insect agrees with M. H. Deyrolle's description, but as I have not seen the insect from which his description was compiled I cannot refer it to his species without a slight doubt of its identity.

Cryptodactylus cæruleus, n. sp.

C. cæruleus; capite punctato; thorace lateribus rotundatis, punctato, punctis in semicirculos dispositis; elytris minute squamo-rugosis.

Entirely cyaneous-blue. Head punctured, furrowed between the eyes. Thorax rather broader than long, anterior margin slightly produced, sides very much rounded, expanding posteriorly but almost imperceptibly; lateral carinæ very short, straight, and near the margin; base sinuate, with a deep median lobe; disk deeply punctured, the punctures arranged in semicircles and transverse striæ. Elytra twice as long as broad, sides slightly sinuate as far as the middle, where they swell out a little, and thence converge to the apex, which is rounded; disk minutely corrugated, having the appearance of being covered with scales. Beneath and legs punctured.

Length $3\frac{1}{2}$ lines; breadth $1\frac{1}{4}$.

Siam.

Genus Corœbus, Cast. & Gory.

Corœbus aurofasciatus, n. sp. (Pl. XXI. fig. 6.)

C. capite viridi; thorace punctato, rufo-cupreo, lateribus auratis; elytris aureo-pubescentibus, maculis quatuor nigris, duabus posticis in fasciam transversam connexis: Subtus aureo-pubescens.

Head green, punctured, deeply and widely furrowed between the eyes, with a scattered pubescence in front. Thorax globose, anterior margin produced, sides slightly rounded, base with a narrow lobe; disk dull coppery-red, very deeply punctured and regularly striated, covered with a remote golden pubescence, which becomes thicker and longer on the sides, giving them a golden appearance. Scutellum dull coppery-red. Elytra scarcely twice as long as wide, sides straight for about two-thirds of their length, then converging to the apex, which is rounded; disk rugose, covered with dense golden pubescence, interrupted by two pubescent black spots (one on each elytron), situated about one-third of their entire length from the base, extending to the margin, and almost to the suture; and midway between this interrupted band and the apex is a complete band of the same colour. Beneath deeply punctured, covered with golden pubescence. Antennæ and legs bronzy, punctured and pubescent.

Length $4\frac{1}{2}$ lines; breadth $1\frac{1}{2}$.

Camboja, Siam.

Corœbus cupreomarginatus, n. sp.

C. viridis; capite thoraceque punctatis, hujus punctis in semicirculis dispositis; elytris rugosis, lateribus cupreis: Subtus viridis, rugosus.

Head green, swollen, very widely furrowed between the eyes, punctured, the punctures arranged in transverse lines. Thorax green, coppery-red on the sides, somewhat globose, once and a-half as broad as long, anterior margin slightly rounded, sides somewhat straight, angles rounded, base deeply lobed, the vertex of the elevated portion of the disk forming a centre to the concentric deeply punctured and somewhat vermicular striæ with which it is surrounded. Elytra twice as long as broad, sides slightly sinuate for two-thirds of their length, then swelling out beyond the middle and converging to the apex, which is largely rounded and very slightly denticulate; disk rugose, green, sides coppery. Beneath and legs bronzy, punctured.

By the aid of a strong glass the whole insect is seen to be covered with scattered hairs.

Length 4 lines; breadth $1\frac{1}{2}$.

Laas.

Corœbus denticollis, n. sp.

C. capite viridi, punctato; thorace antice viridi-cæruleo, postice purpureo, lateribus denticulatis; elytris purpureis, rugosis, apice 4-spinoso, dimidio postico pubescentiâ cinereâ vestito.

Head green, punctured, furrowed between the eyes, pubescent in front. Thorax green-blue in front, purple behind and on the sides; anterior margin slightly produced, sides rounded and regularly denticulate, base largely lobed; disk very convex, rugose and transversely striated; base and sides deeply foveated, the foveæ almost meeting at the base, giving the disk a very elevated appearance. Elytra two-thirds as wide as long, dark purple, sides swelling out beyond the middle, thence gradually rounded to the apex, which is truncate and armed with four spines; the posterior portion for not quite one-half of the length of the elytra is covered with a grey silvery pubescence; disk covered with scale-like rugosities. Beneath rugose, covered with a silvery pubescence.

Length 4 lines; breadth $1\frac{1}{2}$.

Laas.

Corœbus violaceipennis, n. sp.

C. capite viridi, punctato; thorace viridi, rugoso, basi sinuato; elytris violaceis, rugosis, apice rotundato et denticulato: Subtus cæruleus, albipubescens.

Head green, punctured, deeply furrowed in front, covered with a remote pubescence. Thorax green, once and a third as broad as long, anterior margin almost straight, sides gradually rounding from the anterior angles, base largely and deeply lobed; disk convex, remotely pubescent, and rugose, nearly surrounded by the lateral foveæ, which turn at the posterior angles and almost unite at the base. Elytra twice and a quarter as long as broad, violet-blue, sides parallel for two-thirds of their entire length, then converging to the apex, which is somewhat truncate and denticulate; disk remotely pubescent, rugose, the rugosities having the appearance of scales; base transversely impressed. Underside and legs blue, punctured, and covered with a whitish pubescence.

Length 5 lines; breadth 2.

Laas.

Genus Melibœus, H. Deyr.

Melibœus cupricollis, n. sp. (Pl. XXI. fig. 3.)

M. capite viridi, punctato; thorace cupreo, nitente, punctato et striato; elytris violaceo-cæruleis, punctatis et transversim striatis: Subtus cæruleus.

Head green in front, coppery on the vertex, punctured, pubescent in front, slightly striated transversely. Thorax once and a-half as broad as long, brilliant and coppery; anterior margin rounded, sides rounded, base deeply lobed; disk very convex and raised posteriorly in the form of a transverse very obtuse tubercle, deeply punctured and striated transversely, the striæ becoming longitudinal on the sides. Scutellum blue. Elytra violet-blue; sides sinuate to beyond the middle, when they swell out slightly and then converge in a curved line to the apex, which is rounded; disk deeply punctured and transversely ridged. Beneath blue, very strongly punctured. Legs hairy.

Length $2\frac{1}{2}$ lines; breadth 1.

Laas.

Genus Agrilus, Mégerle.

Agrilus armatus, Fab.

Fab. Syst. Eleut. ii. 214, 155; Cast. & Gory, Monog. Bupr. ii. Gen. Agrilus, p. 13, pl. iii. fig. 14.

Var. B.—Head and thorax golden.

Laas, Camboja.

I have five or six examples of this species from M. Mouhot, nearly all of which differ slightly in the form and position of the apical teeth of the elytra.

Agrilus ornativentris, n. sp.

A. capite thoraceque purpureo-nigris; hujus disco flexuose transversim sulcato; elytris nigris, punctatis, utrisque maculis duabus albis ornatis: Subtus niger, pectoris lateribus maculisque duabus magnis in tertio abdominis segmento albis.

Head dark purple, deeply excavated and transversely striated, each side of the excavation having an obtuse tubercle. Thorax dark purplish-black, once and a-half as broad as long; anterior margin slightly rounded, sides nearly straight, angles largely rounded; base lobed; disk strongly and flexuosely ridged transversely, with two dorsal foveæ, one situated at the base, the other almost touching the anterior margin; sides foveated, lateral carinæ very short and curved. Elytra nearly three times as long as wide; sides slightly sinuate till they reach the middle, then converging to the apex, which is armed with two long external spines; disk deeply punctured, sutural half depressed, leaving an elevated ridge midway between the suture and the outer margin; each elytron with two white pubescent spots, one small and placed midway between the shoulder and the apex, the other much larger and placed near the apex. Abdomen extending considerably beyond the elytra in the middle on each side. Beneath black, deeply punctured; the sides of the breast and a large somewhat triangular spot on the third segment of the abdomen white and pubescent. Legs and antennæ punctured.

Length 7 lines; breadth $1\frac{1}{2}$.

Laas.

Agrilus longicollis, n. sp.

A. capite thoraceque viridi-cæruleis, punctatis, hoc etiam transversim striato; elytris æreo-viridibus, minute rugosis, apice denticulato: Subtus æreus, albipubescens.

Head punctured, blue-green, flat, slightly furrowed and transversely striated between the eyes, hairy just above the mouth. Thorax blue-green, almost as long as broad, narrower behind than in front; anterior margin rounded, sides rounded and gradually converging to the posterior angles, which are acute, base sinuate and deeply lobed; disk punctured and transversely striated; posterior angles each with an oblong fovea, the foveæ extending along the sides; near the anterior angle on each side is a white pubescent spot. Elytra dull olive-green, three times as long as broad; sides slightly sinuate as far as the middle, where they swell out slightly, and then gradually converge to the apex, which is rounded and multidentate; the central spine on each elytron is longer than the rest; disk minutely rugose, with a scaly appearance, and slightly pubescent. Abdomen extending beyond the elytra on each side, giving them an appearance of swelling out considerably just beyond the middle; on the first segment on each side is a white pubescent spot. Beneath bronzy, covered with a white pubescence. Legs punctured.

Length $4\frac{1}{4}$ lines; breadth 1.

Siam.

Agrilus octonotatus, n. sp.

A. capite æreo-nigro, punctato; thorace viridi-nigro, lateribus flavipubescentibus; elytris nigris, minute rugosis, utrisque maculis tribus flavis ornatis: Subtus punctatus, pectoris lateribus flavipubescentibus, maculisque duabus in utroque abdominis segmento albipubescentibus.

Head dull bronzy black, punctured, the punctures arranged in transverse striæ, above the mouth covered with a white pubescence. Thorax dark greenish-black, narrower behind than in front, anterior margin rounded, sides rounded, posterior angles almost right angles, base with a deep lobe; disk deeply punctate-striate transversely, dorsal line marked by two shallow depressions, one at the base, the other near the anterior margin; sides foveated, the surface of the foveæ covered with bright yellow pubescence. Elytra three times as long as broad, of the same colour as the thorax, covered with scale-like rugosities; sides subparallel for two-thirds of their entire length, then converging to the apex, which is multidentate, the central spines on each elytron being longer than the rest; each elytron with three spots of a yellow pubescence, one at the base, the second about one-third of the entire length from it, the other about one-third from the apex. Abdomen bordering the elytra beyond the middle, exhibiting a yellow spot on each segment. Beneath punctured, pubescent; the sides of the breast covered with a yellow pubescence; each segment of the abdomen with a spot on either side of a white mealy pubescence.

Length $4\frac{1}{2}$—$3\frac{1}{2}$ lines; breadth $1\frac{1}{4}$—1.

Pachbon, Laas.

I have a smaller specimen from Laas with four spots on each elytron, the fourth one very small and almost touching the apex.

Agrilus leucostictus, n. sp.

A. niger; capite punctato; thorace transversim strigoso, disco impresso; elytris minute rugosis, apice sex-spinoso, utrisque maculis tribus albis ornatis: Subtus punctatus, pectoris lateribus maculâque in tertio abdominis segmento albipubescentibus.

Head black, flat, deeply punctured, and transversely ridged. Thorax black, once and a-half as broad as long; anterior margin rounded, sides rounded, base with a shallow lobe, lateral carinæ much arched behind; disk strongly ridged transversely, with a broad dorsal depression, which slightly widens at the base. Elytra black, about three times as long as broad; sides almost straight for about two-thirds of their length, then converging to the apex, which is armed with six spines, the central spine on each elytron being longer than the rest; disk covered with very minute scale-like rugosities, with three white pubescent spots on each elytron, one near the shoulder, another midway between the apex and the base, and the third, a larger one, about one quarter of the entire length of the elytra from the apex. Abdomen bordering the elytra near the centre, exhibiting a white spot on the first segment. Beneath punctured, slightly pubescent, with the sides of the breast and a spot on the third segment of the abdomen covered with a velvety-white pubescence.

Length $4\frac{3}{4}$ lines; breadth $1\frac{1}{4}$.

Siam.

Agrilus æneicollis, n. sp.

A. capite æreo-viridi, pubescente; thorace punctato transverseque strigoso, lineâ dorsali aureâ; elytris minute rugosis, pubescentibus, fasciâ nigrâ infra medium ornatis: Subtus æreus, abdominis segmentis singulis maculis duabus albis notatis.

Head bronzy-green, pubescent above the mouth, deeply furrowed on the vertex, punctate-striate transversely and flat in front. Thorax bronzy-green, broader than long; anterior margin rounded, sides rounded, converging posteriorly, slightly emarginate before they reach the posterior angles, base slightly lobed; disk transversely ridged, with a wide dorsal golden line not reaching the anterior margin, each side with an oblong fovea reaching the anterior angles, near which on either side is a small irregular pubescent spot; posterior angles golden; lateral carinæ slightly curved and near the margin. Elytra bronzy-brown, finely rugose, twice and a-half as long as wide; sides nearly straight for more than half their length, then converging to the apex, which is multidentate and rounded; disk covered with a golden pubescence, with the exception of an oblong marginal spot on each elytron extending from the shoulder for about one-half of the length of the elytra and a transverse band situated about one quarter of their entire length from the apex; on the base are two small round spots of a dull-white pubescence. Abdomen bordering the elytra beyond the middle, showing a dull-white spot on each side on its first segment. Beneath bronzy, with a grey pubescence and two spots of a dull white on each segment of the abdomen.

Length 5 lines; breadth $1\frac{1}{2}$.

Pachbon.

Agrilus æreus, n. sp.

A. æreus; capite aureo-pubescente; thorace pubescente, punctato, transverseque strigoso; elytris minute rugosis, pubescentibus, apice rotundato ac denticulato, disco infra medium fasciâ nigrâ ornato: Subtus punctatus, pubescens.

Bronzy. Head furrowed on the vertex, covered with a dense golden pubescence. Thorax transverse; anterior margin rounded, sides rounded, slightly converging posteriorly, base very slightly lobed, disk ridged transversely, with a shallow wide dorsal furrow; entire surface covered with greyish hairs, with the exception of a rather broad somewhat raised line on each side of the dorsal furrow; lateral carinæ slightly curved. Elytra twice as long as broad, slightly sinuate for two-thirds of their length, then converging to the apex, which is rounded and multidenticulate; surface finely rugose, covered with a greyish pubescence, except a band beyond the middle extending along the suture towards the base; suture slightly elevated posteriorly. Beneath bronzy, covered with grey pubescence.

Length $3\frac{1}{2}$ lines; breadth 1.

Laas.

Agrilus cæruleicollis, n. sp.

A. capite thoraceque cæruleis, punctatis, transverseque striatis; elytris punctatis, æreo-pubescentibus, fasciâ cyaneâ infra medium ornatis, apice rotundato et denticulato.

Head blue, slightly swollen, punctate, striate transversely, furrowed on the vertex and between the eyes. Thorax blue, slightly narrowed behind; anterior margin slightly produced, sides almost straight, lateral carinæ much arched behind; disk punctate, the punctures arranged in flexuose transverse striæ, sides slightly foveated near the anterior angles, base lobed with a shallow dorsal fovea. Elytra punctured, bronzy, covered with a greyish pubescence, the apical two-thirds of their entire length cyaneous-blue and smooth; sides straight for two-thirds of their length, then converging to the apex, which is rounded and slightly denticulate. (Abdomen wanting.) Under side of thorax and breast blue, punctured, and slightly hairy.

Length 5 lines; breadth $1\frac{1}{2}$.

Siam.

Agrilus viridicupreus, n. sp.

A. capite purpureo-brunneo, transverse striato; thorace æreo-viridi, punctato transverseque striato, impressionibus duabus discalibus; elytris cupreo-viridibus, minute rugosis: Subtus aureo-viridis, punctatus.

Head brownish-purple, punctured and transversely striated, furrowed on the vertex. Thorax olive-green, once and a-half as broad as long, anterior margin slightly rounded, angles produced, sides rounded and slightly converging posteriorly, base with a slight lobe; disk deeply punctured and transversely ridged, dorsal line with two shallow impressions, one near the base, the other almost touching the anterior margin. Elytra twice and a-half as long as broad, sides straight for more than half their length, apex rounded and denticulate; disk green and rugose, sides with coppery reflexions. Underside and legs brilliant golden-green, punctured.

Length $3\frac{1}{2}$ lines; breadth $\frac{3}{4}$.

Laas.

Genus Trachys, Fabr.

Trachys fasciunculus, n. sp.

T. capite cupreo, rufipubescente; thorace pubescentiâ rufâ, crinibus albis commixtâ; elytris pubescentiâ rufâ brunneâ albâque commixtâ, fasciculis duobus comarum brunnearum prope suturam positis: Subtus cæruleus.

Head coppery, deeply excavated between the eyes, covered with a reddish-brown pubescence. Thorax twice and a-half as broad as long, anterior margin emarginate, sides nearly straight, base triangularly lobed; surface covered with a reddish pubescence mixed with a few white hairs. Elytra scarcely longer than broad, shoulders slightly wider than the thorax, sides gradually converging to the apex; surface covered with brown and red hairs intermingled with white, with two wavy bands of white near the apex, and near the suture on each elytron are two fascicles of long brown hairs, one close to the base, the other near the apex. Beneath shining blue, punctured, and covered with scattered white hairs.

Length $2\frac{1}{4}$ lines; breadth $1\frac{1}{2}$.

Laas.

Oncomœa,* n. g.

Caput minutum; epistomate emarginato; antennis brevibus, serratis. *Thorax* postice latissimus. *Elytra* valde convexa. *Tibiæ* dilatatæ.

Head small; epistome slightly emarginate; antennæ short and stout, the first joint pyriform, the second, third and fourth very short and rounded, the remaining portion serrate and slightly dilated; eyes slightly prominent. Thorax very wide behind, posterior angles slightly enclosing the shoulders of the elytra. Elytra very convex, gradually converging to the apex, shoulders rather prominent. Legs large, tibiæ dilated, the outer margin in the form of an arc of a circle; tarsi small, somewhat dilated.

This genus is most nearly allied to *Pachyscelus* of Solier, but its very convex elytra, and at the same time elongate form, I think sufficiently separate it from that genus.

* Ὄγκος, a lump, ὅμοιος, like.

Oncomœa cœrulea,* n. sp.

O. cærulea; capite, thorace, elytrisque punctatis: Subtus punctata, primo abdominis segmento ad medium brunneo-pubescente.

Bright shining blue. Head deeply punctured. Thorax very much wider behind than in front, at the base twice as broad as long; anterior margin nearly straight, sides very slightly curved; posterior angles acute, slightly enclosing the shoulders of the elytra; base slightly lobed, disk punctured, more strongly so on the sides. Elytra convex; shoulders slightly elevated, sides rounded and converging to the apex; disk punctured, suture elevated posteriorly, with a stria on each side of it. Beneath punctured, the first segment of the abdomen with a patch of long brown hair in the middle near the posterior margin.

Length $2\frac{1}{2}$ lines; breadth $1\frac{1}{2}$.

Pachbon.

* This insect may possibly prove to be the *Galbella violacea* described and figured by Professor Westwood in the "Cabinet of Oriental Entomology," p. 83, pl. xli., as suggested by him at the meeting of the Entomological Society at which this paper was read and the insect exhibited. I have not had an opportunity of examining the type-specimen of *Galbella*, which is classed by its author amongst the *Eucnemidæ*, though Prof. Lacordaire remarks (Gen. des Col. iv. 104) that the genus is probably referable to the *Throscidæ*. Subsequent examination however confirms me in the belief that the insect above described is a true Buprestid.

EXPLANATION OF THE PLATE.

Plate XXI.

Fig. 1. *Catoxantha gigantea,* Linn.; var. *brunnea.*
,, 2. *Chrysochroa rugicollis,* E. S.
,, 3. *Meliboeus cupricollis,* E. S.
,, 4. *Engycera rufimarginata,* E. S.
,, 5. *Discoderes tricolor,* E. S.
,, 6. *Coroebus aurofasciatus,* E. S.
,, 7. *Dicercomorpha cupreomaculata,* E. S.
,, 8. *Chrysodema aurostriata,* E. S.
,, 9. *Cardiaspis Mouhotii,* E. S.
,, 10. *Lampetis psilopteroides,* E. S.

VI. *Notes on some Hymenopterous Insects collected by* Mr. Peckolt *at Catagallo, South Brazil.* By Frederick Smith, late Pres. Ent. Soc.

[Read 3rd September, 1866.]

Some months ago Mr. Daniel Hanbury mentioned to me that a correspondent (Mr. Peckolt) was desirous of obtaining the names of certain bees and wasps collected near Catagallo. I readily agreed to assist in furnishing the information required; and the insects have lately come to hand. They were sent in twelve small stoppered bottles, in spirit, and each bottle contained a considerable number of some species of bee, wasp, or other hymenopterous insect. A list of the insects was forwarded, and the vernacular names were given; and they were divided into sections, namely, those of bees, wasps, and ants.

The investigation of the contents of these vials proved specially interesting, so much so as to induce me to believe that a short account of the result of my examination of them will be acceptable to the Society. I may premise that it will be found to have added considerably to our knowledge of the economy of the *Trigonæ*, the stingless honey-bees of Brazil.

I will, in the first place, give some account of the insects placed by Mr. Peckolt in the section of wasps.

As far back as the year 1844, Mr. Curtis published a paper in the Linnean Transactions (vol. xix. p. 250, pl. xxxi. figs. 1, 2) on a species of saw-fly, which he named *Dielocerus Ellisii*, a very beautiful insect, and one whose economy is exceedingly interesting, from its being apparently proved to be a social species during all its changes of condition. That the larvæ of many species of *Tenthredinidæ* are social is a fact long known to Entomologists; but *Dielocerus Ellisii* was stated to undergo its final change in a nest, constructed by the united labour of the community. This nest was described as from four to five inches in length, by about three at its widest diameter, its general outline being oblong-ovate, and of a silky texture, closely resembling the cocoon of a *Bombyx*. The cocoons spun by the larvæ are of a soft and pliable consistency, and, as the larvæ spin in close proximity to each other, the cocoons, which otherwise would no doubt be of a cylindrical form, are pressed into somewhat irregular hexagons, a section of them exhibiting a close imitation of the comb of a wasp or honey-bee. The announcement by Mr. Curtis of a species of saw-fly thus constructing one common dwelling-place naturally produced considerable discussion. A fact so novel elicited even indications of doubt whether there had not been some mistaken observation on Mr. Curtis's part. Such, however, was certainly not the case. The insect is perfectly well known to Mr. Peckolt of Catagallo, who calls it "Marumbouda Seda," the silk Marumbouda, in allusion to the silken nest spun by the larvæ.

The second insect placed by Mr. Peckolt in the division of wasps proved to be the *Bombus violaceus*, a common species in Brazil, and known in the vernacular as "Marumbouda Mangunga."

The third in the list of *Vespidæ* is correctly assigned to that family, being the *Polybia pygmæa* of Saussure. This species constructs a beautiful globular nest, the size of a rather large orange. The combs are of the most exquisite construction, and it is by no means an uncommon circumstance to find the outer envelope of the nest ornamented with patches of delicate hexagonal tracery.

The first species of honey-bee that I propose to notice belongs to the stingless group; it is the *Trigona Mosquito*, named in the list "Abelha Mosquito," the Mosquito bee. It is satisfactory to find that this insect is identical with that forwarded from Brazil to the International Exhibition of 1862, under the same vernacular name, and described by myself in a paper published in the Transactions of this Society, descriptive of the series of honey-bees and wasps then exhibited (Trans. Ent. Soc., 3rd series, i. 510). Some hundreds of specimens, together with the combs, have been sent by Mr. Peckolt in two vials. Fortunately I discovered both workers and females among them, and of the latter half a dozen specimens. I had no difficulty in discovering the queen, she being even more conspicuous than the queen of the common hive-bee (*Apis mellifica*). *Trigona Mosquito* is the smallest species of the genus that I have seen, the worker not being more than two lines long. The queen, when her abdomen is distended with ova, is more than double that length. Her head and thorax are about the same size as in the ordinary worker. The abdomen is therefore enormously swollen and elongated, giving her, in fact, very much the appearance of a gravid female

Termite. Various conjectures have been promulgated by Hymenopterists as to the probable economy of the genus *Trigona.* Nests of enormous magnitude have been described, and their inhabitants represented as countless in number; so that the probability of more than one queen reigning in each community appeared to me highly probable. I have myself indicated a parallel economy between these bees and the social ants, whose formicaria are tenanted by numerous prolific females. The discovery, however, of a female under the conditions described appears to me to militate strongly against the supposed analogy between *Trigona* and *Formica.* The enormously developed abdomen of the queen, rather, I believe, indicates a parallel economy between the *Trigonæ* and the *Termitidæ.* All the accounts of the latter insects, with which I am acquainted, describe a single female capable of depositing eggs in sufficient numbers to carry out all the purposes of their multitudinously tenanted habitations. Such, I believe, must also be the economy of the genus *Trigona;* but subsequent investigation is necessary to confirm or disprove my conclusions.

Besides the gravid female I also discovered five other bees of the same sex; but these in no way differed, either in colour or size, from the host of workers; and had I not been most carefully bent on searching for that sex, they must inevitably have been overlooked. The simple form of the posterior tibia alone distinguishes them, this joint in the worker being broadly flattened and adapted for conveying pollen to the hive. These females I regard as so many virgin queens, destined probably to lead forth swarms and establish fresh colonies, as in the case of the common hive-bee. I am not, however, aware of any instance of such economy having been recorded; but if my conjecture respecting the gravid female be correct, my latter supposition becomes highly probable.

The following is the description of the female and worker:—

Trigona Mosquito.—Female: length a little over four lines; head and thorax nearly black; the antennæ, clypeus, tegulæ, scutellum and abdomen yellow; head narrower than the thorax; wings extending to the second segment of the abdomen; the abdomen twice as long as the head and thorax, much distended with eggs, the segments much constricted; the posterior tibia simple, not expanded as in the worker.

Worker: length two lines, varying much in depth of colour, according to age, adult specimens having the head and thorax black above, and more or less yellow beneath; the abdomen brown, when distended with honey, showing the pale membrane that attaches the segments one to another, giving the appearance of being banded with pale fasciæ; the coxæ and femora dark brown; the tibiæ paler, with the tarsi honey-yellow; the face is covered with a short downy grey pubescence; the mandibles, labrum, and the scape in front, yellow; the wings milky-white, the costal nervure brown; the tegulæ yellow; the scutellum usually more or less pale.

In the Monograph, already referred to, on the stingless honey-bees (Tr. Ent. Soc., 3rd series, i. 497), I have described males as well as workers of *Trigona;* but the female was previously unknown to me; neither do I recollect to have found that sex noticed by any author. M. Guérin discovered six or seven females of *Melipona* in a nest of *M. fulvipes;* but that sex of the genus *Trigona* is, I believe, for the first time noticed in this paper. Whether a colony of *Trigona* at any period contains more than one gravid female cannot be decided; but the fact of finding a single one, and that one apparently the sole mother of the entire brood, leads me to entertain the opinion that the swarms are governed by a single queen, as in the case of the hive-bee. It is true that colonies of these bees are described as containing a countless host; so are communities of *Termites;* and in both cases we find a female with a very similarly enlarged abdomen.

Another vial contained between five and six hundred of *Trigona ruficrus*, all apparently workers. This bee is called " Abelha Cachorro," signifying the bee of the dog. One circumstance is noticeable. The mature bee is entirely black; but among the multitude of specimens were found individuals of every shade of colour between pale testaceous and black. This is analogous to what I have observed in our own social bees and wasps, in whose nests individuals will be found, exhibiting stages more or less approaching maturity. Wasps frequently emerge from their cocoons destitute of all markings on the abdominal segments; and banded species of our black humble-bees sometimes emerge clad in uniform silver-grey, a few days serving to bring out the perfect colouring of the insects.

Another bottle contained a very large number of specimens of *Trigona basalis*, a species first described by myself in the Catalogue of Bees published by the Trustees of the British Museum. Among them was a single specimen of the male. This species is about $3\frac{1}{4}$ lines long. The worker has the head, thorax, legs, and basal segment of the abdomen, black; the rest of the abdomen is reddish-yellow above, but black beneath. The male is a little longer than the worker, and is black, with the abdomen beneath and at the sides reddish-yellow; the metathorax covered with yellowish hair; the clypeus and scutellum pale testaceous, nearly white; the tips of the mandibles, articulations of the legs, and the first joint of the tarsi, testaceous; the antennæ fulvous beneath; the head wider than the thorax; the eyes larger than in the working bee, and more convex externally; the wings fusco-hyaline, with the stigma pale yellow.

Of the ants forwarded by Mr. Peckolt, one species is mentioned as very destructive to coffee beans. This is a White Ant, and is identical with, or very closely resembles, the *Termes cumulans* of Hagen. The series of specimens consisted principally of small workers, interspersed with examples of larger workers, or soldiers, as they are usually called. It is a small species, the largest individuals not exceeding 2¾ lines in length. It is named "Cupim do Café," the ant of the coffee, and is, Mr. Peckolt observes, an important insect, on account of its ravages on coffee beans.

Another interesting ant, forwarded by Mr. Peckolt, is the *Cryptocerus elongatus*, which is stated to be destructive to nests of the Mosqúito-bee. No particulars are given, so that whether we are to regard these ants as destructive to the honey collected by the bees, to the wax, or to the bees themselves, must be a matter of conjecture until we obtain further information. It is notwithstanding a step towards the history of *Cryptocerus* that a species of that genus is found in nests of the stingless honey-bees.

I am indebted to Mr. Bates for the signification of the vernacular names.

VII. *Notes on the Butterflies of Mauritius.* By Roland Trimen.

[Read 3rd September, 1866.]

Having during last year paid a brief visit to Mauritius, I am enabled to lay before the Entomological Society a few Notes on the *Rhopalocera* of that island, so interesting in its relation and propinquity to Madagascar. My stay in the island was very short, being confined to the first three weeks of July; but, through the kindness of many residents, I enjoyed such good opportunities of collecting, that very few of the insular butterflies escaped my notice.

Boisduval, in his "Faune Entomologique de Madagascar, Bourbon, et Maurice," published in 1833, enumerates 20 species of *Rhopalocera* as inhabitants of Mauritius, or, including his *Thymele* (*Ismene*) *Ramanatek*, a doubtful native, 21 species. Of these I met with 16, and was presented with 3 others by Mr. Caldwell and Mr. Colville Barclay. Since my return to the Cape, Lady Barkly has sent me another species; so that but one of Boisduval's list is wanting to my collection, and that is the doubtful Mauritian insect just named.

In addition to the above I captured 4 species not known to Boisduval as Mauritian, and was presented with another by Mr. Barclay. These 5 insects, new to the Mauritius catalogue, are distinguished by an asterisk *, while those species which I did not myself capture, but which are included in Boisduval's enumeration, are marked thus †.

1. *Papilio Phorbanta*, Linn.

This beautiful *Papilio* is common in Mauritius, and was the first butterfly that I saw in the gardens about Port Louis. I met with it also at Pamplemousses, Réduit, Riversdale, Rivière du Rempart, and Vakoa. Its flight (that of the ♂ at least) is strong and rapid, even more so than that of its African ally, *P. Nireus*, though I did not see it soar to the height the latter commonly reaches. When on the wing the bright green-blue patches are conspicuous, causing the butterfly to resemble a large *Diadema* of the *Bolina* group. In the Botanic Gardens at Pamplemousses I noticed that specimens were continually visiting trees of the *Citrus* group, upon which Boisduval notes that the larvæ feed. I never saw a living specimen of the ♀, and from what Mr. Caldwell, who kindly gave me an example, stated as his experience, I believe it to be very scarce. In connection with the apparent rarity of this sex, it is interesting to observe that M. Maillard * notes the ♀ of the very closely-allied *Papilio disparilis* of Bourbon is much rarer than the ♂, the proportion of ♂ to ♀ being 20 to 1. Mr. Bates (Proc. Zool. Soc., November, 1863), with some doubt, includes a single specimen of *P. Phorbanta* in a collection of Mr. Caldwell's as a native of Madagascar. Judging from what is known concerning the nearly-related forms in other Archipelagic groups, it seems to me highly improbable that *Phorbanta* co-exists with its very close ally *Epiphorbas*, in Madagascar. In looking over Mr. Caldwell's collection at Port Louis, I found that his Madagascarene and Mauritian captures were mingled together, and it is not improbable that in the collection submitted to Mr. Bates for examination, an example of *Phorbanta* may have been inadvertently substituted for *Epiphorbas*.

2.* *Callidryas Florella*, Fabr.

This did not appear to be a common insect in Mauritius; but I met with several specimens in Port Louis, at Réduit, and at Pamplemousses. It is a species widely distributed over Africa, and is found in the Cape de Verde Islands; but I am not aware of its occurrence in Madagascar, though, as Dr. Peters met with it at Querimba, and M. Maillard found it "very common" in Bourbon, there is good ground for imagining that it does inhabit the great island.

A specimen of *Florella* was among a few other butterflies shown to me as having been collected by Dr. Burrowes, of H.M.S. "Ariel," at Zanzibar.

3.* *Callidryas Rhadia*, Boisd.

A species rather scarcer than *C. Florella*, but of quite similar flight and habits. Taken at Réduit and at Pamplemousses, and seen at Riversdale. This *Callidryas* has also an extensive African range, though I find no record of its inhabiting Eastern Africa.

* "Notes sur l'Ile de la Réunion (Bourbon)," Paris, 1862; a work, the knowledge of which I owe to the kindness of Mr. Edward Newton, of Mauritius.

There is a specimen from Mauritius in the collection of the British Museum.

4.* *Terias Rahel*, Fabr.

I refer to this well-known African species *Terias pulchella* of Boisduval, having been unable to discover any characters sufficient to separate the latter from the continental form. The breadth of the black border varies slightly in the ♂. Specimens from Madagascar, given me by Mr. Caldwell, are smaller and darker than those I captured in Mauritius, and resemble the example figured in the " Faune Entomologique de Madagascar, &c." The insect is very common in some localities, especially at Réduit and in the Pamplemousses Gardens. Its flight is rather active, but it usually keeps close to the ground, and settles among the herbage at short intervals.

5. *Terias Floricola*, Boisd.

There is little to separate this insect from *T. Hecabe*, Linn., excepting its smaller size and the much narrower black border of the fore-wing; but as these characters appear to be constant, it is perhaps as well, in a group of species so extremely difficult to determine as are those of the genus *Terias*, to keep *Floricola* distinct until further knowledge afford the means of deciding the question. This butterfly is more generally common in Mauritius than *T. Rahel*, and may be found in the same localities. In the Pamplemousses Gardens I found it flying in company with *T. Rahel*, and on one occasion captured a specimen of each species, as the two were sporting and chasing each other. M. Maillard states that, in Bourbon, " the ♀ is much less abundant than the ♂."

6. *Euplœa Euphone*, Fabr.

A common and conspicuous species, gregarious in its habits, and to be found in gardens and wooded spots. Its flight is usually about trees and shrubs, especially such as are in flower; and is not unlike that of *Danais Chrysippus*, though more floating. The ♀ is rather duller in colour than the ♂, and has less of the faint violaceous gloss. Both sexes have the peculiar odour so remarkable in butterflies of this family; and the ♂, when handled, protrudes a pair of curious anal appendages, consisting of an elongate bright yellow filament, ending in a fascicle or tassel of radiating hairs of the same colour.* The species has been met with in Madagascar, but there is no record of its inhabiting Bourbon. In Mauritius I found the insect most common at Réduit and Pamplemousses. In the collection above referred to, said to have been made by Dr. Burrowes in Zanzibar, I found a specimen of *Euphone*, which differed in no respect from Mauritian examples.

7. *Danais Phædone*, Fabr.

Mr. Bates has very rightly (Proc. Zool. Soc., Nov. 1863) placed this butterfly in the genus *Danais*, as it presents all the structural characters of that group, though its peculiar facies and colouring give it a strong superficial resemblance to *Euplœa Euphone*. In connexion with this likeness between the two species, I may mention that I found *D. Phædone* much scarcer than *E. Euphone*, but almost invariably flying in company with the latter. The ♀ is readily distinguished from the ♂ by the broader ochreous band of the hind-wing, which occasionally unites with some of the spots of the sub-marginal row. Mr. Bates (*loc. cit.*), in noting a specimen from Madagascar in Mr. Caldwell's collection, observes that *Phædone* "has hitherto been recorded only as inhabiting the island of Mauritius;" but I find that Boisduval (Faune Ent. de Madag. &c., p. 37) mentions its occurrence in Madagascar, "aux environs de Tamatave." Its nearest ally seems to be the abundant *D. Echeria*, Stoll, of southern and south-eastern Africa, the fore-wings of the two species almost coinciding in colours and markings.

8. *Danais Chrysippus*, Linn.

I took a specimen of this well-known and widely-ranging species in the woods at Vakoa, in the south-west of the island. This was the only living example I saw. M. Maillard notes that in Bourbon this insect is richly coloured.

* Similar appendages exist in many *Euplœæ*;—I possess a ♂ of *E. superba*, Herbst, in which these organs are exserted and conspicuous. A ♂ *Danais Echeria*, Stoll, lately forwarded to me from Port Natal, also exhibits the same appendages; though, among the many ♂'s of this insect that I have captured, I never found one that protruded them. Mr. Bates has recorded a similar structure in two genera (*Lycorea* and *Ituna*) of *Danaoid Heliconidæ*,—a fact interesting as tending to confirm his view of that group being closely related to the true *Danaidæ*.

9. *Atella Phalanta*, Dru.

This butterfly is by no means uncommon in Mauritius, but it is smaller and with stronger markings than those occurring on the African continent. The largest specimens that I have seen are from China. I found *Phalanta* most numerous at Pamplemousses, but took it also at Terre Rouge and at Vakoa. It is stated by M. Maillard to be "very common" in Bourbon, the ♀ being, however, much rarer than the ♂.

10.† *Pyrameis Cardui*, Linn.

I was surprised not to meet with this familiar acquaintance in Mauritius, seeing that Boisduval mentions it as one of the insular inhabitants. A Mauritian example, given me by Mr. Caldwell, differs in no respect from the usual appearance of the species. M. Maillard records the butterfly as a native of Bourbon.

11.† *Pyrameis Hippomene*, Boisd.

This handsome insect appears to be decidedly scarce in Mauritius, and, according to M. Maillard, is rare in Bourbon. Mr. Colville Barclay showed me the wings of a specimen taken by him, some years ago, in the Moka district. From these, from some specimens which I hastily examined in the Port Louis Museum, and from Boisduval's figures and description, I think that the Mauritian form of the species may well be held distinct from the south African form as a marked variety, if not as a sub-species. The examples from Mauritius are considerably larger and darker, with the apical region of the fore-wings and the tails of the hind-wings much more produced; the apical white spots of the fore-wing are smaller, and the under-surface markings of the hind-wing are brighter, with the striæ more angulated.

12.* *Junonia Rhadama*, Boisd.

I was rejoiced to find this brilliant butterfly not uncommon in Mauritius. I first saw it flitting about a grassy bank at the side of the road at Terre Rouge, between Port Louis and Pamplemousses, and instantly recognised the species by its size and colour. The richness and glitter of the metallic-blue upper-surface in a fresh ♂ is exquisitely beautiful, as the insect basks with fully expanded wings in the tropical sunlight; and the ♀, though less splendid, is by no means inconspicuous. In flight the insect is a thorough *Vanessa*, often settling, but active, wary and rapid. Boisduval's figure (Faune Ent. de Mad. &c., pl. vii. fig. 2) gives but a faint idea of the size and beauty of *Rhadama*. The outline of the wings varies much, but the angulation is more marked in the ♀ than in the ♂. In both sexes there is a double streak of a lighter blue than the ground-colour along the hind-margin of the hind-wing; and, in the same wing, between the lower sub-costal and discoïdal nervules, a second ocellus, dull-red, black-ringed (with a black-dotted violaceous pupil), which is occasionally almost obsolete in the ♂, but always large and well-marked in the ♀. In the latter sex, the small ocellus in the fore-wing is more distinct; the apical white dots in the same wing are larger, while there is a row of four other white spots from the costa, conspicuously margining the outer edge of the transverse black streak; and the blue is duller, and much obscured in the basal regions of both wings. Some ♀ specimens present a fuscous surface, in which the blue is almost obsolete. As in most species of *Junonia*, the under-surface is very variable in both sexes, chiefly in the number and distinctness of the ocelli: in some examples it is throughout suffused with greyish, while in others the whitish and blackish streaks and shadings are conspicuous.

I found this species at Réduit, in the Pamplemousses Gardens (where it frequented the attractive flowers of *Lantana*), and once in Port Louis. It was very interesting to learn, on the testimony of many residents (including M. Bouton, Superintendent of the Museum, Mr. Caldwell and Mr. Colville Barclay), that the butterfly was unknown in Mauritius till a few years ago. It appeared suddenly in 1857 or 1858, and was not rare from the first, several specimens having been brought to the Museum at that time from different parts of the Island. M. Maillard observes, that it is a "very common" insect in Bourbon, and Dr. Peters found it at Querimba on the Mozambique Coast; so that *Rhadama*, until lately supposed to be a peculiar product of Madagascar, appears to be not only extending its range, but to have been probably African in its origin.

13.† *Junonia Augustina*, Boisd.

This fine and very peculiar looking *Junonia* is only known to occur in Madagascar, Bourbon and Mauritius. In the latter island it is rare, and, according to M. Maillard, is seldom to be met with in Bourbon. I saw some faded examples in the Port Louis Museum, and two or three, much damaged by insects, in a case of *Lepidoptera* collected in Pamplemousses Gardens by the son of the Superintendent. Mr. Colville Barclay gave me one of two specimens in his possession, taken in the Moka district. This example is a ♀, and presents on the fore-wing a transverse sub-marginal row of four bluish-white spots, of which the first is largest and is edged both above and below by violaceous scales. On the under surface, the greenish-bronzy lustre is very apparent; and there is a conspicuous white marking (not mentioned or delineated by Boisduval) on the costa of the hind-wing, immediately before and adjoining the reddish transverse streak. In spite of the very different outline of wings, the general coloration of this butterfly bears considerable resemblance to that of *Euplœa Euphone,* and I can well imagine its escaping notice if flying in company with the latter species.

14. *Neptis Frobenia,* Fabr.

This does not appear to be common, as I only met with about half-a-dozen examples. It haunts sheltered wooded spots, usually keeping about a particular tree or tall shrub for some time. Its flight is quite that of a *Limenitis.* I only found it in the Moka district, at Réduit and Riversdale. Boisduval records the species as a native of Madagascar. In Bourbon, where *Frobenia* does not occur, its place is occupied by the nearly related form *N. Dumetorum,* Boisd.

15. *Diadema Bolina,* Linn.

I chanced suddenly upon the only specimen of this well known butterfly that I observed in Mauritius, at the edge of a small plantation in the Moka district. Sir Henry Barkly saw another example while I was in pursuit of the first: both were males. M. Maillard notes the species as "not rare" in Bourbon, and (as well as Boisduval) records the occurrence there of the pale variety of the ♀, named *Inaria* by Cramer. It is very interesting to observe how this insect, the ♀ of which so precisely imitates the appearance of *Danais Chrysippus,* almost rivals its model in geographical range, though it does not appear to have yet extended into Southern Europe. Its occurrence in parts of the New World,* where *Chrysippus* is unknown, seems to be regarded by many Lepidopterists as accidental; among others by Mr. Bates (Proc.

* A specimen from Jamaica is included in the British Museum Catalogue; Boisduval gives "Guiana," and Doubleday and Westwood, "Guiana, Cayenne and Surinam," as habitats of *Bolina.*

Zool. Soc., Nov. 1863), whose laborious researches for eleven years in South America give great weight to his opinion.

16. *Cyllo Leda*, Linn.

A very common butterfly in Mauritius, and distributed throughout the greater part of Africa, Asia and Australia. It is always found in shady spots, where it rests upon the ground or upon dead leaves, often under low bushes, and, when disturbed, rises with a heavy, flapping, but very irregular flight, and almost invariably settles before it has gone many yards. In the dark alleys between the rows of sugar canes this butterfly may always be found, though it is not easily caught in such narrow spaces. Towards sunset the insect seems to become more active, and is often met with flying about roads and open spots: indeed, at Flacq, on the Eastern coast of the Island, I watched several specimens of *Leda* chasing each other in the dusk of the evening till it became too dark to see their movements any longer, but, as long as they were visible, I noticed that their flight was circular in its direction, and always near the ground, about one spot. Many of the moth-like *Hesperidæ*, as is well known, are on the wing about, or even a little after sunset, but *Leda* is the only instance known to me of a butterfly belonging to the higher groups that keeps such late hours. Besides the place named, Port Louis, the mountain La Ponce, Réduit, Riversdale, and Rivière du Rempart, are localities in which I met with the species. M. Maillard describes it as "very common" in Bourbon.

17. *Mycalesis Narcissus*, Fabr.

This appeared to me to be certainly the most abundant butterfly in Mauritius. It was to be found everywhere in shady spots, but seemed especially to prefer wood-paths, and the dry channels of watercourses on the mountain sides. It is an active flier for a *Satyrus*, though constantly settling. I took specimens in every locality that I visited. It is "common" in Bourbon, according to M. Maillard, and "very common" in Madagascar according to Boisduval. The latter author's remark that this insect presents a paler and yellower under-surface in Madagascar is borne out by some specimens from that Island given me by Mr. Caldwell, which are both larger and universally paler than the Mauritian examples.

18.* *Libythea Cinyras*, sp. nov.?

I am unable to reconcile with any figure or description to which I have access a *Libythea* given me by Mr. Colville Barclay. Though at first inclined to consider it a variety of *L. Myrrha*, Godt., I find upon examination that the differences it presents warrant its being held a distinct species. In the *fore-wing* there is no longitudinal stripe from the base, but only a narrow, oblique, fulvous spot at the end of the discoidal cell, and a good-sized, rounded, fulvous spot (much as in the Indian *L. Lepita*, Moore), situated upon the second median nervule, between the oblique spot and the hind-margin; while the three apical spots are fulvous in colour and narrowed and contiguous, forming an oblique angulated streak. The *hind-wing* presents a rather broad irregular fulvous sub-marginal band, commencing narrowly and abruptly below the first sub-costal, and elbowed just below the second subcostal nervule; and an additional quadrate fulvous spot on the costa beyond the middle. On the *underside* the spots of the *fore-wing* are paler, that at the end of the cell being much larger than above, while those near the apex (which is irrorated-grey) are almost whitish; in the discoidal cell there is some faint fulvous colouring before the spot. The *hind-wing* is universally grey, with brown hatchings; there is not any dark stripe along the cellular fold, and the spot and band of the upper surface are indicated by paler spaces.

A specimen in the South African Museum, captured by Mr. E. L. Layard in Madagascar, does not differ from that just described; and, to the best of my recollection, a *Libythea*, shown me by Mr. Waller, of the Zambesi Mission, which was taken near the River Shirè, presented the same characters. Mr. Layard's specimen possesses palpi and antennæ, both of which are more slender than those of *L. Myrrha*, the former being also shorter and convergent.

If this species be undescribed, I propose for it the name of *Libythea Cinyras*.

Mr. Barclay informed me that this butterfly is very scarce in Mauritius, and that the specimen he gave me was taken in the Moka district.

19. *Lycæna Bœtica*, Linn.

This species, so very widely distributed in the Old World, was not so common in Mauritius as I had expected to find it, being almost confined to gardens, where it kept about the cultivated pea. I met with it at Port Louis, Réduit, Pamplemousses and Riversdale. M. Maillard notes the insect as occurring in Bourbon, and Boisduval states that it also inhabits Madagascar.

20. *Lycæna Telicanus*, Herbst.

Far more abundant than *L. Bætica*. Lawns in gardens are quite alive with this insect in the early forenoon; and I noticed the species in every locality I visited. The great majority of Mauritian examples consists of individuals considerably smaller and darker than those generally met with in South Africa. The range of the species is almost identical with that of *Bætica*, though the latter occurs further to the North.

21. *Lycæna Lysimon*, Godt.

This is the third very widely distributed *Lycæna* that inhabits Mauritius, and to it I refer a butterfly that I found very common in the island; though, in the absence of any careful figure or minute description of *Lysimon*, I cannot positively affirm it to be that species. The specimens exactly resemble others from different parts of South Africa and from Ceylon. Numerous examples were met with in waste ground in all parts of the island.

22. *Pamphila Borbonica*, Boisd.

Syn.—*P. Fatuellus*, Hpfr. (Peters' "Reise nach Mossambique," Ins. p. 417, pl. xxvii. figs. 3, 4).

An abundant insect, frequenting flowers in gardens. Found at Port Louis, Réduit and Riversdale. Boisduval observes that this species is known in Bourbon as *Hesperia Mathias*, but at the same time remarks that the Fabrician *Mathias* inhabits Coromandel, and that Fabricius's description "convient moins à notre *Borbonica* qu'à trente autres espèces différentes." On examining Latreille's description of *Mathias*, Fabr., I find that there are two points of distinction from *Borbonica*, viz., the possession of "eight or nine" vitreous spots in the fore-wing, while *Borbonica* has but seven at the most; and of five white spots on the underside of the hind-wing, while the number in *Borbonica* is constantly three. The Mauritian insect inhabits South Africa, and is there associated with a closely allied form, *P. Mohopaani,* Wallengren, which may be easily distinguished by two viteous spots in the discoidal cell of the fore-wing, and (in the ♂) by the discal streak.

23. *Pamphila Marchalii,* Boisd.

I did not meet with this insect, but observed a much injured *Pamphila* in Mr. Caldwell's collection which I referred to the species. Since my return to the Cape, Lady Barkly has sent me a ♂ example, which was, I believe, taken in the grounds at Réduit. The species is easily distinguished from *P. Borbonica* by its rufous-brown colour, orange-mixed cilia and under surface, and by the absence of spots, there being only two small discal vitreous ones in the fore-wing (between the first and third median nervules), and none in the hind-wing. The outline of the wings also differs, being considerably less prominent in the apical region of the fore-wing and in the anal-angular region of the hind-wing.

24. *Nisoniades Sabadius,* Boisd.

I met with this species only in wooded ground at Réduit, where I noticed six or seven examples and took three. It is rapid and active in its movements, frequently settling on the under surface of leaves. It frequented the small blue flowers of a species of *Salvia* abundant on the estate. The wings are held fully expanded when the butterfly is at rest. Mauritian specimens are smaller, redder in tint, and less distinctly marked than the South African examples of the species.

25. *Ismene Florestan,* Cram.

Not a common butterfly in Mauritius: I saw but four specimens on the wing during my stay. Its flight is very swift, but is somewhat *bustling*, reminding one of that of the diurnal *Noctuina, e.g.* the *Plusiæ.* Like the moths referred to, *Florestan* seems to require much nourishment, and keeps steadily to flowers, from which its long proboscis pumps the nectar in a most effectual and business-like manner. The wings are elevated when the insect is settled, the hinder pair being held slightly apart from the fore-wings. I found this species at Port Louis, Pamplemousses and Vakoa; and Lady Barkly has sent me examples taken at Réduit. All these individuals belong to the type-form of the species; the form which has some black spots on the underside of the hind-wings (*I. Valmaran*, Wlgr.), and which co-exists with the type in Southern Africa, apparently does not inhabit Mauritius.

26. *Ismene Ramanatek*, Boisd.

I have not seen this species, but it is evident from Boisduval's description and figure in the "Faune Entom. de Madag. &c.," that the insect is allied to *Ismene Florestan*. It is, however, considerably smaller, and the white band on the underside is not only much narrower and more sinuated, but continuous throughout as well as closer to the hind margin.

The following Table exhibits the distribution, so far as known to me, over the neighbouring islands, of the few butterflies inhabiting Mauritius, and also indicates very roughly the range of such of the species as prevail over wider regions of the globe.

Tabular View of the Geographical Distribution of the Butterflies of Mauritius.

Mauritius.	Bourbon.	Madagascar.	Africa.	Asia.	Europe.	Australia.	America.
Papilio Phorbanta.							
Callidryas Florella.	*C. Florella.*	..	*C. Florella.*				
Callidryas Rhadia.	..	..	*C. Rhadia.*				
Terias Rahel.	..	*T. Rahel.*	*T. Rahel.*				
Terias Floricola.	*T. Floricola.*	*T. Floricola.*	*T. Floricola.*				
Euplœa Euphone.	..	*E. Euphone.*					
Danais Phædone.	..	*D. Phædone.*					
Danais Chrysippus.	*D. Chrysippus.*	*D. Chrysippus.*	*D. Chrysippus.*	*D. Chrysippus.*	*D. Chrysippus.*		
Atella Phalanta.	*A. Phalanta.*	*A. Phalanta.*	*A. Phalanta.*	*A. Phalanta.*			
Pyrameis Cardui.	*P. Cardui.*	*P. Cardui.*	*P. Cardui.*	*P. Cardui.*	*P. Cardui.*	*P. Cardui.*	*P. Cardui.*
Pyrameis Hippomene.	*P. Hippomene.*	..	*P. Hippomene.*				
Junonia Rhadama.	*J. Rhadama.*	*J. Rhadama.*	*J. Rhadama.*				
Junonia Augustina.	*J. Augustina.*	*J. Augustina.*					
Neptis Frobenia.	..	*N. Frobenia.*					
Diadema Bolina.	*D. Bolina.*	*D. Bolina.*	*D. Bolina.*	*D. Bolina.*	..	*D. Bolina*	*D. Bolina.*
Cyllo Leda.	*C. Leda.*	*C. Leda.*	*C. Leda.*	*C. Leda.*	..	*C. Leda.*	
Mycalesis Narcissus.	*M. Narcissus.*	*M. Narcissus.*	*M. Narcissus.*				
Libythea Cinyras.	..	*L. Cinyras.*					
Lycæna Bætica.	*L. Bætica.*	*L. Bætica.*	*L. Bætica.*	*L. Bætica.*	*L. Bætica.*		
Lycæna Telicanus.	*L. Telicanus.*	*L. Telicanus.*	*L. Telicanus.*	*L. Telicanus.*	*L. Telicanus.*		
Lycæna Lysimon.	*L. Lysimon.*	*L. Lysimon.*	*L. Lysimon.*	*L. Lysimon.*	*L. Lysimon.*		
Pamphila Borbonica.	*P. Borbonica.*	..	*P. Borbonica.*				
Pamphila Marchalii.							
Nisoniades Sabadius.	*N. Sabadius.*	..	*N. Sabadius.*				
Ismene Florestan.	*I. Florestan.*	*I. Florestan.*	*I. Florestan.*				
Ismene Ramanatek.	*I. Ramanatek.*	*I. Ramanatek.*					
Total, 26 species.	18 species.	19 species.	18 species.	8 species.	5 species.	3 species.	2 species.

The very small amount of local peculiarity is markedly apparent when shown in a tabular form, the only species which are endemic being *Papilio Phorbanta* and *Pamphila Marchalii*; or but $\frac{1}{13}$ of the whole Rhopalocerous fauna. As might be inferred from the relative position of the islands, there is a large proportion of the Mauritian species common to Bourbon (Réunion) and to Madagascar, amounting in the former case to nearly, and in the latter to quite, $\frac{3}{4}$ of the entire number. As regards Madagascar, it must be borne in mind how very little is known of its insect, and indeed of its general, fauna; for it is worthy of note that the five Mauritian species (apart from the endemic forms mentioned above) not recorded to occur there are all natives of the African Continent, and it seems most improbable that these species, common to South Eastern Africa and Mauritius, should not inhabit the great intermediate region.

Looking to Asia, one cannot but be struck by the entire absence of any Oriental butterflies in Mauritius, the eight species common to Asia and Mauritius being not only of universal distribution throughout Africa, but, without exception, remarkable for all but cosmopolitan range. The same remark applies to the *Rhopalocera* of the neighbouring Island of Bourbon, the only species common to it and to Asia being the eight just referred to. Those naturalists who are disposed to assign an Indian (or South East Asian) affinity to the fauna of Madagascar ought to find some confirmation of their theory in the zoology of the islands lying further to the eastward, but such evidence has not, to the best of my knowledge, been forthcoming,* and, certainly, all that is

* As regards the Avi-fauna of Mauritius, I take the opportunity of mentioning that Mr. Edward Newton, who has for some years resided in that Island, and availed himself to the utmost of his excellent opportunities of investigating the ornithology of the Mascarene group, has most kindly given me notes on the range and affinities of the birds found in Mauritius. I have thus Mr. Newton's authority (and it is a high one), for stating that, of the sixteen species which may be considered actual *natives* (there are thirty-two *residents*) of the island, not one is known to inhabit Asia, and only one (*Ardea atricapilla*) to occur in Africa. Yet the insular endemic species are but two in number (*Tinnunculus punctatus* and *Palæornis eques*); while seven species also inhabit Bourbon, and three range to Madagascar. Mr. Newton himself sees reason to incline to the theory of Indian affinities; but, from his notes, I find that (excluding the Seychelles fauna from consideration) the balance is fairly struck, when we turn to the bird *genera*, between Africa and Asia, two genera of either region not occurring in the other having Mauritian representatives. (Sea-birds are not included in the numbers given.)

known of the butterflies inhabiting those islands, as well as Madagascar itself,* tends to establish an opposite conclusion.

The only indication† of connexion with typical Asiatic forms is to be found in the two *Euplœæ*, *E. Euphone* of Mauritius and *E. Goudotii* of Bourbon, but neither species is known to inhabit Asia, the latter being a native of Natal, and the former of Madagascar and (if I am correctly informed as to Dr. Burrowes' collection) of Zanzibar.

It is reasonable to suppose that the collections of M. Maillard and others have made fully known to us the *Rhopalocera* of Bourbon, and it thus becomes interesting to note any differences which occur between them and those found in the neighbouring island. The two islands are not unlike in general character, and are of nearly equal size, but Bourbon is much more rugged, with mountains of greatly higher elevation, and possesses at least one active volcanic centre. But twenty-two species of butterflies are recorded as natives of Bourbon, and eighteen of these are also found in Mauritius. Of the remaining four, two, *Papilio disparilis* and *Neptis Dumetorum*, seem to be peculiar to the island; a third, *Lycæna Mylica*, recorded by Guénée in M. Maillard's volume, is quite unknown to me; and the fourth, *Euplœa Goudotii*, as already stated, is African. A certain parallelism is observable between the species of either island which are not found in the other; thus, in Bourbon, *Papilio disparilis* takes the place which in Mauritius is occupied by *P. Phorbanta; Euplœa Goudotii* takes that of *E. Euphone;* while *Neptis Dumetorum* fairly represents *N. Frobenia.* For the Mauritian *Danais Phœdone* no analogue appears to exist; and, similarly, the Bourbon *Lycæna Mylica* finds no answering species in Mauritius.

It is much to be regretted that no record exists of the butterflies inhabiting Rodriguez, the third and smallest island of the group, which lies much further to the eastward; for there can be little doubt that an island which can boast its own Dodo, as well

* See my paper "On the Butterflies of Madagascar," in the "Quarterly Journal of Science," 1864, p. 648.

† The two species of *Neptis* can hardly be held to be evidence of Indian relations; for, though the genus is far more fully represented in South-eastern Asia than in Africa, both *N. Frobenia* and *Dumetorum* belong to the African group of *Neptis*, which wants the longitudinal stripe from the base of the fore-wings, and includes such species as *N. Melicerta*, Fabr. (=*Agatha*, Cram.) of Western, Southern and Eastern Africa; *N. Saclava*, Boisd., of Southern and Eastern Africa; and *N. Ophione*, Cram., of Western Africa.

as one or more endemic species of existing birds, and its peculiar palm, contains an entomological fauna of much interest, which probably includes some endemic species, and would, if duly investigated, afford valuable data as to the eastward range of many African forms, as well as further evidence on the *vexata quæstio* of Indian affinities.

In conclusion I will only remark as regards Bourbon and Mauritius, that the facts already placed on record afford the very strongest grounds for believing that those islands have received nearly all, if not the whole, of their *Rhopalocera* from Africa, through the intervening region of Madagascar.

VIII. *New Genera and Species of* Psocidæ. By Robert M'Lachlan, F.L.S.

[Read 5th November, 1866.]

This paper contains descriptions of such previously undescribed species of exotic *Psocidæ* as have come under my notice. Many of these are in the Oxford Museum, and have been kindly placed in my hands by Professor Westwood. Two new genera are described, one of which, *Neurosema*, is quite a novel form; the other, *Eremopsocus*, more nearly approaches *Psocus*. The number of species of *Psocus* is apparently very great, and it will soon be necessary to examine how far it may be requisite to transfer some of these to separate genera; some of the American and Ceylonese species will certainly have eventually to be so separated. That I have not here taken the initiative on this point is owing to the fact that I consider a still closer acquaintance with allied forms prudent before proceeding further.*

Thyrsophorus, Burmeister.

Thyrsophorus bellus, n. sp.

T. piceus; antennis pilosis, nigricantibus, ad basin rufescentibus (♀ articulo 3° haud incrassato); capite piceo (♀ infra pallido); scutello pallide vario; alis hyalinis, anticis maculis in dimidio basali (♂) intense fuscis, fascia media ♂ vittaque apicali testaceo-fumosis, pterostigmate triangulari, miniato, venis nigricantibus; pedibus castaneis; ♂ tibiis tarsisque anticis et tarsorum intermediorum posteriorumque apicibus infuscatis.

Var. (♀ ?)—Alis anticis maculis in dimidio basali intense fuscis, sed vitta apicali nulla; pterostigmate flavo marginato; venis apicalibus flavis.

Exp. alar. 5—$5\frac{1}{2}'''$.

Habitat in Brasilia (Dom. Bates).

In Muss. Oxon. et mihi.

* See postscript, p. 352.

A small but very beautiful species; the third antennal joint in the female is thread-like throughout its length, whereas in the male the apical half is gradually incrassated as in the other species of the genus. It is probably variable in the markings of the wings, perhaps independently of sex; the example in my collection pertains to the variety above described, but the head is wanting.

Thyrsophorus speciosus, Burm.

T. speciosus (Klug, MSS.), Burm. Handb. ii. 782, 1; *T. Spinolæ*, Ramb. Névrop. p. 318.

Thyrsophorus pennicornis, Burm.

T. pennicornis, (Klug, MSS.), Burm. Handb. ii. 782, 2; *T. ramosus*, Walk. Brit. Mus. Cat. Neurop. pt. 3, p. 480, 5.

Thyrsophorus leucotelus, Walker.

Brit. Mus. Cat. pt. 3, p. 479, 4.

Hagen (Stett. Ent. Zeit. 1866, p. 238) thinks this may be the female of *T. speciosus*. I scarcely think this possible, but should rather refer it to *T. pennicornis*. In the latter species the two discoidal cells of the anterior wings are occupied by numerous little ramose veinlets, which are wanting in *T. leucotelus;* otherwise the two insects are very similar, but until it is proved that the presence or absence of these ramose veinlets is only a sexual character, I consider it prudent to keep them separate.

Thyrsophorus anticus, Walker.

Brit. Mus. Cat. pt. 3, p. 480, 6.

This may be at once distinguished by the thorax, which is cornuted in front. Is this character present in both sexes?

NEUROSEMA, n. g.

Caput modicum, postice emarginatum, supra fere planum, disci medio linea impressa instructo, fronte convexiuscula; labrum subquadratum, emarginatum; palpi articulis cylindricis; antennæ alis longitudine vix æquales, (probabiliter) 9-articulatæ, hirsutæ, articulis duobus basalibus parvis, 3° longissimo, incurvato, reliquis gradatim paulo brevioribus; oculi magni, subglobosi, valde prominentes; ocelli minusculi, approximati. *Prothorax* obtectus. *Mesothorax* capiti latitudine æqualis. *Abdomen* parvum. *Alæ* anticæ elongatæ, ad apicem subrotundatæ, pilosiusculæ, ante apicem plica transversa instructæ; venis numerosis hyalinis dense sed irregulariter cribrosis, cellulis apicalibus numerosis: posticæ parvæ, vix angustatæ; venis simplicibus, furcis apicalibus duabus, vena transversa una. *Pedes* vix pilosi; tibiæ planæ, utrinque sulcatæ; tarsi 2-articulati, posteriorum articulo 1° valde elongato.

A very singular genus, on account of the deep transverse fold or bend in the anterior wings just before the apex. These wings are densely reticulated with numerous little hyaline veinlets dividing the membrane into small cell-like spaces, which are more abundant in some parts than in others, and are altogether absent in the apical portion beyond the fold; some of these veinlets branch off without meeting others, and are then abruptly terminated in the membrane.

Neurosema apicalis, n. sp.

N. lurido-fusca; antennis nigris, fusco-pilosis, albido-terminatis; capite lurido-fusco; labro nigricante; palpis albis, articulo ultimo fusco-terminato; alis anticis fuscis, cæruleo-plagatis, macula magna apicali sub-elliptica plicaque albidis, venulis numerosis albido-hyalinis, pterostigmate sub-rotundato, venula albido-hyalina circumscripto; alis posticis fuscis, immaculatis; pedibus piceo-fuscis, coxis anticis et tarsorum intermediorum posteriorumque articulo basali albidis, hoc minutè nigro-punctato.

Var.—Tarsis intermediis solùm albidis.

Exp. alar. 7‴.

Habitat in Nova Guinea et insula Salwatty (Dom. Wallace).

In Muss. Oxon. et mihi.

A beautiful insect; the large blue blotches on the anterior wings are visible only in certain lights.

Eremopsocus, n. g.

Caput magnum, obtuso-triangulare, supra fere planum; palpi articulo ultimo clavato; antennæ alis longiores, (probabiliter) 10-articulatæ, articulo basali brevi, dilatato, 2° parvo, reliquis valde elongatis, fere æqualibus, ♂ incrassatis sed gradatim gracilioribus, pilis brevibus dense vestitis, ♀ filiformibus. *Prothorax* obtectus. *Mesothorax* magnus, prothorace latior. *Scutellum* elevatum. *Abdomen* parvum, ovatum. *Alæ* anticæ amplæ, ad apicem oblique rotundatæ; venis ut in *Psoco lineato*, cellula discoidali magna, quadrata, occlusa, cellulæ marginales posteriores quatuor: posticæ parvæ. *Pedes* hirsutiusculi; tibiæ cylindricæ; tarsi 2-articulati.

In structure similar to the species of *Psocus* of the *lineatus* group, but remarkable for the different forms of the antennæ in the sexes, those of the ♂ being strongly incrassate, whereas in the ♀ they form a long jointed thread; they are probably 10-jointed, but some of the apical joints are obscure.

Eremopsocus infumatus, n. sp.

♂. E. nigro-fuscus, nitidus; antennis pedibusque nigris; capite oculisque nigro-fuscis; mesothorace lineis elevatis transversis literam ⋈ formantibus instructo; scutello lineis elevatis radiatis instructo; alis anticis posticisque fuscis, nitidis, illis dimidio apicali pterostigmateque saturatioribus, venis nonnullis disci albido-hyalinis, pterostigmate magno, triangulari.

♀. Pallide brunneus; abdomine infuscato; alis haud nitidis; femoribus flavescentibus; cæteris ut in ♂.

Exp. alar. ♂ 7‴, ♀ $8\frac{1}{2}$‴.

Habitat in Brasilia (Dom. Bates).

In Muss. Oxon. et mihi.

Psocus, Latreille.

A. *Tarsi 3-articulati.**

a. *Cellula discoidalis occlusa; cellulæ marginales posteriores quatuor.*

§ *Pterostigma liberum.*

Psocus griseipennis, n. sp.

P. fuscus; antennis flavidis, fusco-terminatis; capite flavo-griseo, naso verticeque nigro-striatis; scutello abdomineque flavido-variis; alis anticis cinereis, fusco-griseo-marmoratis et reticulatis, venis longitudinalibus albido et nigro alterne punctatis, pterostigmate triangulari, antice elongato, griseo; alis posticis hyalinis, costa ad apicem albido nigroque punctata; pedibus flavidis, tibiis hirsutiusculis, minute nigro-punctatis, femoribus maculis et tibiarum tarsorumque apicibus infuscatis.

Exp. alar. $5\frac{1}{2}$—7‴.

Habitat in Australia.

In Muss. Brit., Oxon., et mihi.

This may possibly be the *P. australis* of Brauer (Verh. zool.-

* In the species of *Psocus* with triarticulate tarsi, the second, or middle joint, is always small, and generally requires a careful examination under a high power, to define it with certainty.

bot. Verein. in Wien, 1865, p. 908), with the description of which it agrees moderately well if the coloration of the body and wings are taken as reversed, but as no sectional characters are given for that species, I think it more prudent to describe my examples as new. In the coloration of the wings it somewhat resembles the European *P. variegatus.*

An example in the Oxford Museum bears the locality-label "Rio," but this must be an error; it is apparently spread over the whole Australian continent. A specimen from King George's Sound is smaller and darker, but not otherwise different.

Psocus fraternus, n. sp.

P. griseipenni similis, sed striis nasalibus punctatis, et antennis nigro flavidoque annulatis.

Exp. alar. $4\frac{3}{4}'''$.

Habitat in Assam (Dom. Jenkins).

In Mus. Oxon.

§§ *Pterostigma cum vena furcata per venulam transversam conjunctum.*

Psocus pallipes, n. sp.

P. niger, nitidus; antennis nigris, ad basin rufescentibus; capite abdomineque piceis; alis anticis hyalinis, nebulis ad basin et ad apicem fasciaque media transversa infuscatis, venis fuscis, ad basin flavis, cellula 3^a posteriori marginali cæteris valde majore, 4^a parva, triangulari, pedunculata; pterostigmate in parte infuscato, elongato, subtriangulari; alis posticis hyalinis, venis fuscis; pedibus flavis, tarsis fusco-terminatis.

Exp. alar. $3\frac{1}{4}'''$.

Habitat ad Adelaide in Australia meridionali.

In Mus. Oxon.

B. *Tarsi 2-articulati.*

b. *Cellula discoidalis occlusa; cellulæ marginales posteriores quatuor.*

§ *Pterostigma liberum.*

Psocus femoratus, n. sp.

P. piceus, nitidus; capite piceo; (antennis defectis); oculis ferrugineis; ocellis rufescentibus; alis anticis nitidis, nigro-fuscis, ad basin et ad apicem saturatioribus, pterostigmate elongato-triangulari, piceo, venis nigricantibus nonnullis disci albido-marginatis ; alis posticis pallidioribus ; pedibus nigris, femoribus (apicibus exceptis) flavis.

Exp. alar. $7\frac{1}{2}'''$.

Habitat in China boreali.

In Mus. Brit.

Psocus grisescens, n. sp.

P. cinereus ; capite immaculato ; antennis flavidis, apicem versus fuscescentibus, pilosiusculis ; ocellis nigris ; alis anticis pallide cinereis, obscure nebulosis, venis fuscis, nonnullis præcipue in disco flavidis, pterostigmate elongato-triangulari, griseo ; alis posticis hyalinis, venis fuscis ; pedibus pallide cinereis.

Var.—Capite linea media nigra, postice furcata.

Exp. alar. $5\frac{1}{2}-6\frac{1}{4}'''$.

Habitat in Natalia.

In Mus. Brit.

Psocus infectus, n. sp.

P. brunneus ; antennis (articulis duobus basalibus exceptis) nigris, hirsutiusculis ; naso, oculis, ocellisque nigricantibus ; mesothorace utrinque et antice nigro-piceo ; abdomine brunneo, flavo-vario ; alis anticis griseo-hyalinis, fuliginoso-nebulosis (præcipue ad angulum analem), nebulis irregularibus ad basin et ad discam vittaque elongata apicali sulphureis, venis fuscis, nonnullis sulphureis, pterostigmate griseo, triangulari ; alis posticis hyalinis, venis fuscis ; pedibus lurido-testaceis, tibiis brunneis, tarsis nigris.

Exp. alar. $8'''$.

Habitat ad Bogota in Nova Granada.

In Coll. mihi.

Psocus reponens, Walker.

Trans. Ent. Soc. ser. 2, v. 188.

Two examples of this species from Mexico (Coffin), in the Oxford Museum do not differ from the Brazilian types described by Mr. Walker. The words "veins white" in the description (*loc. cit.*) are however incorrect ; the veins are dark fuscous.

Psocus cosmopterus, n. sp.

P. rufo-griseus ; antennis nigris, hirsutiusculis, ad basin rufo-griseis ; capite macula nigra in medio postice posita, oculis nigro-signatis ; alis anticis sub-opacis, albidis, basi fascia ante medium postice dilatata, punctis ad marginem posticum fasciaque lata irregulari in dimidio apicali (ad marginem apicalem bis excisa) fusco-nigris, pterostigmate sub-triangulari, ferrugineo, venis nigris, nonnullis ad basin et ad discum rufescentibus; alis posticis hyalinis, venis nigris; pedibus testaceis, tibiarum tarsorumque apicibus nigris.

Exp. alar. 7‴.

Habitat ad Mount Ophir in Malacca (Dom. Wallace).

In Coll. W. W. Saunders.

Closely allied to *P. Taprobanes*, Hagen, and perhaps a local modification of that species; differs in the pale head and thorax, sub-opaque anterior wings, and the colour of the pterostigma; the wings also appear to be somewhat narrower.

§ § *Pterostigma cum vena furcata per venulam transversam conjunctum.*

Psocus striatifrons, n. sp.

P. flavidus; antennis grisescentibus; capite flavido, lineis numerosis in naso punctisque in vertice (in nebulis tribus dispositis) nigris; labro nigro-emarginato; oculis luridis; ocellis nigris, nitidis; scutello fusco, macula media striisque elevatis radiatis quinque flavidis; abdomine flavido-vario; alis anticis hyalinis, fascia transversa interrupta ante medium maculaque ad pterostigma fuscis, venis fuscis, costa radioque albidis; pterostigmate elongato, ad apicem dilatato; alis posticis hyalinis, venis fuscis, pedibus flavidis, femoribus ad basin et ad apicem tarsisque fuscis, tibiis nigro-punctatis.

Exp. alar. 3‴.

Habitat in Australia meridionali.

In Mus. Oxon.

bb. *Cellula discoidalis aperta; cellulæ marginales posteriores completæ, duæ, 2ª elliptica, libera.*

Psocus imbecillus, n. sp.

P. pallide flavidus; antennarum dimidio apicali, abdomineque infuscatis; alis pallide flavidis, venis vix obscurioribus, pterostigmate elongato-ovali; pedibus pallide flavis.

Exp. alar. $2\frac{1}{2}$‴.

Habitat in Mauritio.

In Mus. Oxon.

I have examined one specimen gummed on card, and in bad condition. It is probable that this species may frequent houses and warehouses. I once saw a similar species in myriads in the empty hold of a ship that had just discharged a cargo of tea from China, but the specimens are unfortunately lost.

Postscript.—Since the introductory remarks to this paper were written, Dr. Hagen has published in the Verhand. zool.-botan. Gesellschaft in Wien, 1866, p. 203, ("Psocinorum synopsis synonymica"), a plan for dividing the old genus *Psocus* into several separate genera, which greatly facilitates a knowledge of the family. It is based upon the number of tarsal joints, and the neuration. The genera proposed are *Myopsocus, Elipsocus, Psocus* (proper), *Cæcilius* (Curtis), *Epipsocus, Polypsocus, Peripsocus, Stenopsocus, Calopsocus,* and *Dypsocus.* According to this arrangement, the species above described as *Psocus griseipennis* and *P. fraternus* belong to *Myopsocus; P. femoratus, P. grisescens, P. infectus, P. reponens* and *P. cosmopterus* to *Psocus* (proper); *P. striatifrons* to *Stenopsocus;* and *P. imbecillus* to *Cæcilius. P. pallipes* appears to be the only described species which, with the neuration of *Stenopsocus,* possesses tri-articulate tarsi; for it I propose the generic name *Propsocus.*

IX. *A new Genus of* Hemerobidæ, *and a new Genus of* Perlidæ. By Robert M'Lachlan, F.L.S.

[Read 3rd December, 1866.]

HEMEROBIDÆ.

Rapisma, n. g.

Caput sub prothorace occultum; oculi globosi, parvi; antennæ breves, intus sub-serratæ, pilosæ; palpi parvi. *Thorax* et *abdomen* valde robusti; prothorace late transverso. *Pedes* breves, pilosi. *Alæ* amplæ: anticæ sub-coriaceæ, pilosæ, elongatæ, latæ, sub-acutæ, margine apicali obliquo; spatium costale basi latissimum, venulis transversalibus numerosis, furcatis, areolis numerosis (ad basin seriebus 3-5 dispositis) irregularibus; sub-costa a radio separata, spatio sub-costali venulis transversalibus numerosis instructo; sector primus radio parallelus, sectores cæteros emittens; venulæ gradatæ per-numerosæ, membranam in cellulis parvis dividentes: posticæ anticis breviores, sub-hyalinæ; spatium costale angustum; venæ fere ut in anticis.

Type.—*Hemerobius viridipennis*, Walker, Cat. Neurop. Brit. Mus. pt. 2, p. 276, 1; from the East Indies.

A very remarkable genus of *Hemerobidæ*, on account of its robust body, large size and subcoriaceous anterior wings. It bears some resemblance to *Ithone* (incorrectly placed by Newman and Walker in the *Sialidæ*), but differs in the breadth of the basal portion of the costal area, in the absence of a recurrent veinlet, in the details of neuration, and in the head, which is so much retracted under the prothorax that the front alone is visible; it is probable that the living insect has the power of extending the head, but in dead examples it is so greatly concealed, that but for the antennæ and eyes, it would be scarcely seen at all.

PERLIDÆ.

Stenoperla, n. g.

Palpi maxillares articulis basalibus duobus brevibus, æqualibus, latis, cæteris planiusculis, 3° et 4° singulis 2° duplo longioribus, 5° 4° breviori. *Antennæ* breves, graciles. *Ocelli* tres. *Abdomen* gracile, caudis analibus brevibus, gracilibus. *Alæ* quiescentes corpus circumvolventes: anticæ per-angustæ, elongatæ, venulis transversalibus numerosis regulariter instructæ: posticæ anticis triplo latiores, plicatæ, venulis transversalibus ubique regulariter instructæ.

Type.—*Chloroperla prasina*, Newman, The Zoologist, 1845, p. 853, 2; *Hermes prasinus*, Walker, Cat. Neurop. Brit. Mus. pt. 2, p. 206, 10; from New Zealand.

In the form of the maxillary palpi, and in the numerous transverse veins distributed pretty evenly over the whole of the posterior wings, this genus approaches *Eusthenia* of Westwood. In repose the wings form a nearly complete cylinder concealing the body, as in *Leuctra.*

X. *On the Oak feeding Silkworm from Japan,* Bombyx Yamamai (*Guérin-Méneville*). By Alexander Wallace, M.D., M.R.C.P.

In tenui labor, at tenuis non gloria, si ——.*

In consequence of the present dearth of silk, owing to repeated failures during the last ten or more years in the cultivation of the cocoons of *Bombyx Mori*, every variety of silken tissue is now eagerly sought after, and commands relatively a high prize. As a result of this demand for inferior as well as superior material, attention has been called to the cocoons of other silk-producing *Bombyces*—a large and wide-spread tribe—and several of the most promising species have been introduced into Europe, and are now undergoing more or less successfully the process of acclimatization; so that there dawns before our view the prospect of an extensive future cultivation and production of silken material in Central and Southern Europe, and in many of her colonies possessed of suitable climate and soil. The naturalists who have undertaken these investigations, at the head of whom stands Mons. Guérin-Méneville of Paris, speak most confidently as to the results of their experience, and express a firm belief that at no distant day several valuable races of silkworms may be added to our domestic menagerie. The most valuable perhaps of these races, the *Bombyx Yamamai*, an inhabitant of Japan, forms the subject of this Essay.

All that we know of the past history of this species is as follows: For many years the Japanese have cultivated an oak-feeding silkworm as well as the mulberry worm; and according to some writers, the profits arising from this species exclusively belonged to the royal family, according to others its silken produce was employed to make the rich vestments of the imperial family. In

* [To the Memoir endorsed with the above Motto was awarded a Prize offered by the Council of the Society for 1866, for an Essay on Economic Entomology.—*Sec. Ent. Soc.*]

either case this valuable species was so highly esteemed, that the punishment of death was by law inflicted on any one who exported the eggs. This then explains the reason why for so many years this species was unknown to our naturalists, and its silk to our merchants. It was not till the beginning of the year 1861 that during the presence of the French fleet in the Japanese waters, the attention of Mons. Duchesne de Bellecourt, French consul general and *chargé d'affaires* at Japan, having been directed to the beauty of the silken fabrics produced from the cocoons of the *Bombyx Yamamai,* he was enabled to obtain some eggs, which were transmitted to the Imperial Government of France, and finally entrusted to the hands of the Imperial Society of Acclimatization. Now fortunately there is no difficulty in procuring eggs of this species in Japan, except that sometimes wooden eggs are fabricated to deceive unwary customers. The eggs first sent over to Europe were carefully tended in the Museum at the Jardin des Plantes at Paris. Unfortunately nothing was known of the habit of the insect, not even its food plant. When therefore the first eggs hatched out about the 15th of March, 1861, the young worms refused all the leaves presented to them, and perished. But in the beginning of April an oak (*Quercus cuspidata*), placed under glass, having put out some leaves, these were eaten by the young worms, and hope was now entertained of rearing them. The President of the Society of Acclimatization immediately obtained from Toulon and Hyères in the south of France young oak leaves, with which the baby worms were fed from the 9th April till the time when the oaks at Paris had sufficient foliage. These worms, about forty in all, grew well up to their fourth moult, but being in the Serpent house, the high temperature and close atmosphere proved injurious to them ; at least it was probably from that cause that in their fifth stage all the worms (five only excepted) died off in a few days of the same sickness, a black liquid oozing through the pores of the skin. The remaining five made imperfect cocoons, but no moth hatched out. Happily a few eggs of the same batch had been sent to the learned Entomologist, Mons. Guérin-Méneville, that he might name the species ; of the few worms hatched out of these eggs one only was born sufficiently late to obtain oak leaves. It was sent to Mons. Année at Passy, where it throve under glass near a door which was always open. It spun a very handsome cocoon, whence a female moth emerged. This attempt, insufficient unfortunately to propagate the race, yet sufficed for Mons. Guérin-Méneville to give a name to the new insect, permitted a study of its habits, of its beauty as a larva, of the size, form and colour of the cocoon, of the suppleness, brilliancy and elasticity of the silken fibre; and, lastly, of the physiological and scientific character of the moth.* The chance of a second experiment under such circumstances was greatly to be desired; therefore, Mons. Eugène Simon, the Agricultural Commissioner of the French government in China and Japan, received a special mission to search out and send over eggs of the *Yamamai.* But the Japanese law, entailing death on any one detected in exporting the eggs, was for some time an insurmountable difficulty; and Mons. Simon was obliged to leave Japan with his mission unexecuted. But happily he had made the acquaintance of a *savant* devoted to the cause, Mons. Pompe van Meedervoort, medical officer in the Dutch navy, and Director of the Imperial School of Medicine at Nagasaki, who seeing the importance of such a result was able most fortunately to attain it. To Mons. Pompe van Meedervoort Europe owes the possession of this valuable species, the *Bombyx Yamamai.* Early in January, 1863, this *savant* returned to Holland with a parcel of eggs.† The principal portion of these were sent, according to a promise made to Mons. Simon, to the French government, and by it entrusted to the Imperial Society of Acclimatization, and by them to Mons. Guérin-Méneville for distribution among the members, &c; two other portions were retained by Mons. Pompe van Meedervoort for his friends and his country, and a fourth portion was given to Mons. Guérin-Méneville, through the kindness of a Dr. Blecker, for distribution among those naturalists and sericiculturists who were not members of the Imperial Society of Acclimatization. Subjoined is the translation of a notice published by Mons. Pompe van Meedervoort, relative to the introduction of the *Yamamai* into Europe.‡

"Mons. Duchesne de Bellecourt, Consul general and *chargé d'affaires* of His Majesty the French Emperor at Japan, sent in 1861 some eggs of the *Bombyx Yamamai* to the Society of Acclimatization; with these eggs experiments were made showing the great importance to Sericiculture of this new silk worm.

"In 1862, I had the honour to make the acquaintance of Mons.

* See a Memoir by Mons. Guérin-Méneville, "Description of a new Oak-feeding Silkworm from Japan;" extracts from the Revue et Mag. de Zoologie, année 1861, pp. 227, 402, 435, pl. xi, xii, xiii.

† According to Mons. Guérin-Méneville, vide Revue de Sériciculture, 1863, p. 34, thirty grammes in good condition.

‡ Revue de Sériciculture, 1863, p. 288.

Eugène Simon, Agricultural Commissioner of the French government in China and Japan; he informed me of the great value of the *Bombyx Yamamai*, and together we made every effort, but in vain, to procure eggs of this species; we were told it was absolutely impossible to obtain them. Mons. Simon being obliged to return, I made him a promise before he left to continue my efforts, and, in case of success, to offer the eggs to the French government. But the more I tried, the more I saw how difficult if not impossible was the attempt. I applied in vain to the Japanese merchants, the silk growers, to many native naturalists with whom I was on friendly terms, lastly to the government, but all in vain; the reply was 'the penalty of death is inflicted on any one who may export these eggs.' Another idea then possessed me, to apply to one of my pupils. As the Principal of the Imperial School of Medicine at Nagasaki, I was surrounded with students from the different provinces of Japan, and amongst others from the provinces of Etizen and Vigo, or Hugo, where alone the *Yamamai* silkworms are reared. One of these youths, who had on several occasions given me proofs of his extraordinary devotion, was selected by me for the purpose; to him I explained the whole affair, and proposed that he should go to Vigo at my expense, in order to collect and send me as many eggs as possible. This brave young man, whose name I have promised solemnly never to divulge, started on the morrow, and after an absence of fifteen days secretly sent me the eggs, which he had collected at much difficulty and danger to himself. He told me that no one suspected the object of his journey; that was in Oct. 1862. My mission to Japan was finished Nov. 1st, 1862; I started for Europe by the English mail-packet, and undertook the charge of carrying these eggs to Europe. This was by no means an easy matter on board a steamship in the tropics. If the eggs were kept in the cabin, a great risk of their premature hatching was incurred, for the temperature there in the month of November is above 95° F. and in the Red Sea 105° and more. I followed the advice of Mons. Simon, and placed the eggs in the ice box on board ship, though often but little ice was therein. To this precaution is due in a great measure their safe arrival in Europe in good condition. I arrived at the Hague early in January, 1863, and at once sent out the eggs; the greater part was sent to the French government, and to the Imperial Society of Acclimatization, according to the promise I had made to my friend Mons. Simon. Another portion was sent according to a promise made to a Mons. Bauduin, at Nagasaki, agent to the Dutch Handelmaatchappij, and was divided between M. de Graf and M. de Weckherli, Secretary to the Queen of the Netherlands. A third portion I offered to my own government, and His Excellency the Minister of the Interior transmitted them to the Dutch Entomological Society. Lastly, there remained a few more eggs, which I handed over to the celebrated naturalist Dr. Bleeker, who had asked for them for Mons. Guérin-Méneville."

From this beginning the new species spread over Europe. In 1865 and 1866 several trials were made in England to rear the species; but, I believe, all have been unsuccessful.* The same want of success has attended many trials in France, Holland, and other countries; but still several gentlemen have attained success even on a large scale. Thus, Mons. Guérin-Méneville, at the Imperial farm at Vincennes, on a small scale, and Mons. Chavannes, Professor of Zoology at the Academy of Lausanne, and Mons. Personnat, at Laval, France, have succeeded in rearing thousands of cocoons. Let us hope therefore that in England this *Bombyx* may speedily be successfully cultivated; and I trust that, in writing this Essay, and collecting all that is known about this beautiful but delicate insect, I may hasten the day when these valuable cocoons may be grown on a large and remunerative scale in our own country.

In describing this *Bombyx* I propose to commence with the egg stage, not only as being the first era in the life of the insect, but also because it differs from the Ailanthus silkworm, *B. Cynthia*, and resembles the mulberry worm, *B. Mori*, in passing the winter in the egg state: so that the year commences with the egg state, whereas in *B. Cynthia* the perfect insect first makes its appearance in the early summer, after passing the winter in the cocoon stage.

The egg of the *Yamamai* is large and spheroidal; but, in consequence of the changes that take place within, it often is slightly concave on the upper and under surfaces. Its greatest diameter is from $\frac{1}{9}$—$\frac{1}{10}$ of an inch; its smallest, $\frac{1}{13}$—$\frac{1}{16}$ of an inch. The shell is of a pale straw-pink colour naturally, but is thickly coated over with a tenacious brown gum, which gives it a mottled or marbled dark brown look. The shell appears covered with a number of fine punctations externally, which are doubtless pores, in order to permit the entrance

* Two males, as I am informed, were reared in 1866, at York, by Mr. Dossor, one from a cocoon sent him by Capt. Porrett; and two moths were reared by some schoolboys, one at Louth, and the other at Wootton-under-Edge.

of a minute portion of air. On its inner surface it is highly polished, and of a pink tinge. The gum, which is thick and strong, and when moistened resembles glue in smell, serves not only to retain the eggs *in situ* where deposited, during winter rains and storms, but also as a protection against extreme cold, drought or heat, &c. It is easily soluble in an alkaline fluid. Some few eggs are destitute of gum, aud some possess much more than others. This seems to be due to the accident of deposition, the first eggs laid being the more thickly coated, the last ones more sparingly covered. But this variation* in the quantity of the gum is not to be taken as an evidence for or against fertility of the eggs, as I have had white eggs which have hatched out their larvæ, and brown eggs that have failed to do so. A curious circumstance† connected with the egg stage of the insect has been observed by Mons. Guérin-Méneville, that the young larva is fully developed a month after deposition of the egg, and that he lies during the winter *perdu* within the shell, in a dormant condition, until a vernal temperature and moisture awake him to the active duties of life. This habit of passing the winter within its own shell has not before been observed in any young larva, and well deserves the close attention of Entomologists. In consequence of this peculiar habit, great care should be taken, in the transit of eggs through long distances in winter, not to expose them to high temperatures, lest a premature activity should call the young worm into existence before the food is ready.

In early spring, almost before the oak buds are ready, the young larvæ begin to emerge, unless retarded by being placed in a cool north aspect. This is the case with eggs obtained from North France, and, to a greater extent, with eggs that have been forwarded from Japan. I should therefore infer from this, as well as from the habits of the larvæ, which will be subsequently mentioned, that, in a state of nature, a cool shady locality is selected by the female for the deposition of her eggs, which are inserted into the crevices of the bark on the north aspect of the tree, in order that the sun's rays may not awake

* The same remark is made by Mons. Guérin-Méneville, Revue de Sériciculture, 1863, p. 295.

† Vide Revue de Sericiculture, 1863, p. 295. This discovery caused great anxiety to Mons. Méneville, lest all the eggs might hatch out prematurely, and the valuable race be lost to him for that time; but finding that the same thing had happened to the possessors of eggs in other countries, he concluded that it was a natural but curious condition peculiar to the *Yamamai*. It was brought before the Entomological Society of France, but no analogous instance was known to the members.

them before the food is ready. I have observed, I believe, a somewhat similar shade-loving habit in the Lepidopterous larvæ of *Notodonta trepida*. These I have frequently found in pairs on the cool north side of an oak tree, but I have never beaten them from the sunny side. These larvæ are considered by Entomologists as peculiarly difficult to rear, and the *Bombyx Yamamai* larvæ certainly resemble them greatly in that peculiarity, being very delicate insects. The first sign observed of the young worm's existence is a little round hole, made in the side of the egg wall. This is enlarged to the size of the head of the larva, and after a pause, sometimes of several days, the larva emerges, generally in early morning from sunrise to 9 a.m., few having been found by me to emerge after that hour.

I should observe here that my descriptions of the eggs and of the larvæ, up to the last change, were made from specimens kindly sent me by Mons. Guérin-Méneville and others; but inasmuch as in their fourth stage all my worms perished, I am compelled to finish my descriptions from the accounts of Mons. Méneville, Mons. Personnat, &c.

Immediately after birth the young worm is said to expand in volume in consequence of the air inspired, but probably also because the tubercles and spines, which were previously flattened down inside the egg, are now erect and prominent. I agree therefore with the statement that the worm seems to grow even before it has eaten.

Description of the newly-born larva: length $\frac{3}{5}$ of an inch; head of a pale oak colour, larger than any other segment; collar of a lighter tint of the same colour, having four bright yellow tubercles, situate two on the dorsum and two laterally, emitting long curled bristles. The ground colour is a bright primrose, with five velvet-black longitudinal lines, one dorsal and four lateral. There are also four rows of tubercles, longitudinally placed in the interspaces between the five lines, and a row of tubercles below the lowest lateral line on each side, one set of six tubercles thus belongs to each segment. From the upper row of tubercles spring stout black bristles, curling outwards; from the lower ones spring white bristles. On the third and fourth segments are two more elevated tubercles, forming a hump studded with very black hairs. On the penultimate segment is another pair of elevated tubercles, with similar bristles, and just anterior to these a black velvety spot. The tubercles are at first light-coloured, but soon assume a dark velvety hue. There are three white scaly patches, one above, and two somewhat below and to the side of the anal opening, these also soon turn black. The feet are of a dirty pale straw colour. The bristles nearest the head are the longest, and are used by the larva for the very singular purpose of combing and arranging its hair after emerging from the egg; for while inside their hairs have been pressed, and even slightly fastened down by the moisture within, and, if not attended to after birth, would soon dry and remain attached to the skin, and perhaps cause the death of the larva; therefore one of the first efforts of the newly-born larva is to bend its head backwards over the body in a looped form, so that the anterior and posterior dorsal surfaces are in apposition, then by bending to and fro laterally, the bristles, especially the two anterior ones, act as combs to arrange the other hairs.

About three or four days after birth, according to the amount of food taken, the larva has grown to be half an inch long; the vivid primrose hue has been toned down with green, the tubercles are more plainly visible, of a yellow tint, in pairs, six on each segment, situate midway between the black lines; the lower dorsal line is now observed to begin at the fourth segment, and is replaced on the second and third segments by two black dots; the three blue-black spots on the dorsum, and the black dot or tubercle emitting bristles situate on each segment just above the feet, are more elevated. The prolegs are brown at the tip, black at the base, the claspers are dashed midway with a pale transverse streak of a brown colour; the white scales at the anus are now of a rich velvet black.

It would be impossible to describe all the varieties of tint or ground colour found in the larva; suffice it to say, that I have described the larva as I have seen it, and that my description differs somewhat from the French, which also differ from the accounts of the Japanese larva. It is probable that variations of food, soil and climate produce corresponding variations in the hues of this lovely larva. Erratic for the first few days the young worm causes great apprehension in the mind of its owner, especially for the first time of cultivation, lest the food or locality be not suitable; nevertheless it will be seen that the leaves are slightly nibbled, that frass has been ejected, and that the larva is of a good colour, not dull or pinched, but if any thing somewhat larger than before; these considerations, and a knowledge of its erratic habits, will re-assure the fortunate possessor that all is going on well. A similar restlessness has been observed in other larvæ, chiefly of *Bombyces*, as, for instance, that of *Orgyia antiqua*. It would seem to be the result of a natural instinct or requirement, to enable them in a wild state successfully to reach their food, which may, if the egg be deposited at the base of the tree, be situate at a considerable distance.

It would appear that there is a considerable thirst and desire of drinking in these larvæ. Directions are given by those acquainted with their habits, to moisten the oak leaves twice a day, as if by rain, and I have observed that this *quasi* rain has a tendency to check the vagabondizing, for the larvæ may be observed to place their heads down to the drops and drink them up, to all appearance greedily, as if moisture were very necessary to their existence, and then to repose in the mode common to the *Bombyces*, resting on the hind claspers, the fore part of the body thrown upwards into a curve, the head deflected downwards, and the prolegs tucked together underneath.

Another observation, which soon forcibly strikes the possessor of these larvæ, is the small quantity they consume in their early life, very unlike the larvæ of *B. Cynthia*, whose appetite is most voracious, and whose growth is rapid in proportion; but these larvæ eat very little, and consequently at first grow very slowly; this is probably so ordered lest the unfolding oak buds in early spring might fail to furnish sufficient provender.

About ten days after birth the larva measures $\frac{5}{8}$ of an inch. It is now fuller in the body and eats more; the green tint now predominates over the yellow ground colour; the belly of the larva is of a transparent dull green; the tubercles on each segment have a broad, yellowish-green base, which gives a lighter tint to the dorsal aspect; the head is oak brown, a broad patch of the same colour is continued to the second segment in the mesial line, flanked by two lateral tubercles, which project like black warts, emitting white spines. From the two dorsal rows of tubercles spring curling dark spines, the four lateral rows emit spines of a light colour. The first moult of my oldest larva, which was born April 25th, took place May 22nd, an interval of twenty-two days, whereas in *B. Cynthia* the first moult or change of skin takes place on the seventh day after birth, or even earlier in vigorous larvæ and warm weather; the larva prepares for his moult by spinning a little silken web on the under surface of the leaf, and, fastening thereto the hind claspers, it remains motionless and of a dull colour for three or four days; then the skin is rapidly cast off, and it reposes in its new glory for some hours to harden the head, feet and external membranes. After the moult the larva presents quite a different aspect, its length is $\frac{5}{8}$ of an inch, its colour a vivid grass-green, studded with six rows of tubercles, the dorsal and upper lateral rows being tipped with orange-yellow, and furnished with long dark brown spines, but the spines which belong to the hump on the third and fourth segments are longer, black and curling; the anus is margined with blue, and three small black velvety patches still adorn that part; the head is light chocolate-brown, and two brown dots stud the collar, which is of a pale straw colour; the prolegs are brown, the claspers pale green, having an indistinct transverse streak of a dark chocolate, and a broader termination of the same colour. The dorsal and lateral lines are now nearly suppressed. My oldest larva made up for his second moult May 29th, and changed June 1st, an interval (since the first moult, May 17th) of fifteen days; just before moulting the larva had a glassy, shining look; length $\frac{8}{10}$ inch when contracted and made up for changing; just after moulting the colour is a vivid grass-green, dotted all over with minute straw-coloured specks; the spines are now much longer, especially on the hump and anterior segments, $\frac{3}{10}$ of an inch long; the head and prolegs are pale, but soon acquire a brick-dust colour; the collar is green, the dorsal tubercles are lemon-yellow; the lateral tubercles are tipped with a faint blue dot, the lateral stripe is yellow, it is suppressed on the three anterior segments; the spiracles are of a pale reddish-brown, the claspers are margined with brick-dust colour; the upper anal flap is margined with pale blue, on the lower flaps is a triangular patch of a brick-dust colour, margined externally with creamy-white; the length is one inch; the larvæ now begin to eat enormously. The third moult took place on the 13th June, leaving an interval of twelve days; previous to this change the larva was $1\frac{1}{2}$ to $1\frac{3}{4}$ inches in length; colour grass-green, paler on the dorsum, deeper on the sides and belly; head light brown, collar yellowish-brown, the upper four rows of tubercles yellow, the two lower ones now tipped with blue; the spines $\frac{1}{4}$ of an inch long. After the third moult the larvæ increase greatly in size up to $1\frac{4}{5}$ inches, and consume more food; the colour is a vivid grass-green, the head is green, the collar is tipped and studded with yellow-brown spots; a lateral line of a yellow-brown colour, margined superiorly with darker brown, runs from the posterior to the fifth segment, all the other lines are suppressed; on the sixth, seventh, and eighth segments the line is flecked with a brilliant silver spot, that on the sixth being the largest; the upper two rows of tubercles are faintly silvery, the lower ones are tipped with blue; there is a great increase of bulk in the third and fourth as compared with the other segments; the prolegs are light-brown, claspers deep green, margined with rose-brown; the two triangular brown patches at the anus are margined with yellow and white, numerous short yellow hairs stud the surface, especially the anterior and lateral aspects; the spines curl from behind forwards. Between the third and fourth moults, that is, in the fourth stage, my larvæ, to my sorrow, all died, so that my descriptions are from this point copied from M. Personnat's work, "Le Ver à Soie du Chêne, *Bombyx Yama-Maï.*" The interval between the third and fourth change lasts for seventeen days, four of which are comprised in the last moult, which is the most trying and difficult to the larvæ. It remains a long time after moulting without feeding and even without moving its place, often from twelve to twenty-five hours. Under the influence of air and food the skin, at first pale, assumes the same tints and exhibits the same differences of colour between the French and Japanese reared specimens as in the preceding stages. In the latter the segments from the fourth to the eleventh are traversed by a yellowish-brown stripe, which enters the great brown triangular patch separating on each side the three portions of the anal segment. The head and margin of the claspers are of a reddish-brown, tipped with green, and on each side on the third segment, and often on the sixth below the spiracles, is placed a lovely silvery spot of metallic lustre. In the French specimens the lateral stripe is white, but interrupted and hardly visible at the commencement of each segment, and changing into green at the termination; the head is entirely green, like the rest of the body, there are no metallic spots, the lateral tubercles are of a deep blue, and spots of the same colour changing into dark green frequently appear at the base of the claspers; these differences are common to the fourth as well as the fifth stage. The worm now grows rapidly, becomes enormous, attains a length of $3\frac{3}{5}$ to 4 inches, with a proportionate thickness. The tubercles have all disappeared in a turgescence of the skin, which seems thickened and appears to imbibe the air through an infinity of pores. The metallic spots, which in the Japanese specimens to the number of three, four or seven, are seen on each side, one on each segment, commencing at the fifth, are in the French specimens entirely or almost entirely suppressed. The larva having eaten largely during sixteen or eighteen days, according to the temperature, becomes transparent, of a pale almost yellow green, as the time of spinning approaches. He is now slightly erratic, as if seeking a site for his cocoon; having made a choice, he empties his intestinal canal, similarly to the *Cynthia* larva, emitting a large drop or two of clear liquid, and then folding up in its long diameter a large leaf, or uniting two or three smaller ones together to keep itself concealed, it spins a network of coarse silk like the *Cynthia*, attaches it to the bough with a short rope formed of several strands flattened, and then commences in earnest the more serious business of its cocoon.

The cocoon of *Bombyx Yamamai* most closely resembles that of *B. Mori;* the resemblance is often complete, except in point of size; like it the shape is oval, it is closed at both ends, the colour is greenish or golden yellow. It is much larger than that of *B. Mori;* it measures in its largest diameter $1\frac{4}{5}$ to $2\frac{1}{10}$ inches, in thickness $\frac{9}{10}$ to $1\frac{1}{10}$ inch. The largest are generally those of the females, but some very fine cocoons have produced enormous males. The worm commences to spin around him a web at first transparent, but which soon thickens in proportion as the new meshes are stretched across those first spun. The thread, nearly always continuous throughout the cocoon, measures in length from 870 to 1,100 yards. In the external layers the thread is carried nearly round the cocoon, but in the internal ones circles are formed more or less numerous, first at one end and then at the other. By this arrangement the worm works more freely and rapidly, and the moth makes its exit more easily, as the threads which it detaches easily pull out, lengthen and stretch, facilitating thereby the passage of the insect. Externally the silk is of a deep green or yellow colour, but internally of a silvery whiteness; the inside is also finer and more brilliant. As with all silk-producing species the fibre is composed of a double thread, for the reason that there are two orifices (spinnerets) in the larva through which the thread is emitted; but there is one peculiarity which renders the silk of *B. Yamamai* very superior, viz.:—that as is the case with *B. Mori*, the fibre is covered with a gummy material, which is not perfectly dissolved in the boiling water which contains the cocoons during reeling, so that the two or more threads become during the process as it were naturally agglutinated together and compose a single strand. The cocoon throughout is strengthened with a thick gum, but this softens readily in boiling water; this gum seems to contain a calcareous element, for on drying the cocoon, and rubbing or tearing it, a whitish powder tumbles out, which is often distinctly visible on the surface of the cocoon. The larva continues spinning during four or five days, little by little shrinking up in his narrow prison; afterwards he remains motionless for five or six days, after which a new moulting occurs, and the worm is changed into a pupa.

This, when taken out of the cocoon at first soft and pale, soon hardens and assumes a dark-reddish or black hue. It is prudent to allow fifteen or sixteen days from the commencement of the cocoon before moving them, so as to insure a thoroughly perfect change. The pupa, in a normal state, hangs vertically; it is provided with a reservoir in front containing a particular fluid, destined to dissolve the gum of the cocoon, to soften the threads and to moisten the body of the insect, thus facilitating the exit. This reservoir of fluid has been noticed by M. Guérin-Méneville to be peculiar to all those species which possess closed cocoons, viz., *B. Mori*, *Pernyi*, *Mylitta*, &c., and to be absent from all those species which have open cocoons, viz., *Cecropia*, *Pyri*, *Cynthia*, &c., and has been pointed out by him to belong to the *Yamamai.** Nevertheless I have observed that the face of *B. Cynthia* is perfectly moist while emerging, and that after emerging a drop of fluid, giving a feeble alkaline reaction, stands on the palpi, and that the aperture of the cocoon is frequently left damp.

From thirty-nine to forty days elapse from the formation of the cocoon to the exit of the moth. This magnificent Lepidopteron measures $5\frac{3}{4}$ to 6 inches from tip to tip; on emerging it will expand its wings suspended from the cocoon similarly to the habit of *B. Cynthia*; its birth takes place normally from five to eight p.m., so as to be ready for flight that same night; after a lapse of about three hours the moth expands its wings flat, as is the custom of that tribe; the ground colour of the wings varies much in individuals, but the yellow variety is the most constant in the male, and the brown variety in the female. The male is immediately recognised by his very broadly pectinated antennæ. Like the *Bombyx Cynthia* the upper wing of the male is acutely falcate at the tip, but broader and blunter in the female. This formation, common to many of the large swiftly flying *Lepidoptera*, doubtless enables the male to fly with great rapidity and directness of flight, while the larger tip of the female is generally accompanied by a more broadly developed under-wing, destined doubtless to contribute mainly to the support of the body, which is heavy with its burden of eggs. The abdomen is slender and short compared with the size of the wings. The body and wings are on the upper surface of a brilliant yellow, but sometimes more or less grey, brown or dove-coloured; the head, large, is always grey, spotted with white; some angular and transverse streaks intersect the wings at about

* Vide Mémoire sur le *Bombyx Yama-Maï*, par Mons. Guérin-Méneville.

the first fourth of their length. Nearly in the middle of each wing is a somewhat triangular-shaped spot or eye (ocellus), but with the angles rounded; the transparent portion, which is produced by an absence of scales, is bordered externally by several concentric and semicircular lines severally of yellow, brown-violet and black colours. The eye in its entire diameter measures from $\frac{1}{4}$ to $\frac{1}{3}$ of an inch. It is a little larger on the lower than on the upper wings. Between the eye and the inferior border runs a straight band, white, bordered with grey, blended with a rose-lilac tint; this streak runs across both wings. In the upper wings this band starts nearly from the tip of the wing, and ends on the inner aspect about $\frac{3}{8}$ of an inch from the anal angle; in the lower wings it follows, at the distance of about $\frac{1}{2}$ an inch, the undulations of the external edge. The costa or front margin of the upper wings is bordered with an ashy-blue streak, broad at the base and becoming narrower towards the apex of the wing, darker at the outer, lightest at its inner edge. The under-surface of the wings is either yellowish-grey or brown, more or less shaded according to the general tint, relieved by two or three darker bands and spots of dark-grey; the ocellus is obscurely traced, but the transparent portions are of course visible; the eyes, shaded by the antennæ, are of a blue-green, and emit when examined by daylight rainbow hues, "rayons irisés," which give them a singular appearance. The feet are small, and covered with long tufted hair, similar to those on the body, of the same colour as the wings; the tarsi are dark-brown, and so are the terminal hooks. The female has the antennæ narrowly pectinated, much less so than the male; the upper wings are larger than those of the male, the tip of the wing less falcate; the lower wings larger and broader, the better to bear the heavier body of the female: as to the markings they are mostly similar to those of the male, the colour is generally of a browner tint than in the male. The moth does not eat readily in captivity; in a state of nature it would imbibe the juices of flowers through its proboscis. Copulation generally is effected the first or second night after birth, after which the eggs are deposited and the round of life begins again.

I will now relate the history of my unsuccessful experiment in 1866 to rear this beautiful and valuable Lepidopteron, and afterwards mention a few other similar failures in other parts of England. I could have wished it had been in my power to have reported success even in a limited degree, but as yet I have heard of none.

March 19th, 1866. I received by post from Mons. Personnat, of Laval, France, a letter, outside which was fastened a pill-box, perforated with a few holes; within the box, which fortunately had not been crushed *in transitu*, were some *Yamamai* eggs; on examination 147 appeared to be sound and plump, covered with a rusty brown gum; one, which appeared plump (and which afterwards hatched out a larva), was of a straw-coloured white, it was not depressed in the centre, but simply devoid of gum; twenty other eggs were much depressed in the centre, and two were pierced; one egg was cracked, and contained on examination a fully-formed dead larva; three more were doubtful, being flattened, but in a less degree than the others: total 174. Their diameter was $\frac{1}{10}$ inch; thickness $\frac{1}{20}$ inch. The eggs, I remarked, much resembled those of *B. Pernyi*, another oak-feeder from North China, which had been sent to me in a former year by Mons. Guérin-Méneville. In his note, Mons. Personnat advised me to keep them in a cool airy place. On opening one of the eggs which were depressed in the centre, for the purpose of examination, a yellowish dry serum was contained within, caked; but there was no trace of a worm; these then evidently were non-fertile eggs. The interior aspect of the shell of the cracked egg, whence a dead larva was taken, was polished and of a pale flesh colour. I placed the 148 sound eggs in one pill-box and the doubtful eggs in another pill-box, having made holes for aëration with a penknife in both the lid and bottom of each box; these boxes were placed within a second larger tin box, which was used for collecting larvæ and which had perforated sides for aëration; a little tow was placed therein to steady the smaller boxes and the whole placed in a cellar, where by means of a thermometer the temperature was found to stand at 50° F.; on the 20th, not being satisfied with the temperature of the cellar, fearing that it was too high, I divided the sound eggs into two portions, one of eighty-eight, the other of sixty, and placed them in fresh pill-boxes as before and afterwards in two tin boxes, which were both similarly made; the smaller lot I placed in a porch having an eastern aspect, where it was completely shaded from the sun's rays, and where the thermometer stood at 46°; with this box was also placed the box containing the doubtful eggs, which, however, I may as well at this point mention never produced a larva; the other larger portion of sound eggs I placed in the N.E. corner of my garden, under a wall where the sun's rays could not penetrate. The same situations were occupied by the eggs up to the 27th, on which date I placed the second lot in the porch. I subjoin a list of the temperatures daily observed by me by means of a registering thermometer placed in the immediate vicinity of the tin boxes.

March	21.	Rainy, sleety	.. 40° F.
,,	22.	Minimum during night..	.. 34°
		at 9 a.m.	.. 38°
		at noon, and at 4 p.m.	.. 40°
,,	23.	Minimum during night..	.. 36°
		at 9 a.m.	.. 40°
		at 1 p.m. and 4 p.m.	.. 46°, 48°
,,	24.	Minimum during night..	.. 38°
		at 9 a.m.	.. 40°
		at noon	.. 48°
,,	25.	Minimum during night..	.. 45°
		at 9 a.m.	.. 48°
		at noon	.. 50°
,,	26.	Minimum during night ..	.. 40°
		at 9 a.m.	.. 48°
		at noon	.. 50°, 52°
,,	27.	Minimum during night..	.. 46°
		at 9 a.m.	.. 50°
		at noon	.. 54°

During the rise in temperature, it was found that the porch was cooler than under the north wall; therefore both tin boxes were moved to the porch.

March	28.	At 9 a.m.	.. 48°, 50° F.
		At noon	.. 54°, 58°
,,	29.	Minimum during night ..	.. 48°
		at 9 a.m.	.. 50°
		at midday	.. 56°
,,	30.	Minimum during night ..	.. 50°
		at midday	.. 52°
		at 5 p.m.	.. 56°
		under the north wall..	58°
,,	31.	Minimum during night ..	.. 50°
		at 9 a.m.	.. 50°
		at midday	.. 50°
April	1.	Minimum during night..	.. 46°
		at 9 a.m.	.. 50°
		at 1 p.m.	.. 48°

April 2.	Minimum during night	.. ..	44° F.
	at 9 a.m.	.. .. ..	46°
	at 1 p.m.	.. .. ..	48°

Lost one egg while making an examination.

April 3.	Minimum during night	.. ..	40°
	at 9 a.m.	.. .. ..	42°
	at 1 p.m.	. .. ..	44°
„ 4.	Minimum during night	.. ..	40°
	at 9 a.m.	.. .. ..	41°
	at 1 p.m.	.. .. ..	44°
„ 5.	Minimum during night	.. ..	40°
	at 9 a.m.	.. .. ..	44°
	at 1 p.m.	.. .. ..	46°
„ 6.	Minimum during night	.. ..	44°
	at 9 a.m.	.. .. ..	48°
	at 1 p.m.	.. .. ..	50°
„ 7.	Minimum during night	.. ..	40°
	at 9 a.m.	.. .. ..	42°
	at 1 p.m.	.. .. ..	46°
„ 8.	Minimum during night	.. ..	42°
	at 9 a.m.	.. .. ..	46°
	at 1 p.m.	.. .. ..	50°
„ 9.	Minimum during night	.. ..	42°
	at 9 a.m.	.. .. ..	46°
	at noon	.. .. ..	47°
„ 10.	Minimum during night	.. ..	42°
	at 9 a.m.	.. .. ..	45°
	at 1 p.m.	.. .. ..	50°
„ 11.	Minimum during night	.. ..	44°
	at 9 a.m.	.. .. ..	50°
	at 4 p.m.	.. .. ..	52°
„ 12.	Minimum during night	.. ..	48°
	at 9.30 a.m.	.. ..	54°
	at 1 p.m.	.. .. ..	54°
„ 13.	Minimum during night	.. ..	52°
	at 9.30 a.m.	.. ..	56°
	at 1 p.m.	.. .. ..	53°
„ 14.	Minimum during night	.. ..	47°
	at 9.30 a.m.	.. ..	52°
	at 1 p.m.	.. .. ..	57°

April 15.	Minimum during night ..	.. 46° F.
	at 9.30 a.m. ..	.. 54°
	at 1 p.m.	.. 57°
„ 16.	Minimum during night ..	.. 50°
	at 9 a.m.	.. 51°
	at 1 p.m.	.. 57°
„ 17.	Minimum during night ..	.. 54°
	at 9 a.m.	.. 57°
	at 1 p.m.	.. 58°
„ 18.	Minimum during night ..	.. 48°
	at 9 a.m.	.. 55°
	at 2 p.m.	.. 60°
„ 19.	Minimum during night ..	.. 50°
	at 9.30 a.m. ..	.. 54°
	at 2 p.m.	.. 58°
„ 20.	Minimum during night ..	.. 50°
	at 10 a.m.	.. 58°
	at 1 p.m.	.. 60°
„ 21.	Minimum during night ..	.. 50°
	at 9 a.m.	.. 56°
	at 2 p.m.	.. 60°
„ 22.	Minimum during night ..	.. 46°
	at 9 a.m.	.. 48°
	at 1 p.m.	.. 54°
„ 23.	Minimum during night ..	.. 45°
	at 10 a.m.	.. 50°
	at 1 p.m.	.. 52°
„ 24.	Minimum during night ..	.. 44°
	at 9 a.m.	.. 54°
	at 1 p.m.	.. 55°
„ 25.	Minimum during night ..	.. 42°
	at 9 a.m.	.. 56°
	at 1 p.m.	.. 58°
„ 26.	Minimum during night .	.. 42°
	at 9 a.m.	.. 56°

I have thought it desirable thus to note and record the daily temperatures, that the experience gained in this unsuccessful attempt may at least be a guide to future, and, we will hope, more successful experiments; and as the larva is ready in early spring to emerge almost before the oak sprays are developed, it becomes of the utmost importance to ascertain precisely at what elevation of temperature the young larva is tempted to make its exit, in order that a due supply of food may be at hand, either by forcing the trees and thus obtaining an earlier foliage than can be got out of doors, or else by so retarding the eggs in a cool atmosphere as to prevent the exit till such time as the oak leaves are ready: hence the extreme care in noting daily the temperatures. I had provided myself with young oak trees four to five feet high in pots, which had been placed in a greenhouse to force; on the 12th of April some of these had shoots six inches long, so that I was prepared for the advent of my *Yamamai* larva, and was looking forward with great eagerness to make their acquaintance. On the 15th April, I noted in my diary that the oak buds in the hedges were swelling; on the 18th, that the buds were breaking, so that a week later it seemed as if the time had arrived for the larvæ and the buds to come out together, according to the accounts of the habits of this insect. I had previously, on the 17th, received through the kindness of Mons. Guérin-Méneville, eighty-three more eggs of the *Yamamai*. Of these eighty-one were well rounded, two were concavely flattened—one to a great extent on both sides—the other had a central depression only on one side; both these eggs contained, on examination, dried yellow serum—there was no trace of a larva. Another egg, which was covered externally pretty thickly with long mycelia of a fungus, I took for examination; but on chipping off with a sharp knife a small portion of the shell, a movement within was visible of a living creature, and I therefore proceeded no further. These eggs sent me were plump oval ones, slightly flattened on two sides, about one-ninth of an inch diameter, one-sixteenth of an inch in thickness; the remaining eighty were placed in a pill-box, which was marked and deposited with the others in the tin box in the porch. I now inspected the eggs obtained from Mons. Personnat, which were in the two tin boxes; they seemed to be healthy; out of each lot I took two for examination; in each case one was unfertile, and the other contained a living larva: I now equalized the numbers, so that seventy-six eggs were in each pill-box, and replaced them. I placed the three eggs, which I had examined and ascertained to contain each a living larva, in a pill-box with a glass lid; and this pill-box I placed in the greenhouse, thinking it necessary, now that the shell was imperfect and could not so fully protect from cold, that the larva should obtain a warmer temperature. On the 25th I examined one of these eggs to see how matters progressed: I extracted the larva, which seemed torpid, motionless, and as if dead. I was about to stick a pin into it when I thought it moved —certainly the head was no longer in its former position. It was then placed in the sun, when it began to move briskly; it was placed by itself in a box with two drops of water; it however seemed to have received some damage, as it could not crawl, but lay on its side, prematurely born, and it subsequently died. On the 26th, finding the temperature elevated nearly to 60° during the day in the porch where the eggs were kept, and that the oaks in the lanes were now breaking, and that the young larvæ which I had examined in the shell were lively and vigorous, it seemed that the time had arrived for the natural birth of these creatures; knowing, however, that a little moisture would accelerate birth, and that the moisture incidental to the month of April had been sedulously withheld, and thinking that a pill-box enclosed inside another tin box would be an unfavourable situation for the birth of my little favourites, I determined that the hour was now come in which it was needful no longer to retard the eggs, but to place them under the most favourable conditions for hatching out. Doubtless they would have remained some time longer in the boxes without hatching, but I am inclined to think, from the result of various experiments made with eggs of *B. Cynthia* as well as with those of *Yamamai*, that to retard the development of eggs beyond a natural time, is to injure their vitality, and consequently to diminish the chance of rearing healthy progeny. Therefore, about 10 a.m., I removed the boxes into a room upstairs, used by me as a dressing-room, 13 feet square and 9 feet high, having an Eastern aspect, where the temperature stood at 61°. Having counted the eggs in the three healthy lots, I found 80 in the lot sent me by Mons. Guérin-Méneville, and 142 eggs sent me by Mons. Personnat divided into two lots of 71 each: these three lots were placed on separate pieces of bibulous paper, two or three pieces of paper under each lot, on a wooden tray; over each lot of eggs was placed a glass funnel, open at the small end; the eggs were not placed in the sunshine, but the window was open. It was a sunny day, with a gentle east wind; the bibulous paper was well moistened from outside the funnel, and, as a necessary consequence, the eggs became moistened also, and a moist atmosphere was kept up in the interior. At 3 p.m. I found one larva born—it moved slowly and seemed weakly; it was on the paper close to its empty egg-shell, which was removed to avoid confusion. An oak spray (from one of the trees in pots which had been forced) was passed through a hole cut in a wooden tray, so that one end remained in some water placed in a jam-pot beneath, upon which the tray rested; over the spray was placed a cylinder having sides of perforated zinc, but covered at the top with black gauze, put on to prevent loss of the larva by straying. The larva was now gently but firmly detached from the paper. It resisted at first, but soon yielded to the instrument used, a fine pointed stiff badger's-hair brush; it was then placed on an oak leaf of the spray, and a drop of water was deposited on the leaf close by; the larva was soon observed to apply its mouth thereto, and subsequent observation convinced me that this action was the mode of drinking.

April 27th. The minimum temperature 60°; at 9 a.m. 62°; at 11 a.m. 64°. During the night the larva rested at the edge of the leaf, which was found in the morning to be slightly nibbled. At 7 a.m. a second larva came out, and at 11 a.m. two more; all the four larvæ were born from Mons. Guérin-Méneville's eggs; about 11 a.m., one of Mons. Personnat's eggs produced a larva: they all seemed weakly, were placed on the oak spray in a similar way and were supplied with water; the temperature at noon was 66°, in shade out of doors it was 70°; it was therefore fortunate that I had brought the worms indoors and had placed them so that they could conveniently be watched; had they been out of doors they probably would have emerged in greater number, owing to the high temperature, 70°, and, not being so closely observed, many might have perished; the oak spray was twice watered with the jets from an eye douche, which made a capital syringe; several larvæ were observed to feed, but the one first born seemed to be drying up: temperature in greenhouse 75°.

For greater convenience I append a table of the numbers of the larvæ as they daily emerged. (Total 252. Mons. Guérin-Méneville 80 eggs. Mons. Personnat 142 + 3 opened + 27 unfertile.)

	Guérin-Méneville.	Daily Total.	Personnat.
April 26 ..	1 ..	1 ..	0
„ 27 ..	3 ..	4 ..	1
„ 28, cold day	0 ..	0 ..	0
„ 29 ..	0 ..	0 ..	0
„ 30 ..	0 ..	0 .	0
May 4 ..	1 ..	4 ..	3
„ 5 ..	5 ..	10 ..	5
„ 6 ..	3 ..	6 ..	3
	13	25	12

	Guérin-Méneville.	Daily Total.	Personnat.
Brought forward ..	13	25	12
May 7 ..	3 ..	7 ..	4
„ 8 ..	3 ..	9 ..	6
„ 9 ..	7 ..	17 ..	10
„ 10 ..	6 ..	13 ..	7
„ 11 ..	7 ..	14 ..	7
„ 12 ..	6 ..	9 ..	3
„ 13 ..	1 ..	5 ..	4
„ 14 ..	3 ..	9 ..	6
„ 15 ..	1 ..	6 ..	5
„ 16 ..	2 ..	4 ..	2
„ 17 ..	2 ..	3 ..	1
„ 18 ..	2 ..	6 ..	4
„ 19 ..	3 ..	5 ..	2
„ 20 ..	1 ..	7 ..	6
„ 21 ..	0 ..	2 ..	2
„ 22 ..	2 ..	6 ..	4
„ 23 ..	1 ..	1 ..	0
„ 24* ..	2 ..	4 ..	2
„ 25 ..	0 ..	0 ..	0
„ 26 ..	2 ..	3 ..	1
„ 29 ..	0 ..	1 ..	1
	67	156	89

Total, 156 larvæ born out of 252 eggs.

Continuing my history of these eggs, on the 28th April I observed that the eggs, which were in three separate lots, were looking mouldy. I examined them with a lens; fine white threads of mycelium were seen arising from various eggs and spreading over the others. I then determined to wash the eggs, with a view of arresting the growth of the fungus, which I considered inimical to animal life. I therefore washed lot No. 2 in pure water and No. 3 in a weak solution of liquor potassæ (10 drops to an ounce of water); in order to wash them I placed the eggs on a linen or muslin cloth, and, forming it into a bag, I dipped the bag into water and agitated it for some seconds. When the eggs were removed they were a little lighter in colour, some of the gum having been washed off; the water was not discoloured, but the solution of liq. potassæ was much discoloured, the gum having been much softened and removed, but the colour of the eggs soon

* On the 24th May, one emerged at 5 p.m.

became as dark as ever, owing to the large amount of gum with which they were encased; the eggs were then placed on bibulous paper to dry; from the moistened eggs a strong glue-like smell emanated, and the gum adhered so tenaciously as to be drawn out in strings before giving way. The third lot I managed to clean somewhat by gently rubbing off the mycelium between my finger and thumb, and by the help of a badger's-hair brush.

April 28th. Temperature 65° in the shade out of doors; a gentle shower fell. The larvæ had eaten and exuded a dry frass with some difficulty: the ejecta remaining at the anal extremity attached to the side flaps: the refraicheur (an instrument used for obtaining a jet of scent or other liquid in the form of a fine spray) was used five times at intervals; its effect was to saturate very speedily the leaf and insects with a very fine spray, resembling the effect of a Scotch mist; the larvæ seemed to enjoy its use: temperature at noon 64°, minimum during night 60°; during the use of the refraicheur one larva tumbled or was blown off, it was replaced and settled itself again on the leaf: the larvæ seemed somewhat shrunken, and had eaten very little. I took tender sprays of several varieties of oak and placed thereon the young larvæ and then used the refraicheur; the larvæ soon moved, and subsequently fed sparingly; two were discovered entangled in each other's embraces, and it certainly seemed as if one was sucking the other, but after patiently disengaging them, an event of some time, the one that I thought had been bitten seemed none the worse, and no wound was discovered; but I could have declared positively during the contretemps that one larva was making a meal of the other, and it caused me anxiously to consider how I could possibly rear them if cannibalism was a common trait: the refraicheur was used again after a few hours, all five larvæ were feeding sparingly. No young larvæ emerged to-day, temperature 60°—62°, a gentle rain falling; the oak buds in the garden were bursting, the leaves were 1 inch long.

April 29th. No larvæ out; minimum temperature during night 50°, window being open; rain falling. On examining the eggs which had been washed, No. 3, which had been treated with a solution of liq. potassæ, contained one egg which was covered with mould; this I rubbed off between my finger and thumb, denuding the egg of gum and leaving it a pale flesh colour. No. 2, treated with water, remained clean. No. 1 (containing Mons. Guérin-Méneville's eggs) were getting mouldy again. The larvæ had scarcely eaten, but had exuded dry frass; they were sleeping with their heads retracted and their front segments arched, the hump being the highest point; they seemed vigorous and well but very quiet, their movement being very slow and deliberate: I began therefore to feel relieved in my mind of the anxiety which I had felt on account of their having eaten so little, and to consider that this spare diet was perhaps natural to them, in consequence of the sparseness of foliage on the trees at the present time; temperature out of doors at 5 p.m. 48°, indoors upstairs 55°; in the fields and lanes the oak leaves are now 1 inch long.

April 30th. Minimum temperature during night upstairs 50°; weather cold, wind N.E. Sunshiny morning, at 8 a.m. temperature 75° in room, the eggs and thermometer being in the sunshine daily for about an hour from 8—9 a.m.; at 10 a.m. temperature 65°. I placed oak sprays gathered from the hedges, having leaves 1 inch long, in water for the larvæ, using the feeding apparatus before described; one larva was observed to feed, the other larvæ had eaten during the night; they were more lively in the sunshine.

May 1st. Minimum temperature during night 50, at 8 a.m. 52°; cold day, no sun, rainy, wind N.E.; no eggs hatched; larvæ fed in morning; frass ejected.

May 2nd. Mimimum temperature during night 50°, at 8 a.m. 52°; wind gentle, N.W., warmer, but weather dull and rainy: the larvæ had fed and were thriving, but the one larva which emerged from Mons. Personnat's eggs seemed to get smaller and ate very little; the frass was hard and remained attached to the anus, it was removed by means of a stiff badger's-hair brush; the refraicheur used freely.

May 3rd. Minimum temperature during night 50°, in sunshine at 8 a.m. 60°: the larvæ fed better, emitted more frass, and evidently grew larger. I placed the five young larvæ on an oak tree about four feet high in a pot which had been forced under glass: the upper buds were not all unfolded, and the leaves were not fully expanded: I considered it therefore to be in a state suitable to the young larvæ; they settled well upon it; the refraicheur was freely used.

May 4th. Wind gentle, warm, W., pleasant sunshiny morning; minimum temperature in night 50°, at 8 a.m. 75° in sunshine, in shade 62°, at 11 a.m. 55°.* The larvæ fed during the night, the refraicheur used freely: three larvæ emerged in the early morning, two from No. 3, which had been treated with liq. potassæ, and one from No. 1 (Mons. G. Méneville's); these larvæ seemed to be as large as or even larger than two of the five larvæ which had been

* These temperatures are those of the room in which the larvæ were feeding.

out several days; they were placed on the tree with the other five and the refraicheur used. At 1 p.m. temperature 54°, wind E.; one more larva emerged from lot 3, and it was also placed on the tree.

May 5th. This morning was sunshiny and warm; minimum temperature during night 52°, at 8 a.m. 70°, increasing up to 85° in sunshine, in shade 55°—60°. The larvæ have all settled and fed; at 8 a.m. three larvæ of No. 1 and four out of Nos. 2 and 3 emerged; at 9 a.m. two more of No. 1 and one other emerged; they were all placed on the tree. The two eggs which had previously been opened for examination (wherein a worm had been seen of a bright yellow colour but motionless), and which had been kept in a box in the greenhouse, this morning simultaneously gave birth to two lively larvæ.

May 6th. This morning the sunshine was excluded by a blind being down; minimum temperature during night 54°, at 8 a.m. 56°. I drew up the blind and let in the sunshine, the temperature on the tray rose to 75° and 80°, and at 9 a.m. had sunk in the shade to 65°; four larvæ emerged, two from No. 1, two from No. 3; about 7 p m. two more larvæ emerged; the refraicheur was freely used during the day: two larvæ dropped from the tree looking weak and thin, they were replaced. All my manipulations of these larvæ were made by means of a stiff pointed badger's-hair brush, which was inserted under the larva, and by means of a slight jerk and twist the little creature was elevated and dropped into his place. The larvæ do not cling so tightly with their claspers to a leaf as do the larvæ of *B. Cynthia*, which would perish and be torn limb from limb rather than be so roughly treated.

May 7th. A warm night, minimum temperature 58°, in sunshine at 8 a.m. 75°, in shade 62°; at 8 a.m. two from No. 1 and three others emerged, these were all placed on the same oak tree. Twenty-five larvæ were counted on the tree before those newly-born were added, so that up to this time none had perished.

May 8th. Minimum temperature during night 56°, at 8 a.m. in sunshine 70°, at 8·30 a.m. 80°; seven larvæ emerged by 9·30 a.m.; they were placed on an oak tree in the greenhouse by way of experiment, as I thought that the room upstairs was too cool; the oak tree was previously syringed by means of a hydropult; the young larvæ were observed to place their mouths to the water drops and imbibe fluid, at least the water diminished: it was observed that the thick integument about the anus, which was white on emerging from the egg, was changed in one hour to a velvety-black colour. On the oak tree upstairs two larvæ were found dead, dried up and shrivelled; and one other, with dried frass attached to the anus, was in a dying state. I was unable to find more than five empty egg-shells this morning, though seven larvæ were found crawling about the tray as if newly-born, and as the oak boughs overhung the eggs, it was possible that two larvæ had dropped from the bough; I searched several times diligently for the empty egg-shells, but they did not appear, so I was left in doubt: but every morning when I removed the young larvæ just hatched, I was careful also to remove the empty egg-shells, in order to prevent confusion in my numbers; and it was not always easy to find these empty shells, as they differed in appearance in no respect from the full ones, except in having an aperture, and if the aperture happened to be beneath, or if two egg-shells stuck together and the aperture was situate on the inner side, it was difficult to detect the empty one, and I had frequently to turn over each egg with my brush several times before finding the empty shells. Of these seven larvæ placed on an oak tree in the greenhouse, one was found twice on the floor, and the third time disappeared entirely; the remaining six, together with two others which had emerged during the day and were placed with them, were all right at night; they were well syringed with a hydropult, temperature 60°—75°; the larvæ evinced an inclination to climb to the highest twigs of the tree: upstairs the refraicheur was freely used; the habit of vagabondizing was apparently excited in the larvæ in the greenhouse by the greater exposure to the light and sun's rays, and by the greater heat.

May 9th. Minimum temperature upstairs 60°, in greenhouse 51°; no sunshine, dull morning. The eight larvæ in the greenhouse were counted, and found all right; they had fed. Upstairs twenty-eight were on the tree, two only had died since the beginning, one escaped in the greenhouse; thirty-six remained out of thirty-nine born. During the day those upstairs wandered about very much, and one more was missed in the greenhouse, seven only being found on the tree in the evening; at 3 p.m. the hydropult was used, and the house shut up for the night, by this means a warm steamy temperature was maintained. During the afternoon some ladies came to see my insect cabinets, which were in the same room with the larvæ upstairs. While exhibiting the drawers a strong odour of camphor was given out: possibly it was from this cause that many larvæ were in the evening found straying down away from the tree.

May 10th. Minimum temperature during night upstairs 54°; at 8 a.m. in sunshine 70°—80°; at midday 60°. I received by the morning post a box from the Society of Acclimatization of Great Britain containing five parcels of eggs of *Yamamai*, done up in paper, consisting respectively of 113, 99, 102, 101, 98, besides 22 eggs that were loose, in all 535. The box was packed with paper shavings: on examination of these eggs 102 were much depressed in the centre, and had the appearance of unfertile eggs; but the remaining 433 seemed sound. These eggs were placed, along with the other eggs, on bibulous paper well moistened under a glass funnel, but kept in a separate lot.* About 3 p.m. two larvæ emerged from these eggs, fine healthy-looking larvæ, and were placed on a little seedling oak in the greenhouse, after the hydropulting had been done. During the morning a larva just emerged was placed on a young Ailanthus tree, now fairly in leaf, growing in a pot placed in the room upstairs; this was done to see if that food would nourish the larvæ. It was observed that, after emerging, the larvæ would drink freely; some larvæ upstairs were noticed to be drying up, though the tree was freely syringed.

May 11th. Minimum temperature during night upstairs 57°, a dull rainy morning, no sunshine; eleven larvæ emerged; of these one was born about 10 p.m. the preceding night. No eggs hatched out of lot No. 4, which contained the eggs sent to me by the Society of Acclimatization; the syringe was used freely; the larvæ seemed to have recovered from their dry state, but they are great vagabonds. My method of syringing was now altered. I placed the flower-pot in a round shallow japanned bath, and used an eye-douche to syringe with; by directing the nozzle upwards a shower of quasi rain drops was directed to fall successively upon all parts of the tree. The fluid was propelled by means of pressure made by the hand on an India-rubber bottle; on removing the hand the consequent expansion of the sides of the bottle sucked in a fresh supply of water through a tube at the bottom, and fresh pressure produced another shower. This apparatus was very convenient for the purpose. The superfluous fluid was after-

* It was noticed of these eggs that many had little pieces of cardboard or paper attached to them, as if they had been originally deposited on cards. The glass funnel was placed over the eggs partly to maintain a more moist and equable temperature, partly to prevent the young larvæ from straying, and partly because the smooth surface of the glass offered no firm foot-hold for the young larvæ, which were therefore easily detached and removed to the oak leaves.

wards collected out of the bath by means of a sponge, lest the larvæ, falling down in their wanderings (which constantly happened), should be drowned. The eleven larvæ born to-day were placed on freshly gathered oak boughs; the cut ends of them being plunged through a wooden tray into water contained in a jam-pot beneath; over the oak sprays were placed either glass or zinc cylinders, open at one end and covered at the other with gauze. In the water I invariably dropped a small quantity of brown sugar and a few drops of liquor potassæ; this mode having been recommended to me formerly by Dr. Knaggs as tending, in his experience, to keep the sprays fresher, and render the food sweeter to the larvæ. The larva on the Ailanthus tree had not eaten, but had wandered; this was repeated for several days; and finding that he would not take to the new food, I transferred him to white-thorn to make trial of that provender. In the greenhouse the larvæ had eaten well, and seemed to have got on faster than those upstairs. Of the two larvæ from lot No. 4, placed on a seedling-oak in greenhouse, one had eaten and the other not; the last seemed weak and ailing, did not move, and would not cling to the leaf; the oakling was therefore taken upstairs, placed in the bath and watered freely. The larvæ on the tree in the greenhouse now wander less, eat freely, and grow rapidly. During the day one larva was observed to have frass in his jaws, which he seemed to be trying to get rid of by working it up and down against the side of the leaf; after several attempts he was successful. I came to the conclusion, which was afterwards verified by observation, that he had picked it from the anus with his jaws, having found a difficulty in getting rid of it in the usual way. On another occasion I observed the curled bristles at the side of the head made use of to detach dried frass which was attached to the anus.

May 12th. Minimum temperature during the night 56°; at 9 a.m. 57°, no sunshine, rain falling; syringed the leaves well; the larvæ growing; the seven larvæ in the greenhouse doing well; removed the excreta of several from the anus; still some tendency observed to wander. Two other larvæ, which came out to-day, were placed on white-thorn; the others that emerged were placed on oak sprays, gathered from the hedges. One larva was found to-day injured with a wound in its left side.

May 13th. Cold, dry, no sunshine; five larvæ emerged, they seemed small and sluggish, and one lay curled up a long time on the leaf, as if still inside the egg. Minimum temperature during night 54°, during day 52°, but it afterwards got up to 60°.

The food was changed to-day, and water changed also. In doing so the fresh food was first arranged on a new tray with clean water, and well syringed, and the stale oak sprigs taken out one by one and examined; where any larva was seen it was cut off, leaf and all, or part of the leaf if it was large, and then placed on the fresh leaves; the larvæ soon wandered off the stale pieces, which were then thrown away. A pair of fine-pointed scissars and forceps were used for this purpose; and great care had to be taken, lest, in using these implements, any damage was done to the larvæ. Several larvæ now made up for their first moult, by spinning a little web along the mid-rib of the leaf, and fixing thereto their hind claspers; at this time their colour was dull and glassy. To-day the small larvæ are very torpid; the larvæ on white-thorn have not eaten or passed any frass; the douche was used several times to-day; the oak tree in the pot begins to be much eaten, and the leaves are now crisp and less succulent; the larvæ in the greenhouse are doing well; temperature during night there 50°, during day 60°—70°.

May 14th. Minimum temperature upstairs 54°, dull morning, no sunshine, no wind, cold, at 9 a.m. 54°; one empty shell found among Lot No. 3, without a larva to account for it; the larvæ hatched yesterday are dull, listless and curled up; the larger ones are feeding well. In the greenhouse the larvæ are more active than those upstairs. Took a fresh oak tree upstairs and placed it in the pot, and put thereon several larvæ, placed others in the greenhouse, and three weakly ones on seedlings; washed in water the eggs of Lot No. 4, which were very mouldy.

May 15th. Dull morning, N.W. wind; minimum temperature during night 50°, at 9 a.m. 54°, very cold day; larvæ torpid, three weakly ones on oakling seemed lifeless, and were removed. Seven eggs of Lot No. 4 were removed as being unfertile.

May 16th. Minimum temperature during night 50°, at 9 a.m. 54°, N.E. wind, cold and dull, but little sunshine; soaked some eggs of No. 4 in water to get rid of the fungus; sent fifty eggs of No. 4 to Mr. Gascoyne, of Newark, by mid-day post, in a quill. Three larvæ in the greenhouse seemed dead; another larva, looking very torpid, was removed from upstairs to the greenhouse, and I removed three others towards evening; the temperature of the greenhouse is colder by night, viz. 45°, but in the day is warmer, viz. 60°—70° than the room upstairs; several larvæ upstairs look shrivelled, discoloured and are torpid.

May 17th. Minimum temperature during night 52° upstairs, at 9 a.m. 55°, in sunshine 70°, a fine bright day. The first larva moulted this morning; he was placed along with others on a tree in the greenhouse, after hydropulting;* changed the oak sprays upstairs. It now seemed to me that some of my larvæ in the greenhouse were gone, and in consequence I watched more closely, and soon found a larva attacked by a spider, which I killed in the act; the larva was wrapped up in a shroud of silken thread, which I could not detach; it seemed paralyzed and torpid. On further examination it was found to have been bitten near the head; it remained torpid, discoloured, and evidently dying for twenty-four hours, when it was put into spirit. It was now quite clear how my larvæ in the greenhouse had gone. The larvæ on white-thorn had not fed, and were therefore transferred to oak. The leaves of the tree upstairs, and which had been first fed upon, were dry, hard and crisp, and the edges which had been nibbled were black and studded with a thin film of mould; some of the larvæ thereon seemed shrunken and discoloured, but the larvæ in the greenhouse were thriving. There were therefore difficulties both upstairs and in the greenhouse to overcome, and I removed one of the two oak trees and two trays of oak sprays into the greenhouse, the temperature during the night of the 17th—18th being 47° in the greenhouse, at 9 a.m. 65°; upstairs, minimum temperature during night 54°, in shade 58°, in sunshine 80°; at 8 a.m. several larvæ were found shrivelled on the oak trees, evidently from the food being too dry, and containing no suitable nourishment.

May 18th. The temperature in the greenhouse to-day being high, many of the larvæ were found wandering away from the food, to get into the shade as it were. I removed therefore the two trays upstairs, and the larvæ soon settled down again on the leaves to feed; the larvæ which had moulted for the first time fed during the night. I took a fresh oak tree upstairs and brought back several larvæ from the greenhouse, where the thermometer stood at 65°—70°. I examined five eggs of No. 4 lot, by cutting a bit of the shell out with a sharp knife. No. 1 contained a larva, dead; No. 2, an aggregation of molecular granules, yellow and soft, but no form of a larva; No. 3, a yellow molecular mass more organized than No. 2, having a curled-up form, with a central depression; No. 4, a transparent solid yellow serum with a white patch; these four eggs were very mouldy outside; No. 5 was not mouldy, but had a plump, healthy look; it contained a larva inside, well developed, but devoid of movement, dead. Of these five

* The larvæ bear a sharp stream of water directed on them with impunity; they naturally cling tight, and, being on the under surface of the leaf, are protected from the violence of the shower.

therefore three were unfertile eggs, and the other two contained larvæ which had perished, a bad look out for the rest of the eggs of that lot, very few of which, only five eventually, hatched out; Mr. Gascoyne, of Newark, to whom I sent fifty eggs, writes: "I carefully removed the shells from a couple of the larvæ with a view to ascertain if vitality existed. I found the young perfectly developed and full grown, filling the shell, but both were quite dead. I have given them several hours tender nursing in a genial atmosphere, but without effect; I expect that they have been retarded too long by cold, and I know from experience that if experiments of this kind are carried too far, the result is death. I have little hope for the eggs from the appearances, but will give them every chance under various influences, and will report progress." The same gentleman subsequently wrote: "I divided the ova into three batches: one I placed in an atmosphere of from 65° to 70°; the other two in still higher temperatures; there are not yet (May 30th) signs of vitality in any one of them. I yesterday opened another and found the young larva plump, moist, and I could fancy somewhat larger than before; I could not perceive any signs of life; none of these eggs produced a living larva." I gave fifty more eggs to another Entomologist residing near me, in the hope that he might be successful, but he also failed to obtain a living larva. A similar report was sent to me by Mr. Waterhouse Hawkins: "out of the many thousand eggs received this season, through the liberality of the Imperial Society of Paris, and distributed to several members, we have not reared a single specimen."

The history of these eggs, I believe, is as follows: They formed part of a present sent over by the Tycoon of Japan to the Emperor of the French, and were placed at the disposal of the Imperial Society of Acclimatization, who kindly forwarded a portion to the corresponding Society of Great Britain; these were at first intended to be forwarded by ship to Australia with salmon ova, but reached this country too late for that purpose. As in the preceding spring some eggs of the *Yamamai* had hatched out prematurely, it occurred to Mr. Bush of the Acclimatization Society, who had undertaken their charge, "to retard the eggs in 1866 by sealing them up and keeping them in a cool place;" indeed I believe they were placed in ice; and to this unfortunate retardation I attribute the loss of vitality in those ova which possessed fully-formed worms. Certainly as the result was unhappily the same in every case, the damage was done before the distribution of the ova, otherwise some persons at least might have been fortunate enough to rear the larva. But another cause clearly impaired the chance of success, viz. the large proportion of unfertile eggs, as manifested by the large proportion of those which contained no trace of larvæ, which indeed ought to be fully formed one month after the egg is laid. Hence I think it is clear that the eggs were in the first instance an unhealthy lot; and secondly that their passage to England, and subsequent retardation in too cool a place, had taken away the remaining vitality. By recording this unfortunate result I may warn others from a similarly unhappy treatment of the eggs of this valuable race.

May 19th. A warmer night; minimum temperature upstairs 54°, in greenhouse 49°; at 9 a.m. 65° upstairs, in sun 90°, in shade 60°. In the greenhouse three were dead; I was certain that many larvæ in the greenhouse were missing, either having wandered or been eaten by spiders; those on the sprays were doing well, but rather restless.

May 20th. Minimum temperature in the greenhouse 53°, upstairs 58°; at 8 a.m. 62°; at 10 a.m. 70° in shade, in sunshine 97°; very warm morning, the sprays getting stale, and the larvæ wandering. I occasionally found empty eggs and no larvæ under the funnel, so that it is probable that the young larvæ hatched during the night and crept out of the top of the funnel, and wandered over the table; changed the sprays to-day; two more deaths; the leaves of the oak trees in pots very dry.

May 21st. Kept my blind down this morning; temperature upstairs about 60°; only two larvæ emerged; one larva was sucked in the greenhouse during the night by a spider; four have now moulted for the first time. Placed the sprays under bell glasses to keep the food moist, but these were removed the next day as not permitting sufficient ventilation; one egg of No. 4 hatched out a small shrunken weakly larva, which was placed in an air-tight glass bottle with some dry food; this, however, had withered by the next morning, when the larva was placed on a seedling oak having tender leaves; the larvæ were now brought in from the greenhouse by degrees, and removed upstairs for two reasons; one, that it was too hot for them by day, the other that it was found impossible to kill off all the spiders in the greenhouse, so as to prevent their destroying the larvæ.

May 22nd. Minimum temperature during night in the greenhouse 53°, upstairs 57°; at 8 a.m. 62°; at 9 a.m. 65° in shade, in sunshine 100°. Nine have now moulted for the first time; the food flagged much this morning; took away the last larva from the greenhouse; changed the sprays, syringed them well.

May 23rd. Temperature much the same as 22nd. One larva emerged; washed the eggs in water, as they seemed again covered with mould. Two of the lot No. 4 sank, the rest floated—opened these two and found therein a little yellow serum, no trace of a worm.

May 24th. Minimum temperature 60°, dull morning; three larvæ out vigorous. The larvæ which were under glass cylinders seemed less healthy than those under zinc cylinders, being of a dirty brown yellow hue, whereas the others were of a brighter tint. This was probably due to a less perfect ventilation. One larva of No. 3 was born at 5 p.m.

May 25th. Colder, minimum temperature upstairs 55°; at 8 a.m. 60°; changed sprays. The *Quercus pedunculata* is now in full leaf; *Q. sessiliflora* is a fortnight later in coming out, and is now scarcely in full leaf; the Turkey oak and moss-cup oak and *Q. dentata* are also now just coming into leaf. Leaves of all these varieties were given to the larvæ, and they seemed to thrive indiscriminately on all; but the *Q. dentata* seems to have a crisp, less tender leaf, and is therefore better adapted for the larvæ later on. On the first tray there are nineteen larvæ which have now moulted for the first time: on the second tray thirty-three larvæ commencing their first moult; on the third tray seventeen larvæ about a fortnight old; on the fourth tray twenty-two about one week old; on the fifth tray five babies and four invalids; six more are left on an oak tree in pot, passing through their first moult: total, 106 out of 161 in all born; therefore fifty-five are missing since birth.*

May 26th and 27th. Temperature about 60°; one larva, having just moulted, turned torpid and of a pale colour, seemed shrunken, the spines on the back no longer standing out stiff, but depressed; it subsequently died.

May 28th. Changed food; 105 larvæ in the four trays.

May 29th. One larva out, the last that hatched; temperature about 60°.

May 31st. Changed food on trays, and counted larvæ; 106 doing well; temperature 58°--60°.

* It is always convenient, in rearing larvæ in quantity, to keep the lots as nearly as possible of the same age, so that they all moult together. This is carried to perfection in rearing the mulberry silkworms in France and Italy: there the brood is hatched out in a day, the moults are passed to a day, and the cocoons are all spun to a day, and the moths again emerge to a day.

June 1st. One larva moulted for the second time. I had to help this larva and also another, which was moulting for the first time, by shifting the old skin off the last two or three segments by means of a fine-pointed pair of forceps. This operation becomes necessary when the hind claspers have lost their grip of the silken threads attached to the leaf, and there is no longer any back-hold by means of which the larva can crawl out of his own skin. He is able, by means of alternate extensions and contractions of the segments of the body, to slip off the skin up to the hinder segments; but to get those parts free of the skin the feet require to be attached to the leaf, and he then crawls out, leaving the skin behind. It is often necessary, in rearing larvæ, to help them when by any accident their hind feet have lost their grip; and it is effected very easily by laying hold of the old skin by a pair of pointed forceps, and slipping it over the anus. This must be done carefully, so as not to injure the tender claspers, and patience is needed to watch the moment when the larva elevates his hind feet. In withdrawing the skin, care must then also be taken to withdraw the lining membrane not only of the last pair of spiracles, but also of the intestinal tube. I have in this way frequently operated with success both on *Ailanthus* and the *Yamamai* larvæ, holding them gently between the forefinger and thumb of the left hand. But the skin of the *Yamamai* is much thinner and more easily ruptured than that of *B. Cynthia*;* and whereas I have often, in half-grown and large larvæ of *Cynthia*, removed successfully the old skin, slipping it over the whole body, yet such a proceeding is quite impossible with the *Yamamai*, on account of the thinness of the membrane. And further, I have observed this difference, that the *Cynthia* larva fixes itself more tightly to the leaf, and if accidentally detached, is quite unable to lay hold again, chiefly because the silken threads, being separated from the leaf, are entangled in the hind claspers; whereas, in the *Yamamai*, I have seen the larva refix his grasp on the leaf successfully almost up to the moment of change, so that fortunately there is less fear of losing them from the accident by which so many larvæ of *Cynthia* are lost, viz. by their losing their hold while moulting.

June 2nd. Many moulting; one dead; temperature rising 60°—70°.

June 5th. Ten have moulted for the second time; counted ninety-five alive.

* If a hole is once made in the skin, it is certain death; a green fluid exudes freely, the larva shrinks and soon dies.

June 9th. Ninety are now alive; changed food; examined the eggs which had not emerged. Lot No. 1, the eggs contained fully formed larvæ in various stages of decomposition, a few eggs contained dried serum; No. 2, contained dried-up worms undergoing decomposition; No. 3, contained worms either dried up or decomposing, brown, soft, shapeless; No. 4, the most mouldy ones contained generally dried-up serum, or else larvæ highly decomposed; the other eggs contained larvæ shrunken but formed, soft, and decomposing; several eggs, which had cracks or holes made by the larvæ in their shells, were examined and found to contain larvæ brown and drying up; one was mouldy.

On the 13th June, eighty-three larvæ were counted. At every change of food I was sorry to find that some larvæ were dead, and I am by no means sure that some were not nipped by their comrades. I noticed this day that one larva, after moulting for the third time, seemed flabby, inert, torpid, and soft as if dying. This larva was also very wet, either from water which had fallen upon it during syringing, which was done daily, or from having fallen into a little pool of water. The larva was removed, the water dried up, and a free circulation of air encouraged. After an hour or two the skin began to dry, the muscles acquired firmness, and the larva subsequently recovered entirely.

June 19th, there were only seventy-three larvæ.

June 23rd. Seventy. I then noted that the larvæ were not looking well, but had a muddy look. The temperature now was much higher—about 70° during the day.

June 26th. Found three or four larvæ dead, and many others showing black dusky specks over their bodies, just beneath their skin; colour pale, the transparency changed to an opacity; they seemed weaker; the temperature was now very high, 70° at night, 75° during day, 90° in sunshine. I recognized the formidable malady described by French authors,* which had frustrated the hope of success so many times in different regions, the first symptoms being an opacity of colour, and a number of minute dusky specks. In accordance with the advice given by French writers, who attribute this disease partly to insufficient ventilation and partly to rearing the larvæ on boughs kept fresh by means of inserting their ends in water, I determined, first, to wash them

* This, according to Mons. Guérin-Méneville, is analogous to the disease among the mulberry worms called "des flats," or "vaches."—Revue de Sériciculture, 1864, p. 197.

with water, which was effected by placing each larva, while clinging to the oak spray, in a bason of water, and leaving him there for one minute; and, secondly, to place them out of doors on some young oak trees in the garden. This was done by pinning the sprays to the oak boughs. After doing this I watered them very freely by means of a watering-pot, twice during the day.

June 27th. They were watered again twice; temperature 70° during night, 75°—80° by day; several larvæ were on the ground, having dropped from weakness; others were hanging prone, motionless, and flaccid, suspended only by their hind claspers. The minute dusky specks had increased into spots, and even blotches, which were most numerous in the folds of the segments, leaving the middle part of the segment swollen, and of a lighter but dirty yellow-green colour; the spots increased to irregular blotches, and in some cases the body burst open, emitting a dirty opaque putrilage; in one larva which burst open a whitish patch appeared, as if of mould.

June 28th. A very heavy rainfall, with thunder; two or three larvæ were dead, but they were not so black as those which had died before; some that were on the trees seemed more lively and vigorous; they had eaten the leaves, and their colour was less dusky, but the spots had not disappeared, though they seemed fainter.

June 29th. About six dead; the temperature again warm and sultry; the watering by the water-pot was still kept up; the survivors look blotchy, only two or three looking at all healthy; in some diarrhœa was observed, in others the skin burst open even before the blotches appear; some of the leaves were eaten.

June 30th. Two more dead; all the survivors were spotted; a heavy shower of rain fell.

July 2nd. The last two days were showery; only six larvæ were alive, but two of these looked healthy.

July 8th. Only one larva remaining, but a few dusky specks were visible.

July 11th. The larva was alive, but spotted all over.

July 12th. Dead; one or two larvæ seemed to have been much worried by the little black ants, but these larvæ were much diseased, and exuding a sanious fluid; and it seemed to me, since the other larvæ were not attacked, that the ants had been attracted by the fluids exuding from the bodies of the larvæ.

I will now recount the experience of a lady in Devonshire who obtained a batch of about 100 eggs. "My oaks became covered with a black blight, and the worms which I put in the garden died. I lost the first hatched (only thirty-three) on the plants in pots. I found with you that the leaves are not succulent enough; and I think the only oaks that will answer are the scrub sort in the hedges, which continually put forth fresh leaves, and on these leaves I kept all I could preserve in bottles;* still they died, though I sprinkled the leaves with water. They showed a determination to commit suicide by getting into the water. About thirty eggs did not hatch, though apparently good."

A similar disease attacked Lady Nevill's brood in 1865, and destroyed her hopes of success; and on the continent the same disease has checked the cultivation in many places. I have this year observed the same disease attack individuals of the *B. Cynthia*, which had suffered from the continued cold and wet; but in these worms the skin seems to be tougher and does not rupture easily, though covered with blotches; the worms will remain clinging to the leaves for a fortnight or more, though they eat but little, and remain motionless; but they are blotched in a similar manner, and get soft after a time; they generally die from diarrhœa, but some spin their cocoons. Their constitution evidently resists the disease much more powerfully than does the *Yamamai*.

I will conclude my English experiences with an extract from the Report for 1866 of the Acclimatization Society of Great Britain, p. 20. "Last year (1865) the Society received a limited supply of the eggs of the *Bombyx Yamamai* from France; these were in part distributed to various members of the Society, and the residue were retained by Mr. Bush, at Clapham, where a large number were hatched, but they invariably died after the second casting of the skin; the number was thus reduced to about forty, which grew to the size of $2\frac{1}{2}$ inches, having fed readily and by preference on the common British oak. When they had attained that size they appeared to be attacked by some disease which caused a sudden discharge of the fluids in the body, and the consequent withering and death of this very beautiful caterpillar. They were of a brilliant green, with small silvery spots on the sides. The whole of the number which had reached that size died in this manner, not leaving one to attain the power of spinning; but with our honorary member at Guernsey, to whom a portion of the eggs had been consigned, the experiment was carried further towards a successful issue, as described in the following brief report by the Rev. W. T. Collins, who so indefatigably conducted the experi-

* The cut ends of the oak sprays were put into bottles of water to preserve them fresh.

ments to the end; he says, 'From the eggs supplied us by Dr. Hoskins about sixty worms were hatched in April last; we tried them with every kind of leaf, common or exotic, we could think of; at least 100 sorts were refused by the worms, who to our despair would only feed upon each other. This species of cannibalism, however, disappeared after the first change of skin. They then began to eat the young leaves of the Turkey oak, and during their last stages condescended to feed upon the leaf of the common English oak. Only seventeen worms ultimately remained to us; they were very large and handsome caterpillars of a lovely green colour, with spots of a bright silver arranged in rows along either side. These creatures were much more active than the common silkworms, walking rapidly, highly irritable when touched, and if disturbed while spinning, as was sometimes necessary, in order to place them more securely, they would cease to spin for hours. The silk produced is exceedingly fine, of a pretty light green colour similar to that of the worms, but so easily broken as to be difficult to wind off. Seventeen moths were developed from the seventeen cocoons, but they did not deposit any eggs.' This year (1866) the Society were so fortunate as to receive from the Imperial Society of Acclimatization in France many thousands of the eggs of this interesting silkworm, *Bombyx Yamamai*, which, being received long before there was any possibility of obtaining food for them, were kept from every degree of warmth which might induce their hatching out prematurely. Early in April, Mr. Wilson, one of our vice-presidents, kindly transferred to us a large parcel containing many thousand eggs of the silkworm, which was intended by the Imperial Society of France for presentation to the Acclimatization Society of Melbourne, but arriving too late for the vessel, which was stocked with ice for conveying them to Melbourne, Mr. Wilson considered that the next best thing he could do was to present them to the Society. By the assistance of one of our members, H.J.B. Hancock, Esq., we have obtained 100 oaklings, now in full leaf, upon which the eggs are laid in a warm and sheltered situation with an endeavour to maintain an equal temperature. We are not able to report with any degree of confidence the results." At a later date than the report, I learned that no ova were hatched out.

Tedious and minute as may be thought the account of my unsuccessful experiment to rear and acclimatize these most valuable silkworms, I believe that its chief value lies in the minutiæ recorded. We have to deal with a valuable but highly delicate insect, greatly prized by the Japanese, so much so indeed that they have evinced the utmost unwillingness to allow it to leave their country. We know but little of its habits, and the efforts to rear and acclimatize this valuable race are of necessity a number of experiments, of which some fortunately have been successful, but the majority were the reverse. It is only by narrating the minutiæ of treatment, by carefully noting the temperatures, the atmospheres to which the insects are exposed from the egg to the perfect state—by comparison of their food plants and the various modes of feeding them, that we shall be placed in the best condition eventually to attain success. There can be no doubt in the first instance that the treatment of the ova during the long period of winter, and especially in the spring months, is of the highest importance. It must be that the nearer we approach to the natural condition of the insect in its wild state, the greater our chance of success; and the heated temperature and want of aëration which the eggs must undergo during their two months' voyage to Europe from Japan must materially impair their vitality. Next it is evidently of the greatest importance to be provided with young oak buds and leaves just bursting at a time when the larvæ hatch out. For this a double precaution is necessary; 1st, to force young oak trees in pots under glass, some to a greater and some to a less degree, so that foliage may be ready for the young worms; 2ndly, to keep the eggs in a well aërated cool place, at a temperature not if possible exceeding 50°, till the oak trees are breaking out of doors. As this is the natural period for the exit from the egg, it would seem to be the proper time to place the ova in a warmer but moist atmosphere for hatching out, imitating in fact the natural temperature out of doors. It is stated by French writers that the eggs should not be exposed to frost during winter, but I cannot concur in this statement until it is proved by actual experiment, since I am informed that the climate of Japan resembles that of this country, and that severe frosts occur there, and to these during the winter the egg would in a wild state be subjected. Again, covered as it is with a stout shell and a thick coating of gum, it by no means follows that frost would penetrate to the larva inside; while, lastly, larvæ have been frozen again and again with impunity. In the treatment of the larvæ great stress is laid by French experimenters on maintaining them if possible on the living tree exposed to free aëration; they maintain that the skin of the larva is very porous, and that it is necessary to its well being to inhale a large supply of air; and further that when the oak sprays are placed in water, and too great a proportion of water is drawn up into the leaves, the alimentation of the insect is carried on in an insufficient manner, so that the digestive functions are impaired, and in consequence of the blood being impoverished, a change takes place in the fluids favourable to the development of fungoid disease, and the result is an epidemic accompanied by great mortality. The results of my experiments, and of my experiences of a similar if not the same malady among the *Cynthia* larvæ, seem to lead me to the following general conclusions: that it is necessary to supply the very young larvæ with young succulent leaves—that they will bear a moderate amount of cold for brief periods with impunity—that they avoid the direct sunshine, but like its warmth diffused through the natural leafy shade—that moisture is grateful to them at all times and is necessary for their existence—that a quick growth is most favorable. I have found that the *Cynthia* larvæ when retarded in their changes by cold and wet weather, as has been the case this last summer, are more liable to this and other epidemics. Dry hot weather is prejudicial to the larvæ: for that reason I should think they are likely to do best on large oak bushes planted sufficiently close to allow of shade among the interlacing boughs. Similarly the larvæ of *Notodonta trepida* rejoice in the cool shade of the north aspect of dense forest trees. For that reason the climate of Ireland would probably prove highly favourable to the cultivation of this species. Lastly, I am convinced that they would thrive better out of doors on the trees than in confinement. The nearer we could approximate their life to the natural wild state, the more we should repair their constitution weakened by a long journey, and by a faulty system of education.

I will now relate some of the experiences of French experimenters. In the Revue de Séricicultur for 1863, p. 352, &c., is an account of the complete success of the first trial of Mons. Personnat at Privas, Ardèche: he had received a gramme of eggs from the Society of Acclimatization, part of those brought over by Mons. Pompe van Meedervoort; there were fifty fertile eggs, the rest were dried up; he had provided himself with young oaks in pots, but the birth of the worms coincided with the appearance of the leaves in his neighbourhood. The eggs were placed in a paper tray amongst the young leaves, so that the newly-born larvæ might at once crawl on their food without being touched; they began to appear on the 11th April and continued to do so up to the 28th; out of forty-five worms so hatched he obtained forty-four cocoons, one was lost by accident; he tested the wandering powers of the newly-born larvæ by making them walk the distance of a metre (nearly 40 inches) before reaching their food, and ascertained that they could do this with impunity, and that in their very young state they can remain some little time without food. The larvæ were fed on sprays, placed in vases of water, from young oaks of the species *Q. pedunculata* and also *Q. pubescens*, but the pubescence of the latter renders it less suitable. In the fourth stage they were sprinkled with water daily in the morning, and in hot weather twice daily. The first cocoons were begun on June 25th, seventy-four days after the birth of the first worm; the cocoons were all finished eighteen days afterwards, forty-two very fine, one small, and one imperfect, the worm having been twice disturbed while spinning; the moth which emerged from this one was a very fine one, and Mons. Personnat was enabled to observe in the cocoon the successive changes: that into pupa took place on the 19th day after spinning; two days afterwards the pupa turned dark-brown; the receptable for the dissolving fluid situate on the fore part of the head was large and light-coloured, and contained evidently a large quantity of fluid.

By retarding the first formed cocoons, and hastening the last made by placing them in a warm situation, he diminished the difference of eighteen days in the time of spinning their cocoons down to ten; the latter came out thirty-eight to forty days after commencing their cocoons, the former in from forty-four to forty-seven days; the first were males. In two days he had six males and two females. The cocoons were placed in a case having canvass sides, forty inches by twenty, and about twenty-four inches high, which was sprinkled daily with water to keep up freshness and a slight moisture. The second morning Mons. Personnat ran to see the *Yamamai;* there was no trace of coition; the males had battered their wings; the females, resting against the canvass, seemed to have been untouched. He immediately made arrangements to spend the night in the room, but saw nothing except the birth of three males and two females; the next night he went at midnight, but on his entrance the light caused such a commotion in the box that he found all the moths were at the bottom frightened. The next night at 1 a.m., having arranged the light outside, so that only a few rays could penetrate, he witnessed two fresh pairs in coition; he retired carefully: the next morning there was no trace of what had happened. This very short period of coition seemed strange; nevertheless, it was proved to be a fact by subsequent experience. In one couple which were watched it lasted from 11 o'clock to a ¼ past 1; the eggs of this pair were kept separate and proved to be quite fertile. The males were more numerous at the commencement, the females towards the close of the period of emergence from the cocoon. A great many fully fertile eggs were obtained.

In page 115 of the Revue de Séricículture of 1864 is an account by Mons. Bonnard, of Marseilles, of his experience, in a letter to Mons. Guérin-Méneville :—" I received a box of eggs (160) from you the 20th February; the eggs were at once placed in a room with a north aspect, but notwithstanding my precautions, on the 22nd a worm hatched out to my surprise and despair. I had then, alas, no oak trees sufficiently advanced. This worm died, though I gave him leaves of the evergreen oak. On the 24th another, on the 26th four more, on the 28th thirteen, on the 29th eleven, and others came out successively up to the 8th March. All except the last few died of hunger. I had, moreover, 175 eggs laid by a female *Yamamai* the preceding year; none of them had yet emerged and I hoped they would not hatch till the leaves were ready; but on the 4th March they began, and continued to emerge till the 15th. In the meantime the Zoological Society of Acclimatization sent me on the 11th a gramme of eggs; some had hatched when they arrived, others hatched the next morning, &c., but two-thirds of the eggs were dried up. During the first few days of March, my wife and I offered leaves of various kinds to the young worms; they ate willingly the Neapolitan medlar, as also the hawthorn, but refused the quince. Hence I hoped to preserve the stock. During the first moult many died, and on the 26th I had but 80 out of about 300 hatched out. I travelled with these to the Basses Alpes; on the 3rd April I arrived at Marseilles. There, oaks forced under glass supplied them with natural food till the 7th, on which day, in a warm spot, I found a young oak breaking into leaf. During the night the worms were in a room, during the day they were constantly out of doors in the shade. About the 12th, though they had been watered daily twice or thrice, a kind of epidemic (gattine) appeared. I thought this was the result rather of my keeping them indoors at night than of the change in their diet; whatever the cause, the feet became black, then the whole body, and nothing seemed to stay the malady. On the 15th but forty worms more or less stricken remained. *I then took each worm, dipped him in water for several seconds, replaced him in fresh well-watered foliage, and left the worm out all night long. After two or three dippings all trace of disease disappeared;* and I have now thirty-four magnificent caterpillars in robust health, nearly ready to spin their cocoons; the leaves are changed twice a week; they are watered twice or thrice daily, and are constantly out of doors. I am confident that the evening dew is beneficial to them, and that these cocoons might be cultivated in a little oak plantation, taking care to keep away birds, and water them artificially. Next year I propose, in order to keep my eggs better, to place them in a room where the temperature never falls below freezing point, and take them about the beginning of February to an uninhabited apartment among the oak trees."

M. Oscar Zlik, of Teschen in Silesia,* writes, having received fifty eggs from Mons. Guérin-Méneville, "The young worms began to hatch out the 11th April, but I had no oak leaves for them. In vain did I try to retard them; only the last three, which were born the 27th April and the 2nd and 3rd May, could I save; they eat the leaves of *Quercus pedunculata* and *sessiliflora*: the first stage lasted 8--10 days; the second, 7—8 days; the third, 7 days; the fourth, 10—12 days; the fifth, 17—18 days; in all, from 52—54 days. The first worm, born 27th April, began to spin June 19; the second, born 2nd May, on June 22; the third, born 3rd May, on June 26."

Mons. Frerot, of Aussonce, writes,† "Out of 133 eggs received fifty were dried, out of the remaining eighty-three but sixty-two hatched; eleven worms died soon after birth, another was accidentally drowned; twenty-five are now, while I write, spinning, and in a few days I hope other twenty-five will spin; each worm spins regularly fifty days after hatching; from twenty-five cocoons kept by me, ten males and twelve females emerged, three did not emerge. I only got six fertile pairs, and about 1,500 good eggs. Coition, to my surprise, lasts a very short time; I had to visit my moths at various times in the night to satisfy myself as to the point. I have placed the eggs in bottles, well corked and sealed, in a cellar; when the temperature of the room is lower than in the cellar, I shall withdraw them, and replace them in the cellar in spring. It was thus that I treated the eggs which I received last February. Out of each batch of new eggs I took five or six and exposed them to such a temperature as would ensure incubation; on opening these I found in each a worm fully formed."

The first experiments, therefore, in France, though on the whole

* Revue de Séricicultnre, 1863, p. 325.

† Ib. p. 326.

more successful than in this country, were precarious and uncertain, and gave great anxiety lest the new race should fail in being successfully acclimatized.

Dr. Chavannes, of Lausanne, who has devoted much time and attention to the rearing of silkworms, and who has successfully cultivated the *Yamamai*, is strongly of opinion that it is necessary to rear them out of doors on the living foliage; he writes, Revue de Séricicultire, 1864, page 85, "This method of rearing the larvæ," (on boughs placed in water,) "may seriously compromise the safety of the race. I have had experience in rearing three wild races of silkworms in Brazil and Europe, &c. The first generation so reared may do well, the second does badly, and the third not at all; all the worms perish. I would, in order to preserve them from danger as much as possible, rear the young worms during their first stage in a room on sprays dipped in water, but afterwards on the trees themselves, at the side of a wood, on boughs covered with gauze nets; protected by these nets there is nothing to fear from birds or insects, and by placing at the foot of each tree sawdust impregnated with coal-tar, the ants, their worst enemies, are kept away; for the same reason the branch which bears the gauze net should be wrapped round with cotton wool, dipped in coal tar. As to the sun, I am not afraid of it, if the larva has the shade of a few leaves." His resumé of 1864 is as follows:*—"Out of 900 eggs of *Yamamai*, 640 hatched out, from the 21st April to the 26th. In their two first stages the worms were fed on boughs dipped in water, afterwards on the living trees, protected by metallic or gauze cages. Some worms remained on the boughs till the third stage; 200 worms died the first few days without eating; twenty-six died during their growth, viz., six at their full size; three had been fed on oak boughs dipped in water up to their third stage, and they died of the disease improperly called 'pebrine;' twelve were drowned in the water which had accumulated in the lower part of the gauze bags during their change; four or five were crushed during the changing of the gauze bags; three or four remained little and spun no cocoons. In all I had 414 cocoons. The most important consideration is the preservation of the eggs. What temperature is best? My eggs were kept from September to December 20th, between 48°—55°, F.; after that till March 10th, during fifty-three days, the temperature was 44°—46°; for seven

* Revue de Sériciculture, 1864, p. 324.

days, 41°—44°; for ten days, 46°—49°; during the month of March and to the 15th April, 46°—49°; afterwards to the 21st, 41°—50°, F. I think these temperatures too high, and intend to keep them this winter as near as possible 39°—41°; for on the 21st April I had a premature birth in my cellar at 50°, and I have noticed, as Mr. Hardy did, that worms born at that temperature die soon after birth. To that low temperature, at the moment of hatching, I attribute the loss of the 200 worms. The eggs ought to remain, after being removed from the cellar, for five or six days at a temperature of 55°—60° before hatching, the better to avoid the mortality; the eggs should be moistened two or three days before hatching, by being placed on blotting or bibulous paper moistened. I have shown that to feed them on boughs dipped in water is injurious, for the worms thus nourished up to the fourth stage perished at the end of the fifth. I propose another year to place the young worms at once, or immediately after the first moult, on the young oak trees. The caterpillar seems able to support a very low temperature, for this year has been unusually cold and wet; during June we had several mornings as low as 39°. The time occupied in the several stages has been as follows:—First stage, 11 days; second, 10 days; third, 7 days; fourth, 12 days; fifth, 18 days; in all 58 days. Of sixteen ♀ exposed in the woods, where I set at liberty two ♂ for every ♀, all laid fertile eggs. Out of fifty-four pairs placed separately in gauze cages, in two-thirds of them coition was successfully performed. In a large cage, where many were at liberty together, about half the eggs were sound. I have observed coition to take place about 9 o'clock p.m., between two recently-emerged moths. Thrice have I observed coition repeated a second time by the males. If the sides of the cage are of metal and not of canvass or gauze, the feet of the males are injured by the second night. About 110—112 eggs weigh a gramme."*

I will now translate parts of a very interesting document published recently in the Bulletins of the Imperial Society of Acclimatization. It is a Japanese manual on the culture of the *Yamamai*, translated into Dutch by Dr. Hoffman, and again translated into French by Mons. F. Bleckman, the interpreter of the French

* According to Mons. Guérin-Méneville's experiences in 1862, with the eggs that first came over from Japan, 140 weigh about a gramme, and the average weight of 100 eggs is 0·70 grammes. Vide Revue de Séricículture, 1863, p. 34.

embassy at Japan.* In passing through so many translations, doubtless in some respects the meaning of the passages is slightly altered; but the main features are in general sufficiently easy of comprehension.

"Trees used by the Japanese in rearing the *Yamamai*, generally called '*Yama-Mayn-nomusi*,' or the Worm of the Wild Cocoon.

1. *Sira-kasi*, the White Oak (*Quercus Sirokasi*, Siebold), called in Japanese *Men-siyo;* French, *Le Chêne farineux*.

2. *Kunu-gi on Fotsi-maki* (*Quercus dentata*, Thunberg), called in Japanese *Reki*. Worms fed on these two trees produce cocoons which have a great deal of silk.

3. *Kasi-va*. Japanese, *Kok* (*Quercus serrata*, Thunberg).

4. *Mitsu-nava*. Cocoons produced from these trees are soft (moelleux), strong, and of a superior thread.

5. *Nava-no-ki* (*Quercus serrata*, Thunberg).

As these trees vegetate earliest, and have the most tender leaves, they are the best suited to the young worms up to their third stage. Other trees in certain parts are used to feed these silkworms. In cultivating the cocoons, the oak trees are planted in rows along the farms and on the borders of the ploughed fields, and, in addition to their principal labours, the farmers derive considerable gain from this secondary cultivation, since the silk is very strong and valuable.

There are three modes of rearing the worm; 1, on oak boughs in buckets (baquets), *oke-kai-date;* 2, on oak boughs stuck in the ground, *doma-kai-date;* 3, on trees in the open air, *no-kai-date*. The first mode is used in every case for the young brood till after their third moult; after that the second and third modes are applicable. In the first mode shade but not cold is desirable, in the other two the sun is welcome; the north-west wind is very injurious to the young worms, and it is necessary to protect them from it. (In our country equivalent probably to the east wind.) If the wind blow softly from the south-east† it is favourable to disease, which disappears when the wind returns to the north-west. It is necessary to guard against wind, but in the open air culture the wind is no longer injurious, as the worms are sheltered by the leafy shades. The preservation of eggs is of the utmost importance; the increasing demand of the last two years has introduced into commerce eggs of all kinds; the inexperienced often buy eggs which hatch out badly, or if they hatch out, the worms die at the first or second

* Vide Revue de Sériciculture, 1864, p. 289.

† Doubtless a hot, dry wind.

moult. To distinguish good eggs from bad: as to colour, the light grey are the best, dark grey medium, white are worst.* It is desirable always to open a few if there is any doubt; after thirty days are past a little worm of a clear blue (?)† is found therein; the quality of the lot may be estimated by opening one or two hundred eggs. If this opening be done by means of a sharp razor, or point of a needle, the young worms may escape injury. Some eggs that are offered for sale are well rounded, with a convex surface and shining; these are painted. The best eggs are well-rounded, light grey, and in proportion to their weight contain a more healthy worm, which will move vigorously, even in cold weather, on the palm of the hand, is of a clear blue (? yellow) or light colour, and a si-yoo, a Japanese measure of 385 grammes,‡ gives 101,000 worms. Inferior eggs are not quite round, a little depressed in the centre; the worm on emerging is small, and though it moves is weak. If they emerge too soon they call them waste (kego-kobne) and throw them away. One meets also with eggs rounded and at first sight of the best quality; but on opening them, the little worms are weak and of a red tint; these have fermented soon after they were formed. Other eggs are well rounded, and very shiny, seeming to be of the best quality, but they contain no worm. These are forged eggs (fabriqués.)

About the 22nd April, or a little later, according to the local temperature, the place set apart for the nurture of these worms is examined, in order to destroy ants and other vermin which are injurious. Rush mats are now set up around, and in the middle is placed a wooden frame (estrade) six feet wide, and as long or longer according to the extent required. Beneath are placed the buckets or troughs (oke), fitted with a cover pierced with a number of holes; at the bottom of the trough is fitted a pipe with stopper to allow the water to be drained off from time to time. The troughs are arranged three feet apart from centre to centre; over the frame are stretched (musiro) mats, generally 2 feet 8 inches in width, 5 feet 5 inches long, 5 inches thick, and also (itodate) others, which are mats of the finest straw, 2 feet 7 inches wide and 8 feet long. Within are placed the eggs, which are carefully examined every morning. As soon as the young worms are born, they place fresh

* Contrary to our European experience.

† Always yellow in Europe.

‡ $13\frac{3}{10}$ oz.

water in the first trough; two openings are now made in each mat, immediately over the holes of the trough cover. Several branches of oak are now passed into it, and to one of them is attached the tray of eggs, containing generally $3\frac{1}{2}$ centilitres; any kind of lacquered wood may serve for the tray of eggs, but the bottom must be finely pierced with holes, to allow the rain to escape. When the worms are born, they climb up from the tray on to the branches; when there are about 500 on the foliage, branches are placed in another trough, and the tray of eggs attached; and in this way the worms are apportioned out to the different troughs. Care must be taken to plug well the holes of the troughs, lest the worms get to the water. When the worms have been three days on a branch it is taken away with the worms, and placed on the mat to prevent contact with the earth or sand. A fresh branch is now placed in contact with the old one, from 9 a.m. to 3 p.m.; 6 hours is given to the worms to leave the stale and go to the fresh food; those that remain after that are cut off with scissars and suspended on the fresh leaves, taking care to spread them out and to give them as much room as possible. As they are very small up to the first change, great care is requisite; in the first stage they are called *kengo*, or little hairy ones. Three people are required to fifteen troughs; but the same care afterwards suffices for 300 troughs. The water requires to be renewed every other day. Never touch the worm with the finger; even its own little hairs, which are lost during the first moult, may kill the worm, if they come in contact. As the worms grow, the number of troughs required increases. At first 500 are allowed to a trough, but after the last moult only fifty to each. Ten days after birth the worm ceases eating, and rests for three days for its first moult; as in the common silkworm, this happens four times, and after sixty days, more or less according to temperature, they commence their cocoons. If heavy rains happen before the end of the second moult it is advantageous to suspend mats over them; but after that no covering is needed, however much it rains. A little rain is of benefit. In dry weather it is good to water them three times from 11 a.m. to 1 p.m. with a watering-pot having a fine rose so as to refresh the branches. In the open air a hollow bamboo, having little holes, is used instead. The enclosure and covering of mats is intended to keep away birds, wasps, and other injurious insects; but they are from time to time removed to allow of ventilation. After the third moult it is well to take away the mats by day, till 7 p.m.; but if it rains they are not removed at all. It is a good sign when the worms ascend and rest with their heads downwards; but if they descend, it shows they are ill.* After the fourth moult the mats are taken away, though they have not yet done growing. The enclosure is always kept well ventilated, for the *Yamamai*, a wild denizen of the forests, will not endure an impure close atmosphere. It is for this reason that *no-kai-date*, culture in the open air, is adopted in suitable climates during the last stage; and if a tempest approach, the inclosure must be well shut up to keep off the wind, which would cover with dust and sand the worms and cocoons. The enclosure may be conveniently placed under lofty trees where there is shade and yet free circulation of air. The following are suitable trees: *Celtis Willdenowliana*, *Prunus pseudo-cerasus*, Lindl. These are injurious: *Juglans nigra*, Linnæus, *Xanthoxylon piperitum*, D. C., *Pinus densiflora*, *Cryptomeria Japonica*, &c. Eight days after the fourth moult the cocoon is begun. If while spinning other larvæ approach to eat the leaves, they must be cut away with scissars, and put in a separate trough, leaving the cocoon undisturbed.

The second mode: after the third stage, trenches 1 foot wide and 18 inches deep are made, which are filled with rice chaff—balle de riz; water is then thrown in, and above all is stretched a mat; through this are thrust branches of oak to the bottom of the trench, and the worms are placed on them, by attaching thereto the stale branches with the worms on them. The water in the trench ought daily to be renewed, that the foliage may keep fresh a long time. When changing the branches, the stale one is pulled up and placed on a mat stretched on the ground, that neither sand nor dust may touch the worms, and a new branch is set up in its place. The manipulation is similar to that before mentioned with the troughs. The worms in domesticity, as in their wild state, cannot be too much protected from sand and dust; if they swallow it in the food they become ill and perish. It is for this reason that the branches are placed on a mat, and the dirty boughs are always cleaned in fresh water to fit them for the trough. The enclosure is no longer covered in with mats; the boughs keep fresh by reason of the rains, which commence about May 5th.

The third mode is carried on in the fields and forests. Wherever this method is practised it commences after the third stage. The site chosen should be in the plain and not on a hill, should be cleared a year before of all herbage, shrubs and trees which may

* This does not tally with our experience.

be unsuited as food to the worms. The trees are cut down to a height of 8 feet, in order easily to reach the branches, where are the worms and cocoons: when the spot is situated near houses, care must be taken to guard against the kitchen-chimney smoke. It is said that the smell of musk is prejudicial, and that the worms are alarmed by the sound of horns, drums and bells. After attaching to the trees branches with the worms thereon, these readily and quickly move on to the living boughs. Observe well the following precautions to keep the worms alive in a state of natural vigour. To guard against ants, smear the trunk of the tree at the collar with a decoction of Tokoroten, in Chinese, Chi hoatsai (a kind of sea-weed, from which they make, in Japan, a jelly, which, when dry, is an article of commerce, under the name of Kanten, and passes in China, and also at Paris, for the edible nests of birds); then the ants disappear. Against wasps it is necessary to guard from the first day that the worms are at liberty.* It is necessary, also, to guard against the ravages of birds. For a tree of 16 feet high and a diameter of 10 feet, according to the foliage, one would reckon 50 larvæ.† One person alone would suffice to watch, but it should be very early in the morning, since the birds are also early. As soon as the cocoons are made they should be guarded against mice, foxes and crows; it is well to cut the boughs from time to time, and to hang them on slender cords, and do so without injuring the worms. This mode, in the open air, is a delightful occupation, and there is nothing to fear from the temperature, as in the two preceding methods. If the worms remain on the branches or shrubs, the moths would deposit their eggs there, and the caterpillars be produced the next year. Such is the natural reproduction. In the west of Japan, in the island Kiousiou, and in the interior of Nippon, there are many places where the *Yamamai* is to be found in a wild state in the forests, and many a place where women and children occupy themselves in collecting cocoons in the woods and hills, a source of wealth to many families. This worm does no damage to the trees of the forest or plain. It is nourished, it is true, on the spring foliage; but since it makes its cocoon during the first twenty days of the fifth month, and the trees put out their second shoots in the sixth month, these can very well recover themselves.

Management of the cocoons and moths. Five days after the worms are in cocoon, the branches to which they are attached

* In Europe the wasps do not occur in quantity so early in the summer.

† Too small a crop.

are suspended on slender cords. After ten or eleven days* the cocoons are gathered and placed in flat baskets made for this very purpose, and are kept in a special room apart from all smoke. The moths emerge regularly twenty-five† days after the formation of the cocoons, but the time varies somewhat. Sometimes they do not emerge till the 1st September, and sometimes later still. Some people hang mats above the baskets, but more frequently they place the baskets before a screen, on which the moths repose after emergence. Often they come out before seven a.m.,‡ so that at that time the moths ought to be collected in the baskets destined for their coition. These baskets, Teô kajo, are bell-shaped, 1 foot 7 inches high, and 15 inches wide, and have a lid to shut down. In each basket 100 moths are placed, half females, and half males. The sexes are distinguished by the antennæ. The lid is placed on and the basket hung up: four days afterwards the lid is lifted off, the males fly away, the females remain and deposit their eggs at the side of the basket, which is closed again: then the baskets are placed in the shade and watered thrice daily with a fine shower; at the end of ten days all the moths are dead. The eggs are removed by means of a fine scraper of bamboo, and are spread out thinly in open baskets, which are hung up in a fresh, airy spot. If the eggs were then kept in closed baskets, or in sacks, they would ferment, and no produce would result the following year. It is not till after the autumnal equinox that the eggs are placed in hempen bags, or in little flat baskets, and are then hung up for fear of mice. The eggs are kept on the northern side of the building, shaded from the sun. There is nothing to fear from snow or rain, which, indeed, are beneficial, since they cause the death of the weakly worms. The healthy ones are able to resist the cold and wet, and next year produce a vigorous brood. In hot countries the eggs are placed in card-board drawers, in which they are spread out to a thickness of 5 *boun*, 3 centimetres, about 1 inch. Each drawer is 1 foot by 15 inches, and is closed by a fine copper grating. During the frost it is well to expose the drawer to the air one or two nights.

When the eggs are kept in baskets, these should be only one-third full. In hot countries the eggs are placed where the air is

* Fifteen to eighteen days, according to French experience.

† Forty days in France.

‡ This should be 7 p.m. There is some mistake here, probably of the translators, unless it means that the moths emerge during the night, and are not observed till morning.

freshest, either at the foot of a mountain or in a subterraneous spot, to protect them especially from the temperature of spring.

The hatching of the eggs is also retarded by covering them with wadding: in order to hatch them out they are exposed to the air. Although there exists in Japan a great difference of temperature between one part of the country and another, the difference in the time of the bursting into leaf of the trees and plants is not more than ten or twelve days. The best time for the hatching out of the young brood is the 22nd April for the following parts: Mikawa, Suruga, Idsu, Kai, Mino, Owari, and to the south of the mountains, or in Sanyôdô, Harima, Mimasaka, Bizen, Bitsiou, Bingo, Aki, Suwô, and Nagato. The 2nd of May is the most convenient for the countries of Kôdske, Musasi, Awa (at the south-west of the bay of Yeddo), Kadsusa and Simodskè; and the 12th of May for the parts above Sinano, north-westward up to Dewa and Moutsou. In all these, and also in the more northern parts, the eggs hibernate best in the open air, exposed in some way to snow and rain.

The mode of suffocation of the pupæ. The cocoons are exposed to steam in order to kill the pupæ before winding. They are placed in the *seiroo*, or steam chest, intermingling with them fresh leaves chopped fine of the tree on which the caterpillar has fed: when the water boils the steam chest is adjusted, and a vapour bath given to the cocoons, which are afterwards exposed in a flat basket in the shade to the action of the air: the cocoons dry and crackle, two days afterwards they are exposed to the sun on paper or on network. If they are not carefully strained and dried, the silk is of a bad colour and inferior value.

On the winding of the cocoons. There are three qualities of cocoons; the best are treated as follows: the cocoons are placed in fresh water for twenty minutes, the threads that have loose ends are lifted either singly or in loops, and the cocoons to which they belong are placed in another bason with fresh water, and the threads are attached to a rod placed above the bason. After selecting a hundred of these threads and cocoons, sufficient water is placed in the boiler, and when it boils, these threads are collected and wound in the ordinary way. If the cocoons have been reared in a room, six or seven threads should be wound together. Cocoons of the second quality are washed in a lye before being wound off; they are placed in a basket and then soaked in a basin of lye (lessive) until they are sufficiently soft; the lye is prepared from the ashes of the fresh straw of the *sarrasin*, buckwheat; the ash is placed in a basket and boiling water poured on it falling into a basin below. It is called *soba-aku*, or lye of buckwheat. The cocoons of the third or worst quality are plunged before reeling into a bath with *ki-aku*, or potass, which is obtained by burning branches and leaves in their green state: this ash is mixed in a basket with an equal quantity of buckwheat ash, and boiling water poured on it. When the lye has been soiled by the cocoons placed therein to soften, it must be renewed. The lye might also be used to boil the cocoons in before reeling. In boiling the cocoons, old or fresh, it is important not to soften them too much or too little. In like manner a lye may be prepared with the ash of the *nezasa*, a small kind of bamboo, or from green straw, but the one named above is considered the best. When the silk is intended to be dyed, the cocoons are soaked for some minutes before reeling in a lye made according to the receipt above mentioned. If the buckwheat lye is too strong the silken thread will be, it is true, white, but weak, having lost its green colour. The *soba-aku*, or buckwheat lye, is good for silk intended to be dyed purple or brown, but not for other colours. In proportion as the silk is the less soaked to discharge the green colour it will bear the dye best.*

The pierced cocoons are soaked three days in lye made from straw; afterwards they are wrung out in a bath of cold water until the green colour disappears, but it ought nevertheless to reappear afterwards. In order to make a stiffening for the weaver (ori nori), they take for 175 grammes by weight of silk a decoction of 75 centilitres of starch (wheat), mixed with a little of the starch made from the seeds (*warabi*) of varech d'aigle, *Pteris aquilina*, and a *mai* (1·6 foot square, measure of Japan) of (funori) seaweed, *Fucus cartilagineus*. Silk treated with this decoction, and afterwards placed in a bath of fresh water to take away the stiffening, has a very beautiful lustre."

It is perfectly clear from this account that the culture of this wild race of Japan is reduced to a regular system at the beginning, having three variations as to its termination, and that no difficulty is experienced in the cultivation, is evidenced by the great quantity of this silk exported from Japan.† It is quite evident

* Mons. Guérin-Méneville states, in the Revue de Sériciculture, 1863, p. 67, that a Hamburgh merchant had recently received seventeen bales of the cocoons of the *Yamamai*, weighing about 680 kilogrammes.

† Mons. Guérin-Méneville states, Revue de Sériciculture, 1863, p. 34, that he has seen in London whole bales of the *Yamamai* silk, from Japan, of a quality nearly equal to the best silks of Italy and France.

that, though the details of the culture are not sufficiently clear, probably from faults of translation through three languages, and also from the desire evinced by the Japanese to mislead all inquiry and so protract the period during which they monopolize this valuable race, yet that a similar method might be employed in our own climate, varied somewhat to meet the exigencies of different localities and temperatures. One great climatic difference exists between ourselves and Japan, viz., the rainy season which is spoken of in the Manual as commencing on the 5th of May. I have been informed by those who have resided in Japan, that about that time it rains regularly and without intermission heavily for several weeks; this coincides with the account given "that during the rains the boughs keep quite fresh." It would therefore seem that at least rainy seasons are favourable to the *Yamamai* larvæ, and this point is the only one which seems to me to throw any doubt on the probable success of the cultivation of the worm in Europe. Ireland would, therefore, seem to be a country specially favourable; for the same reason the north-west coast of England and Scotland, as perhaps also the south-west coast, would be specially favourable; whereas the eastern counties are probably the worst. It certainly from the Japanese Manual seems that a very simple and easy method of cultivation is required to rear this worm, and thereby produce a silk of great value and lustre, equalling the very best mulberry silk. It would therefore in this case doubtless pay well to enclose oak trees kept not higher than 12 or 18 feet, with a canvass protection, and therein rear in open air these valuable worms. It would seem, too, from the dates mentioned, viz., from the 22nd April to the 12th May, that the spring of the year must be as cold in those regions as in England, and colder than in France, since according to experience in the latter country, it would be difficult to retain the eggs for hatching to so late a period, owing to the temperature rising up to 60° or 70°, F.; whereas in my experiments the eggs were easily kept to the 26th April without hatching, at which time the young leaves were bursting in the lanes.

It would therefore seem, that a cold and wet temperature is favourable to this worm, whereas a dry warm atmosphere is best suited to the *Ailanthus* moth. This is in some degree advantageous to the prospects of sericiculture in Great Britain and elsewhere, as conferring equal if not greater advantages on those parts of the country which may be thought unlikely, from the habitual cold and damp, to suit Ailanthiculture; in these it would seem that the culture of the *Yamamai* might be favourably carried on.

There is this great consideration in favour of the culture of the *Yamamai* over the *B. Cynthia*, that the latter feeds on a plant which is comparatively unknown in Great Britain, having been introduced little more than 100 years into Europe; there are therefore no plantations of this tree ready made to hand, as is the case with the oak tree, and a knowledge of its cultivation has to be spread and taught, as well as of the insect that feeds upon it. But in the case of an oak-feeder, we have many acres planted with oak trees and many million separate trees in our lanes and hedges, as also in our parks and gardens. It is therefore within the power of every one to experiment upon and become acquainted with the beauties and habits of this valuable insect. The cocoons, moreover, are much more easily wound than those of the *B. Cynthia*, as they require only to be placed in boiling water to unwind easily, as is the case with the ordinary silkworm, *B. Mori*. I anticipate, therefore, a great eagerness on the part of the British public, when they know a little more about it, to make acquaintance with the *Bombyx Yamamai*, and that I may render their experiments less difficult, I will translate some of the cautions and hints given by Mons. Personnat in his valuable work on the *Yamamai*,* supplementing them also with observations of my own.

During the egg stage.† To avoid fermentation, spread out the eggs in a thin layer not more than ¼ inch deep; and move them gently every ten days, in order to renew the layer of air around each egg. Autumnal heat does not expedite their coming out. In the autumn of 1863 my eggs were exposed to a temperature of 80°—86° without damage. On the other hand, his excellency the Marshal Vaillant exposed eggs during the winter, outside a north window, to all the inclemencies of the season, without detriment. Sometimes the eggs adhere, and when the adherent portion happens to be that which the young worm nibbles away to make his exit, he is still unable to get out owing to the opposition of the other shell, and he perishes; hence it is as well to separate gently every egg, by first moistening them and gently rolling

* Le Ver à Soie du Chêne, *Bombyx Yama-Mai*, par Camille Personnat.

† At Trieste Mons. Raimondo Tominz recommends (vide Revue de Séri-ciculture, 1864, p. 224) to keep the eggs during winter in a dry temperature not exceeding 40°. Mons. Personnat recommends a temperature of 32°—50°, Revue de Séricieulture, 1865, p. 65.

them on a polished surface. The experiences of successive years tend to show that though eggs sent over from Japan may hatch out early in the spring, yet that eggs of the race acclimatized in France evince a disposition to wait till the natural bursting into leaf of the tree; the oak trees require twenty days forcing in pots to put out their leaves, the 15th of March is a convenient time to begin forcing. When the time arrives for hatching out the eggs,* *i. e.*, when the first buds on the trees abroad begin to break, for two or three days together a few worms will emerge in early morning; the rest should then be removed by degrees into a warmer temperature, about 60°, leaving them for two or three days in an intermediate temperature, in order to avoid a too rapid change. It is desirable to place the eggs in a little saucer or box lid on the tree or on a fresh bough with the ends dipped in water, so fastened that the young worms on emerging may at once crawl up on to the leaves, as in a state of nature. This process, where there are many eggs, requires some modification. His excellency Marshal Vaillant placed branches in little bundles, having their ends surrounded with moist sponge; this was covered with paper and wrapped round with string: this mode enabled him to place the boughs in their natural horizontal position, resting on the eggs, so receiving the worms naturally. Or, instead of sponge, the oak sprays might, when cut, be thrust into a potato, which, by its moisture, would suffice to keep them fresh; too many larvæ must not be placed on one tree, as it is not easy to remove them without damaging them. It is better therefore to hang a number of little saucers of cardboard or box lids, each containing the requisite number of eggs, over the trees, than to put all the eggs in one saucer. If kept in a room it will be found that the worms make for the light in their wanderings. Every day the eggs must be moistened, to soften the shell and give an easier exit to the larvæ; this may be done by throwing drops of water over them, and moving them about, or by placing them on bibulous paper (which may be obtained at any chemists) and moistening the paper. All saucers or receptacles for eggs should have holes pierced at the bottom to allow the escape of the surplus water, the water retained by the gum covering the shell helps to soften it. It is of the

* Mons. Guérin-Méneville gives the first week in May as a convenient time. Revue de Séricicultnre, 1863, p. 37. He there says that the eggs should first be placed at the entrance to a dry cellar, in a temperature not lower than 35°—40°, not higher than 45°—50°; in a week they may be placed in a warmer temperature, say 50°—60°, and later on the temperature may be gradually raised to 75°.

greatest importance to furnish a supply of fresh air to the eggs and larvæ, both by night and by day, except when the temperature goes down below 54°. The first days of the young worms' existence require many precautions, and a large mortality often occurs from a neglect of these. One of the great causes of infant mortality is to be attributed to the shortness of the oak sprays given to the worms; these are generally cut at first from four to eight inches long, and the cut end, being placed in water, sucks up the liquid, which, arriving too quickly in the leaves, is devoured by the worms in a crude and injurious state, and produces disease by an unhealthy chemical change. Hence the sprays, if short, should be changed every twelve hours, but when cut the length of twelve inches or more, they may be changed every twenty-four hours, but not at a greater interval. A little charcoal in the water is useful to prevent decomposition. Care must be taken as to the bottle or vase which contains the water; if the neck is shallow, evaporation rapidly taking place, the level quickly falls, and the ends of the oak sprays are above the fluid. Hence the neck should be short and wide; it must also be carefully plugged with paper to prevent the worms creeping down and being drowned. To change their food, prepare first a fresh sample in a fresh vase of water, and then taking branch by branch, cut off all the stale leaves or parts of leaves that contain a worm and let them fall on the fresh leaves. It is sometimes better to cut off first the leaves and sprays that do not contain any worm, and having carefully examined them to see that no worm is there, to throw them aside and then cut up the leaves that hold the worms, or place the spray garnished with worms on the fresh food; when they are little the worms often get in a fold or curl of the leaf and are then difficult to see. In this way no worms are touched. The fresh sprays might also be placed alongside of the stale ones; turning the former towards the light, the worms will soon leave the stale for the fresh. As the worms in a state of nature feed most during the night, it is desirable to change the food towards evening, but it should be done by daylight, since by candle light the operation becomes very difficult. It is of importance always to see that sufficient foliage is provided, especially at night, otherwise the worms will stray away in search of fresh food; worms fresh from Japan evince a greater desire for wandering than those acclimatized in France, *i. e.*, whose parents were bred in France. Also if the food be not sufficiently fresh or be otherwise injurious, they will wander away; they always, as before noticed, stray towards the light and fresh air, and this circumstance I have also noted in the larvæ of the *Bombyx Cynthia*, when I have kept them in large numbers in a room. In order not to lose any worm, there should be no carpet or mat on the floor of the room wherein the worms are kept, and a table should be used without a cover, whereon to place the bottles or trays; paper of a smooth character, as newspaper, may be placed under the trays and water bottles; in fact everything should be smooth and present no asperity for the feet to cling to too firmly; this is especially desirable where they stray much, since if they get on to a cloth they cannot be removed without serious injury.* They must also be watched closely when very young, to replace those that have strayed. In order to remove those that have fallen, a stiff badger's-hair brush may be used, or a piece of stiff paper may be slid under the larva dexterously, to which he will often cling, and may so be raised; this is rendered easier by smoothness of surface. If he slide away he may be slipped on to the paper by the feathered end of a pen. Being dexterous in the use of a pair of forceps, I was accustomed to remove my larvæ by holding them between the points of the forceps by a gentle pressure; but this is only attained by considerable practice—too much pressure would kill, too little would fail to convey the worm. It will be found desirable to sprinkle the leaves and larvæ with water in all stages twice or thrice daily or oftener in very hot weather. If any worms should get into the water and appear drowned, they may be recovered by draining the water away by means of blotting-paper, or powdering them over to absorb the water, and exposing them to a free current of air. A good mode of watering them is to dip into water a brush with long hairs, and then passing the hand over it in a direction away from the worms, the bristles rebounding fling the water in the desired direction. Every day the "frass" or ordure of the worm should be removed, when very small, by a puff of the breath.

The *Quercus pedunculata*, or common British oak, is the first to break into leaf—some ten or fourteen days before the other species. The leaves of this oak are placed on short stalks, and

* Another good plan is to provide a round table and round trays, for the worms in their wanderings keep going on and on without arriving at any corner whence they would be likely to drop down on to the ground.

the acorns are on long stalks. *Q. sessiliflora*, or sessile-cupped oak, is distinguished by having its leaves on long stalks, and its acorns on short stalks, or else sessile. This tree is preferred, though a little later in breaking, for the culture of the *Yamamai*, on account of the greater length of its stalk permitting a freer ventilation of air, and a better observance of the larvæ. *Q. pubescens*, distinguished by the woolly character of the leaves on the under side, otherwise resembling *sessiliflora*, and *Q. cerris*, the Turkey oak, and *Q. Ægilops*, the great prickly-cupped oak, are all equally well eaten by the *Yamamai*. It is desirable to keep the worm on the leaves of the same tree during the first stage. The commencement of the first moult is known not only by the worm seeming dull and refusing to eat, but also by the appearance of a sort of triangle at the head, formed by the new head growing too large for the old one, and pushing it forwards. Great stress is laid by the French writers on the worms all being of the same age, in order that all may go through their moultings simultaneously, for fear lest while they are moulting, and the branches are undisturbed, younger larvæ might starve from want of food; and I suppose this is true when large numbers of larvæ are reared; but I have, during the moulting, changed the food regularly, cutting off with scissars the portions of spray or leaflets whereon the larva was attached for moulting, and placed it on the wooden tray, in a horizontal position, without any detriment to the larva.

After every moult the epidermis is very tender for several hours, and great care must be taken not to injure it in changing the food, &c.; in like manner also, as the jaws are soft, it is desirable that the food supplied should be very tender. By the beginning of May the worms will be in their second or third stage, and may be left out of doors during the night. In this way they will be naturally moistened with the dew, of which they are very fond.

If it is wished to place the crop on oak trees in the open air, the most suitable time will be in the middle of the second or third stage, the latter perhaps the best in point of time, about the 10th of May, a period at which, in our gardens, the geraniums are placed out, the same weather being equally suited to that plant and the worms. Trees that have been pollarded or stooled to a height convenient for guarding and observing the larvæ should be selected, having shoots two or three years old, those of one year being rather too soft and watery. All spiders and other injurious vermin should be dislodged. The trees should, for this purpose, be carefully inspected and well shaken, and ants should be got rid of by repeated blows on the trunk, which have the effect of making the ants descend. After all the ants are got rid of, sawdust soaked in gas tar should be placed at the foot of the trunk, and wool soaked in the same should be fastened around the collar of the tree. Over this they will not pass. Cotton wool is also a thorough impediment to the ants. Their little feet get entangled in the fine fibres, and they cannot move on. All boughs that touch the ground should be shortened, and intermingling boughs of other trees cut away. Too many worms must not be placed on the tree. It will be found convenient to fasten the stale boughs, on which the worms have been transported, to the living boughs, with one or two pins. After which the whole may be covered with a net to keep off the birds; but care must be taken to keep the net from pressing on the summit of the oak foliage, as the worms delight to sleep thereon. If the oak be spindled-shaped (tetard), the net may be fastened at the bottom around the trunk, in order to keep boughs for two days without changing. Mons. Personnat recommends that they should be cut from forty to sixty inches long, and then have the cut end placed in water; otherwise he is of opinion that the water is carried up too quickly to the leaves, and is injurious to the larvæ. He used for this purpose sandstone jars, half sunk in the ground, having boughs ten feet long and more placed therein. In order to prevent these from falling under the influence of the wind, he fastens to the boughs three cords, having the other ends fastened to wooden pickets in the ground, forming a triangle. Thus the upright position is retained. A mixture of gas tar and sawdust is placed around the jars, and a net is placed over all. Another method is to place two boards, one above the other, supported by cross-pieces, having an interspace of two-thirds of an inch. They are pierced with corresponding holes, large and small, so as to admit the passage of oak boughs, thirty to forty inches long. These boards are placed on a trough or bucket on four feet, of the same size as the boards, and filled with water, so that the boughs may be plunged therein sufficiently deep. A stop-cock at the bottom would allow the water to be drawn off, and changed every other day. One great advantage of this method would be the possibility of placing fresh branches of oak among the stale ones, or by placing a trough of fresh food alongside the one containing stale food. But there is also this disadvantage, that the boughs, being shorter than in the preceding method, keep fresh for a shorter time, and that the worms do not pass so readily from the stale to the fresh food as when the boughs are plunged into pots. For this reason Mons. Personnat prefers the long boughs in pots, or, better still, oak trees covered with network.

It is well known that during the process of moulting, care must be taken not to disturb the worms, lest by losing the grip of their hind claspers, they are, as I have previously shown, unable to crawl out of their old skin, which lines not merely the external body, but also the whole of the head and jaws, the interior of the intestinal canal, and the spiracles. If, however, the worms are detached from their foothold during the first twenty-four hours, they may be saved by removing them apart, and presenting them with a piece of string to lay hold of, or the edge of a piece of paper, or a leaf or fine twig; but at a later stage they are unable to regain their hold. I have previously pointed out a method of assisting these worms in their moult by the aid of a pair of forceps. During the last two stages the worms increase greatly in size, and therefore require a much larger proportion of food than when younger. This can only be estimated properly by experience. The worms seem to revel in being watered. The best time to do this is mid-day and evening. It is desirable that the worms should obtain shade; otherwise, in hot weather, they will wander away on all sides from their food. For this reason, the shade of a large tree would be desirable as a shelter, under which to place the oak branches. It is especially necessary at this age that a fresh cool air should be abundantly supplied to the worms. Even should a frost supervene, as is the case sometimes in the month of May in England, they will not be injured. Mons. Personnat's worms in 1864, at the end of May, were exposed to the severity of a white frost at an agricultural show at Evreux. They were exposed under an open shed, on a bough, during the night, to two or three degrees of frost. The worms in the morning were stiff and frozen, but remained firm on the sprays. On touching them they did not move, and the impress of the finger remained. Mons. Personnat thought the worms were all destroyed, but at 8 o'clock, under the sun's influence the frost gave, and he was agreeably surprised to see his worms return to life by degrees. Half an hour afterwards they were eating away as if to make up for lost time. Not one was lost. All his worms at home or a few miles away were exposed to the same frost without detriment. After the last change the skin of the larva is observed to swell out and become inflated as if with air, and the larva then becomes very hungry, and eats voraciously for three or four days, during which time abundance of food must be supplied. If they eat their old skin it is a sign that fresh and proper food is not supplied to them. In the last stage the worms require well-developed leaves. Young green shoots are to be withheld as injurious, being too watery. Care must be taken, when the worms are looking out for a site for their cocoons, not to disturb them by changing the food. If once disturbed they rarely spin again and change into pupa. Fresh branches therefore, if required, must be placed on the outsides for those worms which are still eating. If there is one worm still spinning, and another commences to eat the leaves which envelope the cocoon, the first is often disturbed and falls, and frequently dies, as a slight blow proves fatal at that period. At spinning time the waterpot is to be withheld.* Fifteen or twenty days after the cocoons are begun they may be cut off, and a thread or string be passed through the upper portion, above where the moth emerges, so that the pupa hangs vertically. They are then to be hung up, ten at a time. If, however, the cocoons are not all spun at the same time, this cannot be done to a nicety ; and then, as the change into pupa has not taken place, great care must be taken in gathering them to avoid shock or pressure; in order to preserve these in a vertical position they may be suspended by a hook for a few more days, and afterwards treated as the others.

The cocoons may now be divested of their dried leaves and wound, if desired ; but if reserved for breeding, further care is necessary. Naturally the males would emerge first, the females later, and in order to obviate this and obtain both males and females at the same time, it becomes necessary to hasten the exit of the latter and retard that of the males. It is necessary also to hasten the last formed cocoons, and retard the earlier ones, in order that the moths may all emerge about the same period, which would give a better chance of obtaining eggs with a minimum of uncertainty and trouble.

In a state of nature the exit of insects is prolonged often over a considerable period, doubtless in order that a greater chance may thereby be given for continuing the race. For were it otherwise, and the majority of one species were hatched out simultaneously, a fortuitous coincidence of unfavourable conditions, atmospheric or otherwise—as, for instance, a sudden frost or inundation—might

* The change into pupa being about the seventeenth to nineteenth day after beginning to spin ; vide Revue de Sériciculture, 1865, p. 76.

destroy all chance of a future brood. But since under the care of man these results are mostly prevented, it becomes our aim to economise trouble, by hatching out nearly at one time all the brood. Hence Mons. Chavannes recommends to separate the male and female cocoons, to retard the former and hasten the latter. The following is his method for determining the sexes of the cocoons: since the females which carry eggs are the largest and heaviest, he advises to weigh, say 100 cocoons, then dividing the whole by 100 he obtains the mean weight of a single cocoon; the female cocoons will then weigh a little heavier, and the male cocoons lighter than this. Many of the machines for weighing letters will easily perform this office, if suitably weighted.

About forty days from the commencement of the cocoon the moth emerges. Mons. Personnat recommends a peculiarly formed cage (la cage oblongue) for the purpose of fecundation and deposition of eggs, and he advises to suspend the cocoons in this cage on the thirtieth day. The cage is a frame of wood covered with canvass or coarse muslin, old and rubbed lest the fine threads should annoy the moths; the muslin is dipped in a decoction of tan, which colour is believed to be agreeable to the moths; the wood is also dyed; tan is employed to keep off by its smell noxious insects. The cage is straight and of any convenient length, the bottom is 12 inches wide, the sides 20 inches high, and the top 22 to 26 inches wide; hence it follows that the sides slope outwards from the bottom to the top, and this slope favours the moths at rest, either when just emerged or during coition, or when depositing their eggs; the ends of the cage are sloped in like manner. He has observed that if not sloped the moths, after passing a night within and flying about in pursuit of one another, have lost the hooks from off their feet, especially the females; these lie exhausted at the bottom of the cage and die before they can lay their eggs; whereas if the sides are sloped, the body of the female being supported, they retain their strength much longer. On the top he arranges a little opening, closed by a canvass door, situate every forty inches, in order to obtain access to the interior to remove empty cocoons and dead moths. It is found to be convenient to suspend in the interior in two rows at an equal distance from each other and from the sides, every 10 inches apart, a loop of grey string, strong enough to allow of the moths clinging to it. On these he has often witnessed coition taking place, and eggs are often deposited thereon. Lastly, in a corner a sponge full of water, or in a large cage several sponges are suspended in order to maintain a fresh cool atmosphere. The two ends are moveable, that is, fastened with screws or hooks, in order occasionally to clear out from the interior the quantity of fine dust which comes from the moths; when the ends are open a pair of bellows will cause the dust to be blown out at the further end; this dust is very irritating to the air passages, and it is recommended to wear a veil when busy about the moths; a box 100 to 120 inches long will suffice for 1,000 cocoons; the cocoons should be suspended inside a few inches higher than the bottom of the cage, in rows or chaplets equalling in their length the breadth of the cage. The bottom should be of canvass for better ventilation. The cage should be placed in a shady well ventilated spot not too warm; it might be placed, supported on legs, under the shade of a tree or wall. The moths emerge at the beginning of August; cats must be dreaded, since they are attracted by the fluttering inside as it were of birds, and will spring on the cage and tear it to get at the prey; it should therefore be elevated on iron supports above their reach, say 5 feet high. Should it rain, a piece of oil cloth is thrown over the whole, so disposed as to throw off the rain; metallic gauze is unsuited for these cages, it would injure the moths too much, and would rust where the eggs were laid and probably injure them.*

The method employed by Mons. Chavannes differs somewhat and is as follows: A muff-shaped cylinder of gauze or cotton is constructed about 40 inches high and 18 to 20 inches in diameter. Three iron wire rings keep this in shape, one at each end, round which the material is fastened so as to form a floor by which the moth is prevented from making its exit. A little opening is arranged at the upper end in order to introduce the moths; towards evening the moths are placed therein; if thought desirable only one pair of moths may be placed therein, in which case they do not flutter so as to spoil their wings; after coition the females may all be placed in one cylinder to lay their eggs. These cylinders are easy to make and to hang up wherever it is wished, viz. in a tree during night; but if made with sloping sides like Mons. Personnat's cage, and dyed of a tan colour, they would perhaps be better. These cylinders are more suitable for a limited number of moths.

In cultivating the *Yamamai* on a large scale for the commercial value of the cocoon, two crops may be in view. 1. The cocoons

* From this cage, in 1864, Mons. Personnat obtained from 640 cocoons the large quantity of 242 grammes of eggs Revue de Séricículture, 1865, p. 80.

for winding; 2. The eggs for reproduction. In order to obtain the second result greater care is needful than for the first, as not only is a large handsome cocoon desirable, but also a healthy moth and progeny, otherwise the race would deteriorate; hence the nearest approach to the natural state furnishes the best mode of culture. The brood therefore should at the earliest moment, in the egg state if possible, be placed out of doors on the living oaks, so arranged as to carry them on to the second moult. The branches of the oak must be freed from noxious enemies, especially from the little green spider, a great pest, which is very abundant. To do this it is recommended to place a pan of live sulphur among the trees; this causes the spiders, &c. to drop, and if then the collar of the trees be smeared with gas tar, and be surrounded with ashes or sawdust impregnated with gas tar, they cannot get up again. Afterwards the eggs may be suspended on the trees in little shallow trays or boxes pierced with many holes. The oak shrubs may then be covered with nets, or wire trellis-work, to keep away birds, &c.; in order to prevent the eggs being knocked out of the trays, it is desirable to moisten the lower part with gum and to attach the eggs. If the temperature descend below 54° it would be desirable to cover with matting the oak plantation while the worms are quite young. If circumstances are unfavourable for placing the eggs out of doors, the culture must be carried on either on trees in pots or on cut boughs in the manner before described, but with great care as to changing the boughs and water, and after the first or second change at latest the worms may be placed out on the trees intended for them, taking care not to place too many, lest the foliage be insufficient to last them till they spin their cocoons.

The culture intended solely to obtain cocoons is somewhat similar, but inasmuch as several or many acres are devoted to this end, the precautions need not be so very minutely observed. Care must be had thoroughly to exterminate noxious vermin and insects, and to clear away all shrubs and herbage that might shelter them. It will still be well to bring up the young brood up to the second moult under protection in a small space, as before described, in order to render their chance of a crop more sure. Afterwards the worms might be placed out at large. In this case nets would be inadmissible, and guns would be of use to deter the birds. It might be desirable in some parts to bring up the young brood under a shed, using as a feeding apparatus the method described p. 414, of a bucket or trough, having two boards for a cover pierced with holes, &c., only on a much larger scale. In the middle might be placed the box or tray of eggs. Possibly also, by way of economizing space, the method might be used up to the cocoon stages; but it is open to the objection of producing a less healthy worm, and consequently a less valuable cocoon. It is also possible that these worms might be successfully reared on trays, with leaves only given them four or five times daily, as they treat the ordinary silkworm.* Amongst the enemies, besides those already mentioned, earwigs and wasps are to be reckoned; but these only appear in any number at a period subsequent to that at which the cocoon is made. Tomtits are dangerous to the old brood, and also to the unfinished cocoon, which they soon pierce; the robin will do the same. Sparrows are also occasionally dangerous. The Quince, the red flowers of the Japanese Quince *Pyrus Japonica*, White-thorn, Neapolitan Medlar, *Photinia glabra*, *Sorbus Aria*, and the Chestnut, have all served successfully as food.† It is recommended to plant oaks three years old in November, to form a plantation intended for the culture of the *Yamamai*. These should be disposed in quarters 5 to 7 feet in width, with paths between for observation 30 to 40 inches broad; the rows, as also the trees, should be 10 to 12 inches apart, so that the worms may pass from one to another easily: by planting the trees in an oblique position, so that the tip of one touches the collar of the next, the branches which are made the first year, and are small, touch one another, so that even in the second year the worms may be placed thereon.

Eggs may be transmitted from place to place from September to February in perforated boxes of cardboard or wood. The eggs may be wrapped in canvass to prevent the effect of rude shocks. In March they should not be exposed to a high temperature "en route." If near the time of hatching, a little oak bud or spray should be enclosed with the eggs in a canvass bag; the end of the spray should be stuck into a potato to keep it fresh; the potato must be fastened firmly down to the box; if the worms hatch out they will find provision on the road.

Worms should be sent on a journey on a bough having the end placed in a bottle of water. It will be an advantageous plan to

* Vide Revue de Séricículture, 1866, No. 8, p. 172, where this method, practised by Madame la Comtesse de Beaumont, met with complete success.

† Also the following varieties of oak:—*Q. Mirbeckii*, *Q. macrocarpa*, from America; the Black Oak, the Pyramidal, *Q. Tauzin*, *Q. Phellos*, *Q. rubra*, from America. Revue de Séricículture, 1864, p. 202.

place the ends of the bough in a potato instead of a bottle, having fixed it to a box perforated with holes; and it is as well to choose the time of their first or second moult. The branches should be well fixed to the sides of the box, and when they moult they will be at their journey's end. Cocoons may be transmitted, twenty days after they have been commenced, in perforated shallow boxes.

The cocoon of *B. Yamamai* weighs 7 to 8 grammes,* whereas the cocoon of *B. Mori* weighs $2\frac{1}{2}$ to 3 grammes.† The silken material is in the same proportion, viz. 70 to 80 centigrammes;‡ that of the mulberry, 25 to 35 centigrammes.§ To estimate the resultant silk in weight from a given weight of cocoons, it is customary to allow 12 lbs. of cocoons to make 1 lb. of silk, allowing for waste, &c. The *Yamamai* cocoon will have a slight advantage in this over the mulberry cocoon, owing to its greater size and less waste. It is wound as easily as that of the mulberry cocoon, from end to end in a continuous thread, when placed in boiling water. There are two qualities of silk, the exterior layers of the cocoon being stouter and of a greenish yellow tint, and the interior of a fine texture and white colour; hence the winding is divided into two operations, so as to preserve the two qualities distinct. Regarding the quality of the silk, Mons. Gelot pronounced the following opinion at the International Exhibition of Insects at Paris in 1865.‖ "The silk of the *Bombyx Yamamai* seems to me to occupy, after that of the mulberry worm, the highest rank. It is perhaps a trifle less fine, but is quite as brilliant as that silk. I believe in many cases it might be employed instead of it; and that if we succeed in acclimatizing its production on a large scale, it might make up for our deficiency in the production of mulberry silk. The clear green tint which it naturally possesses is no obstacle to the various shades of dye, for it disappears with washing and becomes white. The rapid development of this valuable branch of industry cannot be too highly encouraged." Elsewhere ¶ we read: Several bales of *Yamamai* silk have been purchased at Yokohama, Japan, at 550 piastres the

* About $\frac{1}{4}$ oz.

† About $\frac{1}{10}$ oz.

‡ 10—12 grains.

§ 4—6 grains.

‖ Vide Revue de Sériciculture, 1865, p. 188.

¶ Revue de Sériciculture, 1865, p. 39.

picul (60 kilogrammes).* As the piastre = 6 francs, these raw silks fetched at the place of production 55 francs the kilogramme.† At the same time and place were sold bales of ordinary silk, at 600 to 612 piastres per picul, or 60 to 61 francs per kilogramme, about *25s.* per lb.

Another and higher value was given to the silk by Mons. Pompe van Meedervoort,‡ when he brought over the first batch of eggs to Europe. "The silk of the *Yamamai* is much esteemed in Japan, and is used in the Japanese crapes (so rare in Europe) to make the white parts. The price of the silk in Japan is 800 to 900 Mexican dollars per picul, which is nearly 4,500 to 5,000 francs, or *133l.*; or 75 to 85 francs the kilogramme, *33s.* to *38s.* per lb." §

Mons. Personnat has drawn out a calculation of the profits to be obtained by the cultivation on an extended scale of this valuable worm; though as yet few cocoons by comparison have been produced, insufficient to enable a precise estimate of their value to be formed, yet the experiences of the last three years have enabled him to arrive at an approximate estimate of the result of cultivation.||

Suppose a hectare¶ entirely planted out with oak trees: to each square metre might be allotted twenty to twenty-five worms; the amount of foliage would, we think, suffice for this. Taking however ten cocoons only, to allow for waste from various causes, as the product of each square metre, that would give 100,000 cocoons to the hectare; as a cocoon weighs 5—8 grammes, say 5 grammes, 200 would weigh a kilogramme, leaving a total of 500 kilogrammes of full cocoons for the hectare. But a deduction must be made for the paths, &c., say one-third, or even two-fifths, then that would leave 300 kilogrammes of cocoons. Now, it takes 12 kilogrammes of cocoons to realize 1 kilogramme of raw silk, the value of which at Japan is 75 to 83 francs. Hence the same weight of cocoons would be worth one-twelfth, say 5—7 francs. Looking at it in another way, this silk and these cocoons have equal value with mulberry silk cocoons, the value of which in France is from 5—8 francs the kilogramme. But taking the

* The kilogramme weighs 2 lbs. 3 oz. 5 dms. avoirdupois.

† About *23s.* per lb.

‡ Vide Le Ver à Soie du Chêne, par Mons. Camille Personnat, p. 89.

§ Since that time the price of silk has greatly risen, and is still rising.

|| Vide Mons. Personnat's book, p. 91.

¶ Nearly $2\frac{1}{2}$ acres, 10,000 square metres, a metre being 40 inches nearly.

value of the *Yamamai* cocoon only at 4—5 francs, the return then would be annually 1,200 to 1,500 francs the hectare,* and this with little trouble, and from a material hitherto useless, oak leaves. The annual expense would be small: a preliminary hoeing to clear the ground; a net to cover the trees, which would last ten years, and its annual value would therefore be one-tenth its cost; the cost of an overlooker for fifty or sixty days, one to every two hectares; lastly, the labour attending the crop. As a set-off, on the other hand, we have the annual value of the wood cut down at the fall at the expiration of several years.

So successful was Mons. Personnat in 1865, that on the 27th of June he wrote from Laval as follows:†—"I have this year reared 20,000 oak-silkworms, partly in the open air on 3,000 oak shrubs planted last winter, partly in an open room or on cut boughs placed in the open air. Success has equally attended all three methods. Half my brood are in cocoon, the rest ready to spin, all will be finished in another eight days. My worms and cocoons are larger than those of last year. I can perceive no difference between those reared in a room and those reared in the open air from their birth, or placed out after the second change; all have done well. My eggs this year remained at the natural temperature up to the 12th April without hatching out, at which date the oaks were bursting into leaf. It seems to me to be possible to recognize in the nearly full grown larval state the male and female worms. I have observed that at the fourth moult a certain number prepare for the change altogether, some days in advance of the others; these continue to feed up and grow more quickly than the others. These then are the first to spin and are probably males; the females, requiring a greater amount of food, require also more time, and spin their cocoons at a later date; hence the male moths appear first. Hence we may be able to retard the male larva by affording a smaller supply of food and a cooler temperature, so as to get him to spin at the same time as the female."

This account is very interesting, as tending to show the continued success which has attended the cultivation of this valuable race in Europe; nevertheless the failures have been also numerous; and before concluding I will relate one that occurred in 1865 to Mons. Claron of Limoux, with eggs that had been received direct from Japan, and sent to him by Mons. Guérin-Méneville.

* From £48 to £60. From £19 to £24 per acre.

† Revue de Séricicultnre, 1865, p. 115.

This attempt closely resembles my own failure previously recorded, the cause of which I am inclined to attribute to, 1st, a deficient vitality among the eggs, causing them to emerge during a protracted period; 2nd, a want of aëration, and of care to observe the various minutiæ of treatment which are evidently necessary, and with which I was then unacquainted; and lastly, the great heat and drought experienced by the larvæ at the end of June.

"The box* in which the eggs were sent to me on the 23rd January had a little hole on four faces; the eggs were placed in a box having two sides of canvass, and suspended in the oolest and dryest place in the house, temperature about 46° in the sun. On the 12th February the weather got warmer, and the thermometer rose to 75° in the sun, 65° in the shade; that evening a hundred worms emerged; these died for want of food. The box was placed in the cellar at a temperature of 50°. On the 13th February I received a paper by Mons. Jaquemart, recommending the eggs to be kept from the influence of the atmosphere by being shut up in a bottle sufficiently large to supply air to the eggs; I determined to test this, as the other mode had already resulted in the birth of some worms; I therefore divided my eggs into four lots, each lot was wrapped up in a piece of muslin, placed in a bottle, and suspended to the lower part of the cork; the cork was then sealed over, so that no air could enter. Different places, each having a different temperature, were then selected in order to observe what difference, if any, resulted, for future guidance.

"No. 1 was placed in the coachhouse in a hole, twenty inches deep, and covered over.

"No. 2 was placed in a corner of the court-yard, at a depth of 32 inches.

"No. 3 was placed in a large terracotta vase filled with fine dry sand, covered with a strong flagstone, and placed under an unused staircase, having a north aspect, where, the door being shut, there was little circulation of air.

"No. 4 was placed in the earth in a cellar, at a depth of 16 inches; in all cases the earth removed from the hole was used to fill it in.

"The temperature was, February 15th, about 46°, varying 3° or 4° less in the court than in the coachhouse. I then waited with confidence till the 20th April, at which time the oaks burst into

* Revue de Sériciculture, 1865, p. 145.

leaf. That day I took up my eggs. I remarked that they were a little dry and hard, but in perfect preservation. Unfortunately I mixed the lots; I placed them in the canvass box and exposed them to the action of the atmosphere, by degrees from 46° to 60°—65°; they were then placed so that at noon the sun's rays fell on them; on the 25th, one worm was born; 26th, four; 27th, eight; and so on up to the 23rd May, by which time fifty or sixty worms were born. It then seemed to me that the shells were too hard and required moistening; I gave the eggs a bath, this was followed by a general outburst. The worms generally were born about 1 to 3 p.m.; by May 6th 500 worms were born, the temperature was 65° to 70°; the worms were fed on oak sprays, with the ends placed in bottles of water, and throve thereon: finding one day many worms drowned in the water, it occurred to me that they required water to drink, and they were watered artificially daily ten or twelve times, and they seemed to enjoy it.

"About the beginning of June I had from 1,500 to 1,600 worms vigorous and healthy, on forty-eight bottles, having oak sprays in them; about 400 were at the point of their last moult, when, on the 6th June, they seemed ill. Their colour grew paler and of a yellow tint, and dusky specks were seen by a magnifying glass, studding their bodies. Ceasing to eat, they discharged a clear liquid. In vain I tried various means. I increased the number of my waterings. I ventilated the room more freely. The thermometer stood at 96° in the sun, at 75° in the room. I chose more carefully their food. All was useless. They all died."

It will be sufficiently evident, from what has already been stated, that the possession and acclimatization of a very valuable race of silkworms in Europe is at the present time "un fait accompli;" *

* Since writing the above, I have heard, with regret, that nearly all the attempts in 1866 made to rear the *Yamamai* in Europe have failed, a few only have been successful, and there is, in consequence, at the present time, a great demand for eggs, which are very dear. Both Mons. Personnat and Dr. Chavannes have, as I am informed, met with a complete check. The latter attributes his want of success to his having watered the eggs too much before they hatched out, and to his not having reared the worms on trees. He states that he has been obliged to purchase eggs for 1867.

But I should rather suggest that 1866 was from the first a most unfavourable year for all insect life; great complaints were made with reference to the eggs of the *B. Mori*, which in many places failed, and this failure was mainly attributed to the great drought and heat experienced in the autumn of 1865. Whatever atmospheric conditions influenced the eggs of *B. Mori* for and that although, up to this time, we have not succeeded in England in rearing this worm, yet we have good grounds for expectation that as a greater knowledge of its habits, and of the precautions necessary to a successful cultivation is diffused (one of the objects of this memoir), we shall find many votaries of this new culture in Great Britain and Ireland, not merely among Entomologists, but among those interested in natural science and industrial pursuits, and especially among the fair sex,* who have in all times, even from the earliest domestication of the mulberry worm, been foremost in their devotion to the cultivation of silkworms. Nor will the progress of this new culture stop here. Interesting and beautiful in appearance, it is also very valuable; for enough has been stated to prove that the silk, which is easily wound from the cocoon, is almost, if not entirely, equal in value to the best mulberry silk, and that the culture, if successful, will be most remunerative. What a boon for this country! What a blessing for the women and children, if another extensive and remunerative source of labour is opened up to their nimble and skilful fingers! What a relief to our purely agricultural villages and districts, whose great complaint is the want of manufactures, *i. e.*, the want of the increase in wages and employment which accompanies the spread of a manufacture! What a precious utilization of a material, at the present moment utterly without value, viz. oak leaves! What a valuable and fairy-like change, through the medium of an insect, from an oak leaf into a silken fibre!—the conversion of thousands of oak coppices, and even of the oak pollards in our hedges, into a precious fabric! Truly it seems a dream, and had such a statement, ten years ago, been put forward, it would have been laughed at and derided. Nay, I doubt not even now many will be unable to credit the statements I have made, and the vista which I have disclosed; yet at no distant date success will surely follow our experiments, and English sericiculture will be placed

ill, may reasonably be supposed to have similarly affected those of the *Yamamai*. Certain it is that both races did badly that year.

The statement, therefore, that the *Yamamai* is already acclimatized in Europe must be considerably modified, and the experience of several years of success is required before such can be positively asserted.

* The empress of China, See Ling See, about 2,700 B.C., was the first to unravel the silk from the cocoon of *B. Mori;* and we find the name of Pamphila, a native lady of Cos, associated with the first weaving of silken fabrics in Europe. Vide Dr. Lardner's Cabinet Cyclopædia, Silk Manufactures, p. 2.

on a firm basis. Even now so much is this new species valued in Europe, so great a demand exists for the eggs, that we read:* "Liberty having been accorded by the Japanese authorities to purchase the eggs of the *Yamamai*, the governments of Holland and Switzerland, as also the French merchants, have taken advantage of the permission, and, to my knowledge, at least twenty kilogrammes† of eggs, of which fifteen are for France, have been imported this winter. This large quantity, so easily obtained, is a proof that the cultivation of this species is carried on in Japan on a large scale, and is no way injurious to the cultivation of the *B. Mori*." Shall we in England be behindhand in taking advantage of this new opening? It would appear that since cool moist localities and temperatures are most suitable to this species, many parts of England, and especially of Ireland and Scotland, might produce large crops of cocoons. Is it then well to leave the development of this new source of riches entirely to the energies of private individuals? Does it not rather demand the fostering protection of government? Individuals cannot afford to risk their money, and, what is more precious, their time, in these experiments, with the sole prospect of enriching posterity; but, alas, not themselves, or their children. Few have the requisite knowledge to carry out the necessary experiments; and of these few, how many have the means and inclination? When the export of silk from China and Japan alone reached, in the years 1855—56, to 62,899 bales, in 1862—63, to 72,884 bales, in 1861—62, to 79,199 bales, and in 1858—59, to 83,130 bales, and when it is placed on record that a fair proportion of this might be produced at home, it is clearly time that some experiments should be carefully conducted to show if this be possible, and, if so, to extend and encourage a knowledge of the art throughout our counties, whereby this great result may be produced. We should then be able to count another utilitarian triumph for Entomology, in addition to those over the bee, the *Bombyx Mori*, the *Coccus*, and the *Cantharis vesicatoria*, &c. We should open up a new field of employment to our women and children. A handsome and useful material would be brought into more general use; for it would be in England as in Japan, where, according to Dr. Sacc, of Barcelona,‡ "the *Yamamai* enables the ladies to wear

* Revue de Sériciculture, 1866, p. 52, by Mons. Guérin-Méneville.

† Nearly 50lbs.

‡ Revue de Sériciculture, 1863, p. 288.

robes of satin at the cost of those of wool." Let all therefore who are cognizant of the worth of this valuable race strain every nerve to disseminate in our own country a knowledge of its habits and culture. Let us ourselves, as much as lies in our power, experiment, and induce others by our influence to do the same, in rearing this species ; and when, by our united efforts, sufficient is known to warrant a fair prospect of success, let us support, by all means in our power, trials on a larger scale, that we may finally enrich our country with a new and precious industry.

PRIZE ESSAYS

OF

THE ENTOMOLOGICAL SOCIETY.

As an inducement to the study of Economic Entomology, the the Council renews its offer of Two Prizes of the value of Five Guineas each to be awarded to the authors of Essays or Memoirs, of sufficient merit and drawn up from personal observation, on the anatomy, economy, or habits of any insect or group of insects especially serviceable or obnoxious to mankind. The Essays may be illustrated by figures of the insects in their different states, and (if the species be noxious) must show the results of actual experiments made for the prevention of their attacks or the destruction of the insects themselves.

The Essays must be sent to the Secretary at No. 12, Bedford Row, indorsed with mottoes, on or before the 30th of November, 1867, when they will be referred to a Committee to decide upon their merits; each must be accompanied by a sealed letter indorsed with the motto adopted by its author, and inclosing his name and address.

The Prize Essays shall be the property of, and will be published by, the Society.

XI. *Descriptions of Six new Species of* Buprestidæ *belonging to the Tribe* Chalcophorides, *Lacordaire.* By Edward Saunders.

[Read 5th November, 1866.]

1. *Chrysochroa similis.* (Pl. XXII. fig. 3.)

C. viridis, punctata; capite rugoso; thoracis lateribus aureis, rugosis; elytris singulis macula flava in medio posita, apice fortiter bidentato: Subtus aurea, punctata.

Bright green; the head in front, the sides of the thorax, especially near the posterior angles, and the underside, golden. Each elytron with a transverse flavous spot situated about its middle, the edges of which are bluish. Legs greenish-blue, tarsi cyaneous. Antennæ black, the basal joint blue.

Head deeply and rugosely punctured in front, less so on the vertex, with a deep longitudinal impression between the eyes, which is met near the vertex by a small transverse one. Thorax widest at the base, not quite once and a half as broad as long; anterior margin rounded, with a slight emargination in its centre, two-thirds the length of the base, sides sinuate, diverging for two-thirds of their length, then straight to the posterior angles, base triangularly lobed; disk deeply punctured, with a faint smooth dorsal line, anterior margin smooth, sides rugose. Elytra much wider than the thorax, twice and a half as long as wide, sides slightly sinuate below the shoulders, apex widely truncate and armed with two sharp teeth; disk punctured, with four elevated smooth ridges. Underside punctured, coarsely in the middle, finely at the sides, which are covered with a short sericeous-golden pubescence. Legs and antennæ punctured.

Length $18\frac{1}{2}$ lines; breadth 6.

Hab.—Penang.

This species comes next to *C. ocellata*, from which it may at once be recognized by the want of the blue centre to the thorax and of the red spots on the elytra, as well as by the armature of the apex and the shape of the spots, which in the present species more resemble bands.

(I have lately seen a specimen of this insect in Count Mniszech's collection bearing the name of *Wingii*, White; but I have failed to find any description of it.—*April*, 1867.)

2. *Chrysochroa Deyrollii.* (Pl. XXII. fig. 4.)

C. viridis; capite et thoracis lateribus rugosis, aureo-viridibus, hujus disco punctato, linea longitudinali lævi; elytris singulis macula flava ornatis: Subtus aurea, lateribus pubescentibus.

Green, shining. Head and sides of the thorax golden; dorsal line, base, anterior margin, and a line on each side bordering the rugose portion internally, fiery red. Each elytron with a transverse flavous spot bordered with bluish-black, situated about the middle. Underside coppery. Legs green.

Head rugose in front, with a deep longitudinal impression between the eyes, which is met near the vertex by a deep short transverse pit; vertex punctured. Thorax broadest at the base, once and three quarters as broad as long; anterior margin straight, with a slight indentation in its centre, not quite two-thirds the length of the base; sides nearly straight, posterior angles slightly rounded; base sinuate; disk punctured, with a smooth dorsal line, sides rugose; on each side of the dorsal line near the base is a shallow impression; the base itself is smooth and shining. Elytra widest behind the middle, punctured, twice and a third as long as broad; sides sinuate below the shoulders, the apex of each armed with a sharp spine. Underside punctured, the sides of each abdominal segment slightly covered with a golden-sericeous pubescence. Legs punctured, slightly hairy.

Length 23 lines; breadth 6.

Hab.—India.

This species is closely allied to the *C. Edwardsii* of Hope, but differs in the colour of the sides and the smoothness of the disk of the thorax, in the less rounded shape of the spots on the elytra, and in its longer form. I have named this species after M. Henri Deyrolle, who first showed me the difference between it and *C. Edwardsii.*

3. *Chrysochroa Parryi.* (Pl. XXII. fig. 5.)

C. viridis, punctata; antennis nigris; thoracis basi elytrorumque apicibus igneis, his denticulatis: Subtus cuprea.

Bright green, the base of the thorax, the apex of the elytra, and the underside, coppery-red. Antennæ black.

Head punctured on the vertex, excavated and rugose between the eyes, with a deep oblong impression. Thorax widest at the base, once and four-fifths as broad as long; anterior margin nearly straight, slightly indented in the centre, two-thirds the length of the base; sides straight; base slightly sinuate; disk punctured, with a slightly raised dorsal line, sides rugose, with a small deep fovea above each posterior angle and a smaller shallow one on each side of the dorsal line at its base. Elytra twice and a third as long as wide, shoulders slightly angular; sides subparallel for two-thirds of their length; the apex of each with eight teeth. The underside and legs punctured, the segments of the abdomen with a slight depression on each side, covered with a sericeous-golden pubescence.

Length $20\frac{1}{2}$ lines; breadth $5\frac{1}{2}$.

Hab.—Ceylon.

This species is closely allied to *C. Chinensis*, Cast. & Gory, but differs in the want of the golden line on the elytra, the larger denticulation of their apices, and in other smaller characters. I have named it in honour of Major Parry, from whose valuable collection I obtained it.

4. *Chrysochroa Andamanensis.* (Pl. XXII. fig. 6.)

C. cyaneo-viridis, punctata; thoracis basi utrinque bifoveata; elytris costis quatuor brevibus, margine posteriore denticulato: Subtus punctata.

Bright green, with bluish reflexions.

Head rugosely punctured in front, with a deep longitudinal impression between the eyes, the punctures on the vertex far apart. Thorax at the base once and two-thirds as broad as long; anterior margin nearly straight, slightly emarginate in the centre, a little more than half as long as the base; sides gradually diverging in a somewhat curved line to the posterior angles; base nearly straight; disk deeply punctured, with a slightly raised dorsal line apparent only in front, sides rugose, near the posterior angles on each side is a small rugose fovea, from which an impressed line extends almost to the base, between it and the dorsal line is a smaller round one, and there is also a small pit on each side of the dorsal line at its base. Elytra widest at the base, twice and a third as long as wide; sides gradually converging to the apex, a little swollen about the middle; the apex of each with six teeth; disk punctured, with four smooth raised lines. The underside of the thorax largely and deeply, of the abdomen finely punctured, the sides of the latter covered with a sericeous pubescence. Legs punctate.

Length 18 lines; breadth 6.

Hab.—Andaman Islands.

5. *Steraspis aurovittata* (Hope, MS.). (Pl. XXII. fig. 1.)

S. capite cupreo-brunneo; thorace cupreo-rufo, valde punctato, linea dorsali viridi; elytris fortissime punctatis, lateribus basi suturaque viridibus, apice denticulato: Subtus cuprea.

Head coppery-bronze; thorax coppery-red, the dorsal line, in some lights, and the anterior angles green; elytra green at the base, sides and suture, the disk of each with a broad purplish-red vitta extending to the apex; underside golden-coppery. Antennæ blue-black, the basal joint green.

Head deeply and widely channelled between the eyes, the edges of the channel raised so as to form a carina on each side bordering the inside of the eyes. Thorax a little more than once and a half as broad as long; anterior margin slightly emarginate, elevated, especially at the sides, where it is reflexed so as almost to form a fold, more than half as broad as the base; sides diverging rapidly for about a third of their entire length, thence nearly straight with a slight emargination just above the posterior angles, which are acute and very slightly rounded; base with a shallow wide sinuation; disk deeply punctured, with a smooth dorsal line, the punctures becoming closer together on the sides and near the anterior angles so as to give a rugose appearance; just above the base is a slightly-raised curved smooth line, widening as it approaches the sides, and occupying altogether about two-thirds of the entire breadth of the thorax. Elytra widest at the angles behind the shoulders, which are very prominent and situated about one sixth of their entire length from the base, thence the sides converge to the apex in a slightly curved line; posterior margin denticulate; disk rugosely punctate, striate, the punctures more irregular on the sides so as to make them almost rugose, on each side above the lateral margin is a carina extending to the apex but strongest about the middle. Underside punctured, covered with silky hairs; the breast with a tubercle on each side; the apical segment triangularly incised.

Length 23 lines; breadth $8\frac{1}{2}$.

Hab.—Sierra Leone.

For this species I am indebted to my friend Professor Westwood.

6. *Cyphogastra auripennis.* (Pl. XXII. fig. 2.)

C. capite et thorace viridibus; hujus lateribus foveatis, disco linea longitudinali valde impressa; elytris punctato-striatis, apice utriusque spinoso.

Head and thorax green. Elytra golden-copper colour, the colour deepening near the apex. Underside green, the abdomen of the same colour as the elytra. Antennæ black-blue.

Head smooth, depressed between the eyes, with a central furrow and a deep pit on each side above the mouth; behind the eyes are a few punctures. Thorax once and three-quarters as broad as long; anterior angles largely cut off laterally, sides then diverging to the base, which is very slightly sinuate; disk remotely punctured, with a deep broad dorsal furrow, and on each side are two rugose foveæ, almost united so as to form a letter C. Elytra twice and a third as long as wide; sides converging to the apex, which is attenuate and armed with a sharp spine on each elytron; disk regularly punctured in lines. Underside punctured, each side of the abdomen with a longitudinal line of white hairs, the apical segment with a semicircular incision. Legs punctured.

Length $10\frac{1}{2}$ lines; breadth $3\frac{1}{2}$.

Hab.—Guam.

DESCRIPTION OF PLATE XXII.

Fig. 1. *Steraspis aurovittata.*
2. *Cyphogastra auripennis.*
3. *Chrysochroa similis.*
4. ,, *Deyrollii.*
5. ,, *Parryi.*
6. ,, *Andamanensis.*

XII. *Additions to the Catalogue of British* Coleoptera, *with Descriptions of new Species.* By G. R. Crotch, B.A., and D. Sharp, M.B.

[Read 19th November, 1866.]

New Species.

We have appended our initials to the description of each species, in order to obviate the criticism of Dr. Kraatz, that two authors cannot describe the same species.

1. *Ptilium concolor.*

P. parallelum, nigrum, opacum, dense subtilissimeque punctatum, pube brevi albida vestitum; prothorace transverso, postice fortiter angustato, haud canaliculato; elytris thorace vix latioribus sed illo plus quam triplo longioribus; antennis pedibusque piceis.

Long. $\frac{1}{4}$ lin.

This is a very remarkable species, and may be known by its narrow and parallel form, its thorax very evidently broader than long, and very much narrowed behind; its elytra not dilated at the sides, scarcely wider but more than three times longer than the thorax. Mr. Matthews, who has kindly examined the insect, assures me that I am correct in considering it a species hitherto undescribed.

I found a single specimen among the coarse sand and shingle on the banks of the Bowmont at Yetholme; Mr. Crotch was with me at the time, and though we saw other specimens, we could not secure them, owing to the minute size of the creature and its peculiar habitat. Its principal companion was *Thinobius longipennis.*

I had intended giving myself the pleasure of dedicating this species to the Rev. A. Matthews, but as his name has already been attached to a species of one of the neighbouring genera, I have been obliged to choose another name for the curious little creature.—D. S.

2. *Atomaria Wollastoni.*

A. oblonga, subcylindrica, fusca, minus fortiter sat confertim punctata, tenuiter cinereo-pubescens; prothorace coleopteris paulo angustiore, antrorsum vix angustato, convexo, basi æqualiter marginato; antennis pedibusque ferrugineis.

Long. $\frac{2}{3}$ lin.

This species is very closely allied to *A. nana*, Er., but I think it is really distinct; the punctuation of the upper surface is closer and much finer than in *A. nana*, and the pubescence is much shorter and more delicate; in these respects it more resembles *A. elongatula*, Er., but from this species its form and facies (very like *A. nana*) render it very distinct. From *A. fumata* it is distinguished by its finer punctuation, more delicate pubescence, and longer and thinner antennæ.

I have found it very rarely on the banks of a small loch near Edinburgh.

I have taken the liberty of dedicating this species to T. V. Wollaston, Esq., an Entomologist for whose works I entertain the greatest respect, and from whose paper on the British species of this genus I (in common with many others) have derived much information and assistance.—D. S.

3. *Telephorus Darwinianus.*

T. niger, antennis basi, capite antice, prothorace geniculisque rufo-testaceis; prothorace subquadrato, parce et obsolete punctato, litura posteriore nigra.

Long. 4—5 lin.; lat. $1\frac{1}{4}$—$1\frac{1}{2}$ lin.

♂ antennis crassiusculis, articulo tertio secundo sesqui longiore, elytris abdomine fere brevioribus.

♀ antennis brevioribus, articulo tertio secundo nonnihil longiore, elytris abdomine brevioribus; abdominis segmento 7mo ventrali utrinque sinuato, lobo medio apice acute inciso.

Var.—Elytris tibiisque testaceis, his nigro-lineatis.

N.B.—Lituræ capitis prothoracisque hac specie multum variant.

Antennæ black, the first joint reddish-yellow, with a large black streak in front; second joint black in front, reddish-yellow behind; third joint black, obscurely reddish-yellow behind; this joint is, in the male, longer by not quite a half, in the female by a very little, than the second, all the other joints are black. Head rufo-testaceous, apex of the mandibles darker, two spots between the antennæ, two others between the eyes, and a space behind the eyes on either side black. Thorax subquadrate, obsoletely and sparingly punctured, rufo-testaceous, with a variable letter-like mark on the posterior part of the disc black; scutellum black; elytra sometimes black, sometimes testaceous, the sculpture much as in *T. lituratus*, a raised longitudinal line down the middle of each, and inside this at the base the commencement of another. Femora black, with the extreme apex testaceous; tibiæ variable in colour, sometimes entirely black, sometimes black with a testaceous streak on them, sometimes testaceous with a black streak. Tarsi black, claws testaceous, the exterior one with a strong tooth. On the underside the edges and margins of the abdominal segments are obscurely testaceous. Wings small, reaching when unfolded only just beyond the apex of the abdomen.

This species is closely allied to *T. lituratus*, having the joints of the antennæ in the ♂ without any glabrous lines on them, but may be distinguished by the following characters: the antennæ are much shorter and stouter, their third joint not so much longer than the second; the prothorax is longer in proportion to its breadth, and the elytra are shorter; and *T. Darwinianus* is altogether a more compact and robust insect.

I have captured at different times a considerable number of specimens under seaweed on the shores of the Frith of Forth at Aberlady; I have never found it climbing on plants and herbage as the other *Telephori* do. Mr. Hislop accompanied me on one of these occasions, and captured it freely. Some of the females have the elytra and antennæ very deformed (reminding one of the apterous females in neighbouring genera) and seem to be in great favour with the males.—D. S.

4. *Telephorus scoticus.*

T. elongatus, niger, antennarum basi, ore, prothoracis marginibus plus minusve, elytris tibiisque testaceis.

Long. 3—4 lin.; lat. vix 1 lin.

♂ antennis articulis 4—10 linea impressa, tertio secundo fere duplo longiore.

♀ antennis brevioribus, simplicibus; articulo tertio secundo fere sesqui longiore.

Black, antennæ elongate, with the two or three basal joints more or less obscurely testaceous; mandibles testaceous, their apex pitchy. Thorax a little broader than long, nearly as broad as the base of the elytra; posterior angles nearly right angles, anterior angles and front margin rounded, with a pitchy-black blotch on the disc, generally entirely occupying it, and leaving only the mere margin lighter; sometimes, however, this blotch only occupies about half the area of the thorax, but even when most reduced it is a blotch more or less angulate, and not a letter. Elytra elongate and narrow, about four times the length of the thorax, without any trace of raised lines; sculpture and pubescence as in the neighbouring species. Femora black, their extreme apex and the tibiæ testaceous; tarsi pitchy, claws testaceous.

Mr. Rye, in the Catalogue annexed to his "British Beetles," has suggested the above name for a species of *Telephorus* found in Perthshire, and placed in Mr. Waterhouse's Catalogue as *Rhagonycha* (indeed though a true *Telephorus*, it has much the appearance of the species of *Rhagonycha*), and which has caused a good deal of trouble to British Coleopterists. It would appear to be most allied to *T. figuratus*, but with somewhat the colour and appearance of a small specimen of *T. assimilis*. I am not sure that I am acquainted with the true *T. figuratus*, but judging from descriptions of that species the differences appear to be as follow:—The colour is very different, the whole head of *T. scoticus* being black, with the exception of the parts close to the mouth; the space between the antennæ over the mouth being black, whereas in *T. figuratus* it is always yellow; the antennæ longer and stouter; the thorax larger, with anterior angles and front margin more rounded, and the black colour spread over a greater area of it; and the elytra and legs longer.

This species is found abundantly by sweeping in open marshy places at Rannoch in Perthshire, in company with *T. testaceus*, *paludosus* and *elongatus*: it has not, so far as I am aware, been found elsewhere.—D. S.

5. *Sitones ononidis.*

S. oblongus, niger, antennarum scapo, tibiis tarsisque testaceis, squamulis supra vix metallico-nitidis subtus grisescentibus vestitus; oculis sub-depressis; elytris punctato-striatis, interstitiis planis.

Long. 2 lin.; lat. $\frac{3}{4}$ lin.

This species is to be placed in division 2 A. of M. Allard's monograph (Ann. Soc. Ent. France, 1864, p. 334), and is very closely allied to *S. suturalis*, from which it differs as follows: it is on the average rather larger, and is less cylindrical and not so convex in form, while the scales with which it is clothed are scarcely metallic; its eyes are a little less prominent (though more prominent than in *S. hispidulus*), and when viewed from the side are seen to be narrower in their transverse diameter, and not so circular in outline but more elliptical than the eyes of *S. suturalis*. The elytra are not so strongly punctate-striate, and the interstices are quite flat, while they are slighly convex in *suturalis*.

I took a great number of specimens in company with *Apion ononidis* off *Ononis spinosa* at Herne Bay in September last year; *S. suturalis* occurred on a species of vetch at the same place and time, but each species was strictly confined to its appropriate plant. Dr. Power captured it subsequently and also in numbers at the same locality. Many of the species of *Sitones* are very closely allied to one another, and a single specimen is often very difficult to determine. The insect at present under consideration is undoubtedly very closely allied to *S. suturalis*, but I think the above characters (drawn from a long series of specimens), and its different food plant, render it desirable that it should be distinguished by a name of its own. Like many other species of the genus it varies somewhat in the colour of the scales with which it is clothed, these in some specimens showing no trace of metallic lustre.—D. S.

6. *Anthicus salinus.*

A. niger, griseo-pubescens; capite parce tenuiter punctato; thorace antice latitudini capitis æquali, postice valde coarctato, mox ante basin constricto, creberrime et subtiliter punctato, opaco; elytris nitidis, parce et minus fortiter punctatis, transversim subrugulosis; antennis nigro-fuscis, brevioribus; femoribus piceis, tibiis tarsisque rufescentibus.

Long. 1—1$\frac{1}{3}$ lin.

A. humili, Germ., affinis, sed thorace antice latiore puncturâque subtiliore et crebriore facillime distinguendus.

Found near Lymington in the Salterns by Mr. Waterhouse, also at Gravesend. It is, I believe, the Sp.? No. 2 of that gentleman's Catalogue.—G. R. C.

7. *Gyrophæna Poweri.*

G. flava, capite elytris angulo externo apicali abdomineque ante apicem piceis; capite fortiter punctato; thorace parce sed æqualiter punctato, seriebus dorsalibus obsoletis; elytris crebre rugoso-punctatis, abdomine nitido lævi.

Long. vix 1 lin.

♂ abdominis segmento ultimo in spinis 4 producto, duabus externis incurvis; segmento 6to tuberculis 4 parvis instructo.

A *G. gentili* statura multo minore et thoracis punctura differt; a *G. minima* capite punctato et abdominis ♂ structura discedit; a *G. congrua*, cui colore et magnitudine proxima est, thorace æqualiter punctato abdominisque structura bene distincta est.

This species is the Sp. ? 6* of Mr. Waterhouse's Catalogue, and was found near London by the zealous and indefatigable Dr. Power, to whom I have much pleasure in dedicating it.—G. R. C.

8. *Philonthus addendus.*

(*P. temporalis*, Mulsant, forte.)

P. niger, antennis tenuioribus, capite prothoraceque nigro-æneis, hoc disco utrinque 4-punctato; elytris æneis, abdominis segmentis supra parcius punctatis, horum basibus subtus quam supra crebrius punctatis.

Long. 5—5½ lin.

♂ abdominis segmento septimo ventrali apice emarginato, tarsis anticis haud dilatatis.

Black, head and thorax brassy-black, elytra brassy (their tint a little greener than in *P. æneus*); the joints of the antennæ from the fifth to the eleventh become gradually shorter but scarcely broader. Head with the posterior angles rounded, with four punctures between, and numerous small and large punctures behind the eyes. Thorax on each side with four discoidal punctures, the usual fine punctures at the anterior angles, and others along the lateral and posterior margins, the sides slightly sinuate before the posterior angles. The elytra are scarcely longer than the thorax, thickly punctured and pubescent. Abdomen black and shining, on the upper side sparingly, on the under rather more closely (especially at the base of each segment), punctured. Each of the third and fourth segments has on the upper side a carina at the base. In the male the posterior margin has on the underside of the seventh segment a small triangular notch nearly filled up by a membrane, and the tarsi are scarcely visibly dilated.

This species must be placed near *P. æneus*. It is, I believe, specifically identical with the *Philonthus* introduced some years back as British under the name of *temporalis*. It is very difficult, judging only from Mulsant's description of his *P. temporalis*, to speak positively, but the specimens above described certainly appear to me irreconcilable with that description. There are now seven European species of this genus forming a group of which *P. æneus* is the centre; several of them are very little known, and in my opinion could they all be examined by one competent authority, their number would be reduced to four or at most five. I shall hold specimens of *P. addendus* at the disposal of any one who can obtain authentic examples of the other species for comparison with it. I have captured about two dozen specimens at different times under a heap of freshly cut grass on the Corstorphine hills near Edinburgh.—D. S.

9. *Lathrobium Jansoni.*

L. castaneum, lineare; capite nitido, vertice parce lateribus profundius punctato, thorace vix latiore; hoc nitidissimo, profundius punctato, linea media brevi; elytris thorace vix brevioribus, crebre sat distincte punctatis; abdomine dense evidenter pubescente; antennis pedibusque testaceis.

Long. $2\frac{1}{2}$ lin.

L. pallido valde affine, sed colore obscuriore, elytrorum longitudine et punctura fortiore, facillime distinguendum.

This species was sent by Mr. E. W. Janson under the MS. name "*Hardii*" to Dr. Kraatz, and was returned by that gentleman as new. I have proposed a new trivial name in honour of its captor, who has done so much to advance the cause of British Entomology, inasmuch as Mr. Hardy had no hand either in its capture or identification.—G. R. C.

10. *Stenus Shepherdi.*

S. niger, parce cinereo-pubescens; capite elytris angustiore, vertice plano, oculis minus prominentibus; thorace elongato, crebre subrugulose punctato; elytris hoc vix longioribus, minus crebre punctatis; abdomine parce punctato, carinulis fortiter elevatis; antennis pedibus palpisque nigris, his articulo primo flavo.

Long. 2 lin.

St. cinerascenti valde affinis, sed major, nitidior, coloreque palporum sat distinctus; a *St. buphthalmo* abdomine parce punctato facile distinguendus.

Found at Hammersmith marshes near London by Mr. E. Shepherd, and communicated to Dr. Kraatz by Mr. E. W. Janson. It was returned by him as certainly distinct from any known species.—G. R. C.

11. *Stenus annulatus.*

S. niger, vix æneo-micans, parcissime pubescens; capite thorace dimidio latiore, fortiter punctato, late bisulcato, vertice lævi; thorace paullo longiore quam latitudine sua, sat crebre inæqualiter punctato; elytris thorace tertia parte longioribus, sat crebre et fortiter punctatis, obsolete tri-impressis; abdomine late marginato, basi fortiter apice subtiliter punctato; antennis palpisque testaceis, illis articulo primo infuscato; pedibus testaceis, geniculis posticis distincte nigris.

Long. 2 lin.

St. impresso valde affinis, et elytris longioribus geniculisque posticis nigris tantum distinctus. In Anglia cum *St. impresso* haud rarus.

By no means rare in the London district, and scattered throughout England; it very closely resembles *St. impressus*, Germ., and is possibly a winged form of it.

Dr. Kraatz, to whom specimens were sent some years back, returned it as new. It must be very near *St. flavipalpis*, Thomson, but that should have much shorter elytra, according to the description; nevertheless when three years ago I saw his types I made a note that it appeared to me to come near *St. impressipennis* and to have longer elytra.—G. R. C.

Species previously described by Continental Authors.

1. *Gyrinus colymbus*, Er. Käf. 191.

A few specimens of this species were placed among *G. marinus* ♀ in my collection; the red reflexed margin at once distinguishes it.—G. R. C.

2. *Gyrinus opacus*, Sahlb. Ins. Fenn. 47.

M. Scriba records this species from England in his paper, Stett. Ent. Zeit. 1842, p. 11; it appears to be not uncommon and to be most nearly allied to *G. marinus.*—G. R. C.

3. *Parnus nitidulus*, Heer, Faun. Col. Helv. 467.

A single specimen taken by me at Aberlady near Edinburgh last July.—D. S.

4. *Elmis* (*Limnius*) *troglodytes*, Gyll. iv. 395.

A few specimens of this species were placed with the common *L. tuberculatus* in my collection. It seems to be rare.—G. R. C.

5. *Hydræna palustris*, Er. Käf. i. 200, 1; Ksw. Linn. Ent. iv. 167.

This species has long existed in the cabinet of Dr. Power, and was taken by him in the north of England; it is also the Sp. —? No. 2 of Mr. Waterhouse's Catalogue. Recently it has been found at York, through the indefatigable exertions of the Rev. Wm. Hey. It was formerly in our lists, but was then represented by *H. nigrita*.—G. R. C.

6. *Hydræna angustata*, Sturm, Ins. D. x. 77, 5; Ksw. Linn. Ent. iv. 175.

Two examples of this distinct species were mingled with *H. riparia* in my collection. They probably came from Scotland. —G. R. C.

7. *Hydræna pulchella*, Germ. Ins. Spec. i. 94; Ksw. Linn. Ent. iv. 187.

This also was detected many years since by Dr. Power, and it is the Sp. —? No. 6 of Mr. Waterhouse's Catalogue. Since then I have seen several specimens from the Derbyshire and Yorkshire moors, where it would appear to be not uncommon in company with *H. flavipes*, St.—G. R. C.

8. *Anisotoma silesiaca*, Kr. Stet. Ent. Zeit. 1852, p. 380.

I captured this species at Invercannich at the foot of Glen Affrick, Inverness-shire, in July last.—D. S.

9. *Epuræa immunda*, Er. Germ. Zeits. iv. 269, 9.

Nine specimens of this well-marked species were taken by me under bark of birch at Invercannich, Inverness-shire, this summer. Its peculiar coloration renders it at once distinct from all the other species.—G. R. C.

10. *Meligethes ebeninus*, Först. Uebers. der Käf. 15.

Of this species I have only seen one ♀. It is very distinct by its deep black appearance, and sparse punctuation.—G. R. C.

11. *Meligethes marrubii*, Bris. Gren. Cat. 54, 70.

M. Brisout has kindly determined this species for me from a single specimen taken by myself. The spines on the intermediate tibiæ render it unmistakeable.—G. R. C.

12. *Meligethes obscurus*, Er. Ins. Deutsch. iii. 203.

Two specimens of this species were in Mr. Wollaston's collection, taken in the north of England.—G. R. C.

13. *Cerylon semistriatum*, Perris, Ann. Soc. Ent. France, 1865, p. 567.

I have long had separated in my collection a species of *Cerylon* allied to *histeroides*; indeed I have sent it to some of my friends under the MS. name *parcepunctatum*. I believe I am correct in referring it to the above recently-published species, though I must admit it does not agree satisfactorily on all points with M. Perris's description.—D. S.

14. *Hypocoprus latridioides*, Motsch. Bull. Mosc. (1833), 75.

This interesting addition to our fauna was found at Brandon, Suffolk, under cow-dung in a sandy field. It was apparently very rare, as a diligent search failed to detect it in any other place. It is hitherto recorded only from Greece and Southern Russia, and more recently from the Canary Isles. The synonymy is somewhat confused, it having received two generic and four specific names.—G. R. C.

15. *Atomaria longicornis*, Thoms. Sk. Col. v. 269.

One specimen only, which agrees with the description of the above species, was taken this summer near Beauly, Inverness-shire.—G. R. C.

16. *Latridius angulatus*, Mannh. Germ. Zeit. v. 74.

One specimen only of this species stood in Mr. Wollaston's collection. It was named by M. Motschulsky, the originator of the species.—G. R. C.

17. *Latridius consimilis*, Mannh. Germ. Zeit. v. 99.

Two specimens of this distinct *Latridius* have been taken by the Rev. A. Matthews, at Gumley; one of these he has kindly ceded to me.—G. R. C.

18. *Gnathoncus punctulatus*, Thoms. Sk. Col. iv. 242.

I have hitherto seen only one specimen answering to the description of this species. It was taken near London, and given to Mr. E. W. Janson. It appears from recent accounts to be not uncommon throughout Europe.—G. R. C.

19. *Aphodius nemoralis*, Er. Ins. Deutsch. iii. 816.

Taken by Mr. Crotch and myself at Rannoch last spring. On the Continent it is found in deer's dung, and I think it very probable our specimens had a like habitat.—D. S.

20. *Aphodius niger*, Panz. F. G. 37, 1; Er. Ins. Deutsch. iii. 834.

This species has been hitherto confounded with the immaculate form of *A. plagiatus*, L. It is abundant in the spring at Deal.—G. R. C.

21. *Aphodius consputus*, Creutzer, E. V. 41, 11; Er. Ins. Deutsch. iii. 877.

Three specimens stand in my collection without locality; I am inclined however to think that they come from the Lancashire coast.—G. R. C.

22. *Psammodius cæsus*, Panz. F. G. 35, 2; Er. Ins. Deutsch. iii. 913.

This species, already in our lists as a reputed native, has been taken this year by Mr. Sidebotham, who has insisted on placing his specimen in my collection. It will doubtless soon cease to be unique, its near congener, *Ægialia rufa*, having already turned up. —G. R. C.

23. *Athous subfuscus*, Müll. Fn. Frichsd. 17, 269; Ksw. Ins. Deutsch.

Three or four specimens were received a few years ago from the Shetland Isles by Mr. Edwin Brown of Burton-on-Trent, two of which he has most liberally placed in my collection.—G. R. C.

24. *Limonius parvulus*, Panz. F. G. 61, 7; Ksw. Ins. Deutsch. 335.

One specimen, taken by Mr. Sidebotham near Devizes. *À propos* of this capture I must record my firm conviction that this and the other novelties taken at the same time are true natives of this country, Mr. Sidebotham's accurate account of their capture leaving no room for doubt.—G. R. C.

25. *Cyphon nigriceps*, Ksw. Ins. Deutsch. 413.

This genus will probably admit of still further extension. Thomson's *C. nigriceps* certainly differs from the above, which is at present somewhat rare, but confounded with the other species. —G. R. C.

26. *Cis Jacquemartii*, Melliè, Ann. Soc. Ent. Fr. 1849, p. 328.

Closely allied to *C. nitidus*, with which it is doubtless mixed in collections. I have hitherto seen only one specimen, from Scotland. —G. R. C.

27. *Ceuthorhynchus suturellus*, Schh. vii. 168.

This species was first taken by the Rev. Hamlet Clark, and recently by the Rev. William Tylden, who at once detected its novelty. M. Brisout has been kind enough to compare one of my specimens with Schönherr's types, which he had received from Sweden for his Monograph of the genus. Some remarks on the discrepancies between these specimens and Schönherr's description will be found in the "Entomologist's Monthly Magazine," vol. ii. p. 256.—G. R. C.

28. *Cionus Thapsus*, Fabr. Ent. Syst. ii. 434, 168; Schh. iv. 726, 4.

This species has indeed been in our lists for some time, but is very generally represented by *C. hortulanus*, Marsh. The two are however quite distinct. *C. Thapsus* is much the rarer of the two. The slightly acuminate polished rostrum of *C. hortulanus* ♀ is very noticeable.—G. R. C.

29. *Tychius polylineatu* Germ., Brisout.

A single specimen of this insect was taken by me at Cambridge about three years ago. M. Brisout, who has paid considerable attention to the group, returns it with the above name. It is very distinct from the one so called by Mr. Waterhouse, and which is M. Brisout's *T. lineatulus*. The nomenclature of the group certainly requires a thorough revision.—G. R. C.

30. *Anoplus roboris*, Suffr. Stett. Ent. Zeit. 1840, p. 59.

This species has long been separated in Dr. Power's cabinet. Mr. Wollaston also had received it as a new species from

Leicestershire. It has been identified by M. Wencker, to whom I sent examples of our British *Erirhinidæ*.—G. R. C.

31. *Magdalinus barbicornis*, Latr. Hist. Nat. xi. 103.

This was admitted by Stephens, but afterwards rejected by Walton, and rightly; but since that time it has, I believe, been more than once taken. Many suppose that *M. pruni* has large antennæ in the male; this is the case in *M. cerasi* and *M. barbicornis* only. Dr. Power's specimens, on which this notice is founded, were taken in the vicinity of London.—G. R. C.

32. *Rhynchites uncinatus*, Thoms. Sk. Col. vii. 36.

Dr. Power had recognised this as a distinct species some years ago, but it was first described by Thomson. It appears to be not uncommon, more abundant indeed than *R. nanus* in the south of England.—G. R. C.

33. *Hypera elongata*, Payk. F. S. iii. 236; Schh. ii. 374.

I have seen one specimen only, which was so named by M. Capiomont, who is engaged on a revision of the genus.—G. R. C.

34. *Sitones longicollis*, Schh. vi. 171; All. 345 (1864).

This species comes very close to *S. flavescens*, Msh., and is possibly confounded with it in collections. M. Allard found three or four specimens among some *Sitones* sent by me for examination. —G. R. C.

35. *Sitones lineellus*, Gyl. Ins. Suec. iii. 281.
S. tibialis, Thoms. Sk. Col. vii. 100.

One or two attempts have already been made to establish the claim of this insect to take its place in our lists, but hitherto they have proved abortive. Some two years since I saw Scotch specimens in Mr. Hislop's collection which I thought would prove to be Gyllenhal's species, and last spring I myself captured a specimen at Aberlady, near Edinburgh. I am much indebted to Mr. Bold, who kindly sent me for examination a fine series of a species of *Sitones*, which he considered to be Gyllenhal's *S. lineellus*; these agree in all respects with the specimens above mentioned, and were captured near Newcastle.

Our common species, *S. tibialis*, appears to be unknown to Thomson, who (*loc. cit.*) refers Gyllenhal's *lineellus* to *tibialis*, and Gyllenhal's *tibialis* to *sulcifrons*. Thomson, however, himself appears to be not quite clear in his synonymy, for he gives no reference to Schönherr's *tibialis*, though this author's name is quoted by him for all the other species and varieties of the genus. Hence I conclude that *Sitones tibialis*, Schönh., so common in this country, does not occur at all in Sweden; this is supported by the well-known fact that *Ulex europæus* (the principal food plant of *tibialis* in this country) is wanting in Sweden.—D. S.

36. *Barynotus Schönherri*, Zett. Thoms. Sk. Col. vii. 129.

Occurs rarely in various parts of Scotland.—D. S.

37. *Xyloterus quercus*, Eichhoff, Berl. Ent. Zeit. 1864, p. 381.

This is the species generally standing in British collections as *X. lineatus*; it has especially been found by the Rev. A. Matthews, in Sherwood Forest, and by Charles Turner, in the New Forest. The true *X. lineatus* has been found by Mr. Rye and by myself at Rannoch.—D. S.

38. *Tomicus quadridens*, Hartig, Ratzeb. Forst. Insect. 193.

Found at Rannoch. Ratzeburg considered it a remarkable variety of *T. bidens*; I am, however, inclined to think that it will prove a distinct species. However this may be, its occurrence in this country has not hitherto been recorded.—D. S.

39. *Cryptocephalus querceti*, Suffr. Linn. Ent. viii. 145.

Two specimens of this species have been taken by the Rev. A. Matthews in Sherwood Forest; one of which, with his wonted liberality, he has presented to me. It is quite distinct from *C. geminus*, Gyll., which exists only in the Leachian collection. —G. R. C.

40. *Haltica ericeti*, Allard, Mon. Alt. 82.

This species was named for me by M. Allard from some specimens taken by Mr. Wollaston in the west of England. It is probably not rare upon heath, and is certainly abundant near York.—G. R. C.

41. *Haltica longicollis*, All. Mon. Alt. 83.

Three specimens from Scotland. The ♂ of this species has the anterior tarsus singularly dilate, one joint being large and cordate.—G. R. C.

42. *Haltica helianthemi*, All. Mon. Alt. 85.

Three or four specimens. Named by M. Allard.—G. R. C.

43. *Phyllotreta flexuosa*, Ent. H. 71, 42; Kutsch. Wien. Mon. 1860, p. 205.

One specimen only, from Mr. Wollaston's collection. This is not the *P. flexuosa*, All., which is synonymous with *P. undulata*, Kuts.—G. R. C.

44. *Thyamis nigra*, Ent. H. 57, 33; All. Mon. Alt. 95.

Two old specimens in Mr. Wollaston's collection.—G. R. C.

45. *Thyamis absinthii*, Kutsch. Wien. Mon. 1862, p. 217.

Very common on *Artemisia maritima* at Weston-super-Mare. Also (I believe) at Gravesend.—G. R. C.

46. *Thyamis atriceps*, Kutsch. *l. c.*

Three or four specimens in Mr. Wollaston's collection from the west of England.—G. R. C.

47. *Thyamis medicaginis*, All. Mon. Alt. 124.

Five or six specimens in Mr. Wollaston's collection labelled *nov. spec.*—G. R. C.

48. *Plectroscelis Sahlbergii*, Gyll. iv. 662; All. 570 (1860).

It appears that the insect commonly known as *P. Sahlbergii* is distinct from that species and has been described as new by M. Kutschera under the name of *P. subcærulea*. The true *P. Sahlbergii* is very rare, having as far as I am aware only been taken near Cambridge, where it was first detected by Dr. Power. It is at once known by its much shorter antennæ.—G. R. C.

49. *Salpingus æratus*, Muls. Rost. 34.

Two specimens taken by Mr. Wollaston in Lincolnshire. I have also taken it in Scotland, and Mr. Hislop has a specimen which I think is referable to it.—G. R. C.

50. *Xylophilus neglectus*, Aubé, Gren. Cat. 91, 110.

Two specimens from the New Forest are certainly distinct from any other species in our list, and agree tolerably with the description above cited.—G. R. C.

51. *Anthicus quisquiliarum*, Thoms. Sk. Col. vi. 360.

Not rare in dung heaps, &c.; confused with *A. floralis*, L.—G. R. C.

52. *Homalota hypnorum*, Kies. Kr. Ins. Deutsch. ii. 203.

I have found a single specimen of this fine *Homalota* in Strath-Cannich, Inverness-shire.—D. S.

53. *Homalota crassicornis*, Gyll.
H. granigera, Kr. Ins. Deutsch. ii. 207.

Three specimens among dead birch leaves in Strath Cannich.—D. S.

54. *Homalota subtilissina*, Kr. Ins. Deutsch. ii. 230.

I have found this tiny species in several localities in Scotland among the clean sand on the banks of rivers and lochs.—D. S.

55. *Homalota pallens*, Redt. Kr. Ins. Deutsch. ii. 261.

Three or four specimens on the banks of the Avon near Falkirk. —D. S.

56. ? *Tachinus frigidus*, Er. Gen. et Spec. Staph. 256, 21; Kr. Ins. Deutsch. ii. 402.

I have taken in Inverness-shire a specimen belonging to the genus *Tachinus*, which I cannot consider specifically identical with any of our recorded species. It agrees tolerably well with Kraatz's description of *T. frigidus* (Erichson's description appears to have been drawn up from two species), a very rare species, of which, according to Kraatz, there are three specimens in the Berlin Museum, two of them from Unalaschka, the other from the Tyrol; these are all males and the female is still undescribed; my specimen being a female, I cannot, under the circumstances, feel sure that I am right in my determination of it. The following is a description of the structure of the seventh abdominal segment. The seventh dorsal plate ends in three long teeth, of these the middle one reaches beyond the side ones, and its thin apical part is longer than in *T. proximus* or *rufipes*. The notch between the middle teeth of the seventh ventral plate is not simple, but has a triangular projection at its base as in *T. pallipes*. Thus, the structure of the seventh segment on the upper side most resembles *T. proximus*, but on the under side is most like *T. pallipes*. The insect is altogether smaller and rather more finely punctured than its allies.—D. S.

57. *Mycetoporus tenuis*, Muls. Op. ii. 67.

I have found this species on the top of Cheviot and also on a mountain between Strath Farrar and Strath Cannich, Inverness-shire. The specimens appear to be larger than the above description would lead one to expect.—D. S.

58. *Quedius brevicornis,* Thoms. Sk. Col. ii. 175.

Distinguished from varieties of *Q. fulgidus* with red elytra by its entirely black antennæ, with shorter articulations. Found under the bark and at the sap of trees: *Q. fulgidus* is found in cellars and outhouses. Dr. Power has long recognized this insect as specifically distinct from *fulgidus.* I cannot make out the frontal setæ, which Thomson considers diagnostic of this species. —D. S.

59. *Xantholinus lentus,* Grav. Mon. 101; Kr. Ins. Deutsch. ii. 644.

One specimen under bark at Invercannich, Inverness-shire.—G. R. C.

60. *Thinobius linearis,* Kr. Ins. Deutsch. ii. 883.

Found in Scotland in company with *Homalota subtilissima.*—D. S.

XIII. Crambina, Pterophorina *and* Alucitina, *collected in Palestine, by the* Rev. O. P. Cambridge, *March to May*, 1865; *determined, and the New Species described, by* Professor Zeller ; *the German Descriptions translated into English by* H. T. Stainton, F.L.S.

[Read 7th January, 1867.]

List of Species.

Crambina.

1. *Calamotropha Hierichuntica*, n. sp.
2. *Crambus Cassentiniellus*, Mann.
3. *Eromene ocellea*, Haworth.
4. *Pempelia Dionysia*, Zeller.
5. *Nephopteryx Dahliella*, Treitschke.
6. *Myelois circumdatella*, Lederer.
7. *Myelois monogrammos*, n. sp.
8. *Euzophera pilosella*, n. sp.
9. *Euzophera Samaritanella*, n. sp.
10. *Euzophera Faustinella*, n. sp.
11. *Euzophera Favorinella*, n. sp.
12. *Homœosoma nimbella*, Zeller.
13. *Ephestia elutella*, Hübner.
14. *Ephestia tenebrosa*, n. sp.
15. *Ematheudes punctella*, Treitschke.
16. *Melissoblaptes bipunctanus*, Zeller.

Pterophorina.

17. *Pterophorus aridus*, Zeller.
18. *Aciptilus ischnodactylus*, Treitschke.
19. *Aciptilus desertorum*, n. sp.
20. *Aciptilus Siceliota*, Zeller.

Alucitina.

21. *Alucita palodactyla*, Zeller.

Calamotropha Hierichuntica, n. sp. (Pl. XXIII. fig. 1.)

Palpis longis; alis anterioribus latissimis, acutis, lutescenti-griseis, vittâ mediâ costâque tenuissime venisque pallidis, puncto venæ transversæ nigro; posterioribus dilute cinereis, liturâ ante marginem medium obscuriore. ♂.

Long. alar. ant. lin. 6.

Palpi long. Anterior wings very broad, pointed, luteous-grey; a central vitta, a very narrow costal streak and the veins pale; a black spot on the transverse vein. Posterior wings pale grey, with a darker blotch before the middle of the hinder margin. ♂.

In its elongated palpi, and the pale-veined luteous-grey anterior wings, this has a certain resemblance to *Chilo phragmitellus;* but it has not any ocelli, and the apex of the posterior wings does not project beyond the anal angle of the anterior wings. Two depressions, which indeed are little perceptible, before the middle of the hind margin of the posterior wings, also afford a peculiar character.

Size of an average *Ch. phragmitellus.* Palpi as long as the head and thorax together. Tongue short. Anterior wings very broad, pointed, darker on the two sides of the pale central vitta which springs from the base and vanishes towards the hind margin; on the transverse vein is a black spot; all the longitudinal veins are thin and pale. Posterior wings pale grey, darker towards the apex; the above mentioned depressions lie on each side of the first branch of the median vein.

From the plains of Jordan.

Crambus Cassentiniellus, Mann.

Zell. Chil. et Cramb. Gen. p. 27; Entom. Zeitung, 1849, p. 312; H.-S. fig. 173, 174.

These specimens from Palestine are of the size of those from Asia Minor. Two males from Mount Lebanon are even larger, and of so dark a colour that they may be regarded as a distinct variety, and described as follows:—

Cassentiniellus (var.); large, the broad veins of the anterior wings, a nearly straight fascia in the middle, and a shade bordering the inner side of the second transverse line, are dark golden-brown; the posterior wings are dark grey. ♂.

In this variety the first transverse line is transformed into a fascia, the upper part of which is curved inwardly; the posterior transverse line is faint, and on the inner side broadly shaded with golden-brown.

EROMENE OCELLEA, Haworth.

Zell. Chil. et Cramb. Gen. p. 54; H.-S. fig. 144, 145.

A pair of this species from Palestine have the posterior wings pale as in Herrich-Schäffer's fig. 144. (A female from Egypt has the darker posterior wings of fig. 145; *vide post*, p. 462.)

PEMPELIA DIONYSIA, Zeller.

Isis, 1846, p. 760; H.-S. fig. 160.

Two females, from the plains of Jordan. In one the anterior wings are more tinged with grey and the inner margin is darker than in the ♂, and the other has the transverse lines of the wings more distinctly expressed.

NEPHOPTERYX DAHLIELLA, Treitschke.

Treitschke, ix. 1, 198; Zeller, Isis, 1846, p. 750; H.-S. fig. 63.

One female, from the plains of Jordan.

MYELOIS CIRCUMDATELLA, Lederer.

Wiener Ent. Monatschrift, 1858, p. 149, tab. iv. fig. 5.

Three males from Shunam, which differ but slightly from those which Lederer obtained from the neighbourhood of Damascus.

MYELOIS MONOGRAMMOS, n. sp. (Pl. XXIII. fig. 2.)

Capite ochraceo; alis anterioribus flavido-canescentibus, postice gilvescentibus, strigâ posticâ superne reflexâ argenteâ, lineâ marginis postici atrâ, exterius argenteo-marginatâ. ♀.

Head ochreous-yellow. Anterior wings pale yellowish-grey, more yellow posteriorly, towards the hind margin with a silvery transverse line of which the upper part is recurved; along the hind margin is a deep black line, externally margined with silvery. ♀.

This is so similar to *Myelois argyrogrammos*, that the differences at first sight appear to indicate only a variety, or to be sexual; but the median vein of the posterior wings having four branches, whereas in *argyrogrammos* it has only three, shows that we have here a distinct species. It is rather larger, with the anterior wings narrower, more pointed and greyer, and the first transverse line of *argyrogrammos* is entirely wanting, and the second is nearer to the hind margin and its upper portion is strongly curved inwardly. Instead of the deep black spots of the hind margin, we have here a continuous line. The posterior wings also are darker, with the transverse vein differently placed.

One specimen from the plains of Jordan.*

Euzophera† pilosella, n. sp. (Pl. XXIII. fig. 3.)

Parva; alis anterioribus perangustis, nigricantibus, squamis ferrugineis adspersis, strigis duabus albidis (priore curvâ, posteriore in medio angulatâ) opposite late nigro-marginatis; posterioribus albidis. ♂.

Long. alar. ant. lin. $2\frac{3}{4}$—$3\frac{1}{4}$.

Small, with the anterior wings very narrow, blackish, dusted with ferruginous; with two whitish transverse lines, the first broadly margined with black on the convex posterior side, the second strongly dentate in the middle and broadly margined with black on the inner side; posterior wings whitish. ♂.

The name of the species has been suggested by the very long hair-like scales of the thorax.

The anterior wings are very narrow, blackish, slightly mixed with ferruginous, and with scattered long white scales; they are intersected by two whitish fasciæ, of which the first is curved inwardly and is convex exteriorly, the second has a sharp tooth internally in the middle. The space between them is more or less whitish; the extreme base of the wing is likewise whitish. Posterior wings whitish, rather transparent.

Three males from the plains of Jordan and from Jerusalem.

Euzophera Samaritanella, n. sp. (Pl. XXIII. fig. 4.)

Parva; alis anterioribus angustis, albidis, nigro-punctulatis, strigis duabus dilutioribus, priore oblique curvatâ interius rufescente, posteriore infra medium dentatâ exterius rufescente, puncto venæ transversæ nigricante; posterioribus albidis, margine cinerascente. ♀.

Small, with the anterior wings narrow, whitish, dusted with

* Herr Lederer has also met with this insect near Amasia: "twelve miles from Amasia, in a dry place, not very scarce in June. I only, however, caught one, as I thought it was *argyrogrammos*."—Lederer, *in litt.*

† I propose this name for the genus founded by Von Heinemann, Schmetterl. Deutschlands u. der Schweiz, zweite Abtheilung, Band i. Heft ii. p. 190, under the name of *Stenoptycha*, afterwards (p. 209) changed to *Melia*.

blackish, with two paler transverse lines, of which the first is obliquely placed and curved, internally reddish, and the second is dentate below the middle and reddish externally; on the transverse vein is a blackish spot. Posterior wings whitish, with the margin grey. ♀.

As I have before me females only, the genus to which they should be referred is not perfectly certain. This remark also applies to the two following species.

Samaritanella is small, with the anterior wings not so narrow as in *pilosella*. The ground-colour of the anterior wings is pale-grey, palest on the costa. The first transverse line is convex externally, very obliquely placed, and is prolonged along the costa to the base of the wing; the second is sharply interrupted almost in the middle; both are rather thin, and the first is internally, the second externally margined with reddish. Posterior wings very pale grey.

This species is from the plains of Jordan.

Euzophera Faustinella, n. sp. (Pl. XXIII. fig. 5.)

Parva; alis anterioribus angustis, gilvis, vittâ costali, strigis duabus rectis (priore obliquâ) lunulâque venæ transversæ albis; posterioribus dilute cinereis, albido-ciliatis. ♀.

Small, with narrow ochreous-yellow anterior wings; a costal streak, two straight transverse lines the first of which is obliquely placed, and a lunule on the transverse vein, are white. Posterior wings pale grey, with white cilia. ♀.

Similar to *Samaritanella* in size, colour and marking, but the ground-colour of the anterior wings is yellowish-grey, and the costa bears a white streak; of the two white transverse lines the first is obliquely placed, but less curved, and the second is almost straight. Instead of the blackish spot on the transverse vein in *Samaritanella*, we have here a white lunule.

From the plains of Jordan.

Euzophera Favorinella, n. sp. (Pl. XXIII. fig. 6.)

Alis anterioribus angustis, pallide ochraceis, strigis duabus tenuibus albis, priore obliquâ, curvâ, interius anguste nigro-marginatâ, posteriore rectâ, lunulâ venæ transversæ albâ, infra nigro-marginatâ; posterioribus cinereis, albido-ciliatis. ♀.

Long. alar. ant. lin. 4.

Anterior wings narrow, pale ochreous-yellow, with two slender white transverse lines, the first obliquely placed, externally curved, internally margined with black; the second straight; on the transverse vein is a white lunule, margined beneath with black. Posterior wings grey, with the cilia whitish. ♀.

Larger than either of the two preceding, with a superficial resemblance to *Nyctegretes achatinella*, whence it appears to come near to *Nyctegretes* (?) *albociliella*, Staudinger, (Entom. Zeitung, 1859, p. 225.) But in that species the second transverse line is externally dark-margined, and all the cilia are white.

Anterior wings narrow, broader posteriorly, pale ochreous-yellow. The first of the two slender white transverse lines is very obliquely placed, externally convex, finely bordered with black on the inner side; the second is straight and terminates on the costa in a black spot which lies towards the apex of the wing. The white lunule of the transverse vein is shaded with blackish internally, and is terminated beneath by a black longitudinal streak. Between the first transverse line and the base of the wing is a brownish spot on the inner margin. The posterior wings are grey, darker before the whitish cilia.

From the plains of Jordan.

Homœosoma nimbella, Zeller.

Heinemann, Schm. Deutsch. u. Schweiz, ii. 2, p. 197; H.-S. fig. 79.

The specimens from the plains of Jordan belong to the variety b. of the Isis, which is characterised by the smallness and pale colour of the specimens.

Ephestia elutella, Hübner.

Hübner, fig. 163; Heinemann, *lib. cit.* p. 201.

One specimen from Jerusalem.

Ephestia tenebrosa, n. sp. (Pl. XXIII. fig. 7.)

Alis anterioribus angustis, cinereo-fuscis, basi dorsoque late rufescentibus, strigis duabus dilutis, priore obsoletissimâ, posteriore obsoletâ; posterioribus albidis, subpellucidis. ♀.

Anterior wings narrow, grey-brown, with the base and the inner margin broadly reddish; the first of the two pale transverse lines is very faint, the second is rather more distinct; posterior wings whitish, somewhat transparent. ♀.

As large as a large *elutella*, and closely allied to that species, but with the costa of the anterior wings almost straight, and only a little curved posteriorly. The dark brownish, or smoky-brown, ground colour of the anterior wings is, at the base, and for a considerable breadth along the inner margin, paler and somewhat reddish. The two pale transverse lines are very faint, and are placed nearer to one another than in *elutella*; they are placed also rather in a different direction. The whitish posterior wings form a striking contrast to the dark colour of the anterior.

One female from the plains of Jordan.

EMATHEUDES* PUNCTELLA, Treitschke.

Semnia punctella, Heinemann, *lib. cit.* p. 199; *Anerastia punctella*, Zell. Isis, 1847, 768, et 1848, 590; *Chilo punctellus*, Treitschke, ix. 2, 268; H.-S. fig. 85.

Both sexes taken in Palestine.

MELISSOBLAPTES BIPUNCTANUS, Zeller.

Isis, 1848, p. 598; Heinemann, *lib. cit.* p. 205.

The female specimens captured in Palestine differ from ours by the first transverse line of the anterior wings being more distinct, but the difference is not such as to induce the idea of a distinct species.

PTEROPHORUS ARIDUS, Zeller.

Linnæa Entomologica, vi. 366.

In the plains of Jordan.

ACIPTILUS ISCHNODACTYLUS, Treitschke.

Treitschke, ix. 2, 223; Zeller, Linn. Ent. vi. 396.

One female of the variety b.

From the plains of Jordan.

* A new generic name is necessary, since *Semnia* already occurs amongst the true *Pyralides*.

ACIPTILUS DESERTORUM, n. sp.

Capite, corpore alisque pallide stramineis, alis anterioribus liturâ obsoletâ fuscescente in fissurâ, liturâ cinereâ ciliorum dorsalium post fissuram; digiti tertii ciliis posticis exalbidis. ♂.

Head, body and wings very pale yellow; the anterior wings with a faint brownish blotch at the fissure, and a grey blotch in the inner marginal cilia, beyond the fissure; the cilia of the hind margin of the third digit almost white. ♂.

In structure, and the entirely unicolorous pale yellow head, this is allied to *ischnodactylus*, but is entirely without black dots, having only a very faint brownish spot at the fissure of the anterior wings, and a grey blotch in the inner marginal cilia beyond the fissure.

From the plains of Jordan.

ACIPTILUS SICELIOTA, Zeller.

Linnæa Entomologica, vi. 401.

A single specimen from the plains of Jordan, which only shows a black scale in the hinder-marginal cilia of the third digit.

ALUCITA PALODACTYLA, Zeller.

Linnæa Entomologica, vi. 407.

One specimen from the neighbourhood of Damascus. It is a veritable dwarf, the anterior wings being only two lines long, and the grey markings are extremely faint.

DESCRIPTION OF PLATE XXIII.

Fig. 1. *Calamotropha Hierichuntica.*
2. *Myelois monogrammos.*
3. *Euzophera pilosella.*
4. „ *Samaritanella.*
5. „ *Faustinella.*
6. „ *Favorinella.*
7. *Ephestia tenebrosa.*

XIV. Choreutidæ *and* Crambina, *collected in Egypt, by the* Rev. O. P. Cambridge, *January to April,* 1864; *determined, and the New Species described, by* Professor Zeller; *the German Descriptions translated into English by* H. T. Stainton, F.L.S.

[Read 7th January, 1867.]

List of Species.

Choreutidæ.

1. *Simaëthis Ægyptiaca*, n. sp.

Crambina.

2. *Schœnobius Niloticus*, n. sp.
3. *Eromene ocellea*, Haworth.
4. *Eromene Cambridgii*, n. sp.
5. *Etiella* (*Pempelia*) *Zinckenella*, Treitschke.
6. *Pempelia* (*Salebria*) *Psammenitella*, n. sp.
7. *Nephopteryx* (?) *scabida*, n. sp.
8. *Nephopteryx* (*Ceutholopha*) *Isidis*, n. sp.
9. *Ephestia elutella*, Hübner.
10. *Ephestia Cahiritella*, n. sp.
11. *Ephestia interpunctella*, Hübner.
12. *Melissoblaptes bipunctanus*, Zeller.

Simaethis Ægyptiaca, n. sp. (Pl. XXIV. fig. 1.)

Alis anterioribus acutis, brunnescentibus, strigâ posticâ angulatâ fuscâ cinereo-circumdatâ, lineâ marginis postici non flexuosi badiâ; posterioribus rufo-ferrugineis. ♀.

Long. alar. ant. lin. 3.

Anterior wings pointed, brownish-yellow; the hinder transverse line angulated, brown, edged with grey; along the hind margin, which is not wavy, is a brown-red line; posterior wings ferruginous. ♀.

Easily recognized by the colour of the posterior wings. Of the size of *nemorana*, but more like *pariana* in form, and the scarcely-flexuose hinder margin of the anterior wings shows that the genera *Simaëthis* and *Choreutes* cannot properly be kept separate.

Anterior wings pointed, bright yellow-brown, inclining to reddish posteriorly; before the middle of the wing is a broad grey transverse streak; the posterior transverse line is slender, black and sharply angulated. The posterior wings are ferruginous, the costa narrowly grey-brown.

One specimen taken in a garden at Cairo.

Schœnobius Niloticus, n. sp. (Pl. XXIV. fig. 2.)

Alis anterioribus subacutis, lutescentibus, costâ punctisque marginis postici nigris, puncto venæ transversæ albo nigrocincto, liturâ ex costâ ante apicem fuscâ; posterioribus albidis, serie transversâ posticâ macularum fuscescentium. ♂.

Long. alar. ant. lin. $4\frac{1}{2}$.

Anterior wings rather pointed, luteous-yellow, the costa and spots on the hinder margin black; on the transverse vein is a white spot, surrounded with black; a brown blotch from the costa before the apex; posterior wings whitish, posteriorly with a transverse row of brownish spots. ♂.

Very like *S. gigantellus*, but quite a dwarf, and certainly distinguished by the shorter palpi, and the rather more pointed anterior wings. Moreover, *gigantellus* has on the anterior wings, at each end of the transverse vein, a black spot; instead of this, in *Niloticus* we see, at the lower end of the transverse vein, a black spot with a white pupil; it has also a black costal line, and larger, almost confluent, black spots along the hind margin.

The anterior wings are luteous-yellow, irrorated with brown. A brown blotch, which starts from the costa before the apex, runs almost parallel to the hind margin, and ceases before the inner margin. Posterior wings whitish, with a brownish shady streak, formed of separate spots, before the darker apex of the wing.

Taken at Alexandria.

Eromene ocellea, Haworth.

Zeller, Chil. et Cramb. Genera, p. 54; H.-S. fig. 144, 145.

One female has the dark-coloured posterior wings of Herrich-Schäffer's fig. 145.

(A pair from Palestine have the pale posterior wings of fig. 144; *vide ante*, p. 455.)

Eromene Cambridgii, n. sp. (Pl. XXIV. fig. 3.)

Alis anterioribus oblongis, postice dilatatis, griseis, fusco crebrius squamulatis, strigâ mediâ tenui ochraceâ superius angulatâ interius anguste albido marginatâ, plagâ magnâ nigro-squamatâ posticâ, strigâ geminâ fuscâ proxime ante puncta marginalia atro-orichalcea. ♂.

Long. alar. ant. lin. $3\frac{1}{2}$.

Anterior wings elongate, posteriorly broader, dusty-grey, abundantly sprinkled with brown scales; in the middle is a slender, ochreous-yellow transverse streak, angulated above and internally edged narrowly with whitish; a large black-scaled spot lies beyond it; the brown posterior double-line is placed immediately before the deep black spots of the hind margin, which have a bronzy gloss. ♂.

One of the smallest species of the genus. The first transverse line on the anterior wings is slender, ochreous-yellow, margined internally with whitish, obliquely placed and the upper part curved towards the base; on the inner side of the concavity of the second transverse line is a very large spot formed of black scales, which in its upper part contains a black longitudinal streak; the apex of the wing is rendered dark with black scales, and has a whitish hook from the costa. The posterior wings are yellowish-grey, with the apex darker, preceded by a faint grey line.

One ♂ taken near Minyeh.

Etiella (Pempelia) Zinckenella, Treitschke.

Heinemann, Schmett. Deutsch. u. Schweiz, ii. 2, p. 154.

Mella Dymnusalis, Walker, Cat. p. 1017.

One specimen from Assouan (*Syene*) in Upper Egypt.

Pempelia (Salebria) Psammenitella, n. sp. (Pl. XXIV. fig. 4.)

Alis anterioribus angustis, sensim dilatatis, fumosis, ante medium scabriusculis, strigâ posticâ geminâ undulatâ fuscâ, lineâ marginis postici atrâ; posterioribus exalbidis, pellucidis. ♂.

Long. alar. ant. lin. prope 5.

Anterior wings narrow, expanding gradually, dark grey-brown, before the middle rather smoky; the posterior double line is brown and wavy; the hinder margin bears a deep black line; posterior wings yellowish white, transparent. ♂.

Easily distinguished from its allies by its dull colouring and by the transparent posterior wings. *Lignosella*, Zeller, Isis, 1848, p. 883, has much narrower anterior wings, and only three branches to the median vein of the posterior wings. *Fumosella*, H.-S. 169, has a similar dingy colour, but broader anterior wings and dark posterior wings.

Of the size of *subornatella*. Anterior wings dark grey-brown, paler on the inner margain and rather reddish; before the middle of the wing are some dark brown rather smoky scales; the spot on the transverse vein is dark but faint; the posterior transverse line is rather wavy, pale and very faint; a slender deep black line runs along the hind margin. Posterior wings dirty yellowish-white, transparent, with four branches to the median vein.

From Lower Egypt.

NEPHOPTERYX (?) SCABIDA, n. sp. (Pl. XXIV. fig. 5.)

Alis anterioribus oblongis, dilute rufescenti-cinereis, fasciâ latâ rufo-fuscescente scabidâ ante medium, strigâ posticâ dilutâ flexuosâ exterius rufescenti-marginatâ, punctis venæ transversæ duobus cinereis; posterioribus canis, subpellucidis. ♀.

Long. alar. ant. lin. 4—4¼.

Anterior wings elongate, pale reddish-grey, with a broad reddish-brown rather smoky fascia before the middle, and with the pale wavy posterior transverse line externally edged with reddish; on the transverse vein are two faint grey spots; pos- wings whitish-grey, rather transparent. ♀.

Smaller than *Dahliella*, and distinguished from all the allied species by the broad, perpendicular, reddish-brown, rather smoky fascia before the middle of the anterior wings.

Anterior wings posteriorly broader, particularly pale before the fascia; the posterior transverse line is angulated acutely above, slightly beneath.

From Jebel e Tayr.

NEPHOPTERYX (CEUTHOLOPHA) ISIDIS, n. sp. (Pl. XXIV. fig. 6.)

Alis anterioribus angustis, fusco-griseis, strigis duabus dilutis, priore interius, posteriore exterius rufo-marginatâ, maculâ ante priorem subdorsali fuscâ; posterioribus cinerascentibus, hyalinis, venâ subdorsali secundâ atro-squamatâ. ♂.

Long. alar. ant. lin. prope 4.

Hæc species, quæ quandam *Neph. roborellæ* similitudinem sed alas angustiores habet, notas præbet ad subgenus condendum aptas, quod hoc modo definiatur.

Nephopt. subgenus *Ceutholopha:* alæ anteriores ♂ subtus in plicâ fasciculo e squamis longis instructæ; posteriores superne venâ subdorsali secundâ ad basim longe-squamatâ; cellulâ medianâ brevi.

Anterior wings narrow, brown-grey, with two pale transverse lines, the anterior of which is margined with red internally, the posterior externally; before the first is a brown subdorsal spot; posterior wings pale grey, transparent, the second subdorsal vein clothed with deep black scales. ♂.

This has a superficial resemblance to *Neph. roborella*, but has narrower wings and such peculiarities that it appears adapted for the formation of a subgenus, namely:—

Ceutholopha: the anterior wings with a bundle of long scales on the underside in the fold; the second subdorsal vein of the posterior wings clothed at the base with long scales; the median cell short.

At a first glance *Neph. Isidis* is distinguished by the short deep black line on the basal third of the subdorsal vein of the posterior wings, and which is formed of long appressed scales. The spot formed of similar scales on the underside of the anterior wings in the fold, not far from the base, is more concealed.

The anterior wings are brownish-grey; beyond a blackish spot but before the middle of the wing is the first transverse line, which is placed almost perpendicularly, and is pale, internally margined with reddish; the posterior transverse line is also pale, but blackish internally, externally reddish; it is rather wavy. Posterior wings pale grey, transparent, darker on the hinder margin towards the apex of the wing.

Taken at Manfalut.

EPHESTIA ELUTELLA, Hübner.

Hübner, fig. 163; Heinemann, *lib. cit.* p. 201.

From Lower Egypt.

Ephestia Cahiritella, n. sp. (Pl. XXIV. fig. 7.)

Alis anterioribus angustis, cinereis, strigis duabus dilutis obsoletis, priore rectâ et exterius late nigricanti-marginatâ, punctis duobus venæ transversæ nigricantibus obsoletis; posterioribus canescentibus, hyalinis, griseo-venosis. ♀.

Anterior wings narrow, grey, with two faint pale transverse lines, the first of which is straight and externally margined broadly with blackish; on the transverse vein are two faint blackish spots; posterior wings whitish-grey, transparent, with the veins dusky-grey. ♀.

A dull obscure-looking insect of the size of the largest specimens of *elutella*, well distinguished in the genus by the first transverse line of the anterior wings, which is straight, almost perpendicular and externally margined broadly with blackish; the posterior wings are transparent, very pale grey, with the veins conspicuously dusky-grey.

Two specimens from Cairo.

Ephestia interpunctella, Hübner.

Hübner, fig. 210; Heinemann, *lib. cit.*, p. 202.

One female from Alexandria.

Melissoblaptes bipunctanus, Zeller.

Isis, 1848, p. 579; Heinemann, *lib. cit.* p. 205.

The female (as in the specimens from Palestine, *vide ante*, p. 459), differs from ours by the first transverse line of the anterior wings being more distinct; but the difference is not such as to suggest the idea of a distinct species.

Taken at Siout.

DESCRIPTION OF PLATE XXIV.

Fig. 1. *Simaëthis Ægyptiaca.*
2. *Schœnobius Niloticus.*
3. *Eromene Cambridgii.*
4. *Pempelia Psammenitella.*
5. *Nephopteryx scabida.*
6. *Nephopteryx Isidis.*
7. *Ephestia Cahiritella.*

XV. *A Monograph of the Genus* Hestia, *containing Descriptions of Forms not hitherto noticed; with a Tabular View of the Species of* Danaidæ, *and Remarks upon their natural Affinities. By* Arthur G. Butler, F.Z.S., *Assistant in the Zoological Department, British Museum.*

[Read 7th January, 1867.]

Genus Hestia.

Hestia, Hübner, Verz. bek. Schmett. p. 15 (1816); Doubleday and Hewitson, Gen. Diurn. Lepid. p. 94 (1847); F. Moore, Cat. Lep. Mus. East Ind. Comp. p. 131 (1857).

Idea, Fabricius, Syst. Gloss. (Illiger's Mag. vi. p. 283, 1808); Latreille, Godart, Boisduval, Marchal, Vollenhoven.

Limnas, Hübner, Samml.

Idea, being the older name, should perhaps be used; but as Linnæus has given this name to the typical species, it seems better that *Hestia* should be retained.

Div. I.

Alæ anticæ maculis discalibus in serie submarginali ad costam currentibus.

Subdiv. 1.

Maculis discoideis valde elongatis.

1. *Hestia Idea.*

Papilio Idea, Linnæus, Amœn. Acad. 6, 405, 63 (1749); Syst. Nat. ii. p. 758, n. 73 (1767); Clerck, Icones, tab. 38, fig. 1 (1759-64); Cramer, Pap. Exot. i. p. 1, pl. cxciii. fig. A, B (1779); Herbst, Pap. vol. i. tab. lxxxvi. fig. 1, 2 (1789); Donovan, Gen. Ill. Ent. Nat. Hist. Ind. pl. 29 (1800).

Limnas (*thalassica*) *Idea*, Hübner, Samml. Exot. Schmett. Band i. pl. 18 (1806).

Hestia Idea, Hübn. Verz. bek. Schmett. p. 15, n. 71 (1816);

E. Doubleday, List Lep. Brit. Mus. pt. i. p. 52 (1844); Doubl. and Hewitson, Gen. Diurn. Lepid. p. 95, n. 7 (1847).
Idea Agelia, Godart, Enc. Méth. ix. pp. 194, 195, n. 1 (1819).
Amboyna, Ceram. Brit. Mus.

I have little doubt that the insect figured by Cramer, pl. ccclxii. and by Herbst, pl. lxxxvi., as a variety of Linnæus' *Idea*, is the *Idea Aza* of Boisduval. Herbst's figure is copied from Cramer's; the only difference which he makes in any of his insects is that he represents them with the wings closed when the under side is to be shown.

Donovan says of this species: "Drury names it *Papilio Lynceus*; but it is almost superfluous to add that it is beyond dispute the *Papilio Idea* of Linnæus."

2. *Hestia Aza.*

Idea Aza, Boisduval, Faune de l'Océanie, p. 107, pl. 3, fig. 4 (1832).
Hestia Aza, Doubleday and Hewitson, Gen. Diurn. Lepid. p. 95, n. 7 (1847).
Papilio Idea, var., Cramer, Pap. Exot. 4, p. 141, pl. ccclxii. fig. D (1782); Herbst, Pap. vol. i. tab. lxxxvi. fig. 1, 2 (1789).
Bouru. B. M.

This species differs from *H. Idea* in being smaller, having the wings much narrower and proportionally longer, the inner margin of the front wings much shorter, the discal and discoidal spots smaller, no spot on the centre of the costa, the sub-marginal series of discal spots in the front wings not so distinctly hastate, in the hind wings slightly broader and less continuous.

3. *Hestia Blanchardii.*

♂ *Idea Blanchardii*, Marchal, Revue Zoolog. p. 168 (1845).
♂ *Idea Tondana*, Van der Hoeven, Tijdschr. voor Ent. p. 41, pl. 4 (1860).*

Borneo (Marchal), Celebes. ♂ ♀. B. M.

The female of this species much more nearly resembles *H. Idea*, the spots being much larger than in the male, the apices of the wings darker, and the interneural streaks more distinct; the

* Having carefully compared M. Marchal's description with the insect figured by Van der Hoeven, I have no doubt that they represent the same species, although from different localities.

wings are also broader and larger, the anal outer margin of the front wings being dentated at the folds.

4. *Hestia D'Urvillei.*

Idea D'Urvillei, Boisduval, Faune de l'Océanie (Voyage de l'Astrolabe), p. 107, pl. 3, fig. 4 (1832).

Hestia D'Urvillei, Doubleday and Hewitson, Gen. Diurn. Lepid. p. 95, n. 9, pl. 13, fig. 3 (1847).

Aru Islands. B. M.

Var. Alæ ochreo-tinctæ, anticæ apice magis fuscescente, macula cellam terminante majore, lineis discoideis aliter dispositis; margine externo anticarum nigro albo-maculato, nec, velut in forma communi, interrupto; striis intermediis distinctioribus magisque productis.

New Guinea. B. M.

Subdiv. 2.

Maculis discoideis fasciam angulis alternis formantibus.

5. *Hestia Leuconoë.*

Hestia Leuconoë, Erichson, Nova Acta Acad. Nat. Cur. xvi. p. 283 (1834); Doubleday and Hewitson, Gen. Diurn. Lepid. p. 95, n. 4, pl. 13, fig. 2 (1847); F. Moore, Cat. Lep. Mus. East Ind. Comp. p. 135, n. 271 (1857).

Philippine Islands, Borneo. B. M.

This species is somewhat variable; some specimens have all the spots very large, and the nervures broadly black. Borneo specimens are paler than those from the Philippines.

6. *Hestia Clara*, sp. nov.

Alæ supra niveæ, area basali anticarum paulo fulvescente, venis maculisque nigris; *H. Leucothoë* similis, sed major, alis anticis magis productis; apice non fuscescente, margine postico anticarum interrupto; venis vix nigro-marginatis; cella anticarum striis obsoletis; fascia media magis obliqua et minus irregulari; maculis discoideis posticarum minoribus, striisque tenuioribus: posticæ subtus macula parva subcostali apud basim posita; aliter velut supra: corpus velut in *H. Leucothoë*, majus autem.

Exp. alar. unc. $6\frac{1}{8}$.

Java? B. M.

We have three specimens of this insect in the national collection. It is closely allied to *H. Leucothoë*; but, I think, quite distinct.

Subdiv. 3.

Maculis discalibus ovalibus et plerumque separatis.

7. *Hestia Belia.*

Hestia Belia, Westwood, Cab. Orient. Ent. p. 75, pl. 37, fig. 2 (1848); Doubleday and Hewitson, Gen. Diurn. Lepid. [Addenda], p. 531 (1852); F. Moore, Cat. Lep. Mus. East Ind. Comp. p. 135, n. 269, pl. iv. fig. 12 [Metamorph.], (1857).

Java. B. M.

8. *Hestia Hypermnestra.*

Hestia Hypermnestra, Westwood, Cab. Orient. Ent. p. 75, pl. 37, fig. 1 (1848); Doubleday and Hewitson, Gen. Diurn. Lepid. [Addenda], p. 531 (1852).

Borneo. B. M.

8 a. Var. *Idea Hypermnestra*, var., Van der Hoeven, Tijdschr. voor Ent. p. 43 (1860).

Idea Jasonia, var., ibid. pl. iii.

Van der Hoeven very rightly calls his insect a variety of *Hypermnestra*, but he refers to pl. iv. instead of iii., where he figures the insect as a variety of *Jasonia*.

Div. II.

Alæ anticæ maculis discalibus serie submarginali, sed apud apicem oblique intus ad costam currentibus.

9. *Hestia Jasonia.*

Hestia Jasonia, Westwood, Cab. Orient. Ent. p. 87, pl. 42, fig. 1 (1848); Doubleday and Hewitson, Gen. Diurn. Lepid. [Addenda], p. 531 (1852).

Ceylon. ♂, ♀. B. M.

9 a. Var. (*Alis minoribus, fuscescentibus, præcipue ad apices; maculis marginem externum magis approximantibus.*)

Ceylon. B. M.

10. *Hestia Agamarschana.*

Hestia Agamarschana, Felder, Reise der Oest. Freg. Novara, p. 351, n. 495, tab. xliii. fig. 7 (1865- ? 67).

Andaman Islands.

A local form of *H. Jasonia.*

11. *Hestia Lynceus.*

Papilio Lynceus, Drury, Ins. ii. tab. vii. fig. 1 (1773).

Hestia Lynceus, E. Doubleday, List Lep. Brit. Mus. pt. i. p. 52 (1844); Doubleday and Hewitson, Gen. Diurn. Lepid. p. 95, n. 1 (1847); F. Moore, Cat. Lep. Mus. East Ind. Comp. p. 134, n. 268 (1857).

Hestia Lyncea, Hübner, Verz. bek. Schmett. p. 15, n. 72 (1816).

Idea Lyncea, Godart, Enc. Méth. ix. pp. 194, 195, n. 2 (1819).

Penang, Sumatra. B. M.

Var. *Papilio Idea*, Stoll, Suppl. Cram. Pap. Exot. pl. xlii. fig. 1 (1791.)

Borneo. B. M.

Var. *Hestia Idea*, Doubleday and Hewitson, Gen. Diurn. Lepid. pl. xiii. fig. 1 (1847).

Malacca. B. M.

As I have now completed (see Proc. Zool. Soc. 1866), the determination of the insects belonging to the family *Danaidæ*, I think it would be well to give a table of the species, exhibiting their relative position in the several genera.

Many of the forms are very closely allied, and it is not impossible that, if we could know more of their transformations, we should be compelled to reduce the number of species to a considerable extent; I shall therefore bracket together such forms as may possibly be varieties or local modifications of one another.

[The second part of the "Novara Voyage" having recently arrived in England, I find many species, which I have described and figured in the "Zoological Proceedings," reproduced, the plates being dated as published in 1865. As no notice of these species appeared in the "Zoological Record" for that year, and moreover as a notice of the publication of the first part in 1865 did appear, I conclude that separate proofs of the plates were to be had for some time previous to their publication in the work; if I am correct in this supposition my species will certainly have the right of priority. This idea is strengthened by the notice upon the cover of the work, which states that *the plates* for the third part will be ready at the end of the year 1866. No coloured copies of the second part arrived until the latter end of January, 1867; and I am informed that the reply given in the early part of January, 1867, by the publishers in Vienna, to an application then made for part ii., was to the effect that the part was not yet ready.

I have not been able to recognize many of the closely allied species included in the above work, and shall therefore place them at the end of their respective genera.—*April*, 1867.]

Fam. DANAIDÆ.

Genus 1. Euplœa.

	Name of Species.	Author.	Locality.	Date.	Typical Description.
1.	Euplœa Prothoë	Godt.	N. Ceram; Amboyna.	1816.	Enc. Méth. ix. p. 177, n. 1.
2.	,, Semicirculus	Butler.	Gilolo.	1866.	Zool. Proc. part ii. p. 269.
3.	,, Phœbus	,,	Penang; Java.	1866.	,, ,, p. 270.
4.	,, Elisa	,,	Ceylon.	1866.	,, ,,
5.	,, Ochsenheimeri	Lucas.	E. India; Java.	1853.	Rev. et Mag. Zool. p. 315.
	Var. a.	Butler.	Borneo.	1866.	Zool. Proc. part ii. p. 271.
	Var. b.	,,	Borneo; Madjico-Sima; Penang; Siam.	1866.	,, ,, ,,
6.	,, Camaralzeman	,,	Siam.	1866.	,, ,, ,,
7.	,, Chloë	Guér.	Pulo Penang; Sumatra.	1843.	Deless. Souv. Voy. Ind. App. 72.
8.	,, Superba	Herbst.	China. N. India.	..	Pap. Exot. t. 119, 120.
9.	,, Splendens	Butler.	Nepaul.	1866.	Zool. Proc. part ii. p. 272.
10.	,, Callithoë	Boisd.	New Guinea.	1832.	Faune de l'Océanie, 93.
11.	,, Klugii	F. Moore.	Bootan.	1857.	Cat. Lep. E. I. C. p. 130.
12.	,, Kinbergi	Wallengr.	China.	1860.	Wien. Ent. Monatschr. iv. 35.
13.	,, Modesta	Butler.	Siam.	1866.	Zool. Proc. part ii. p. 273.
14.	,, Janus	,,	Java.	1866.	,, ,, ,,
15.	,, Huebneri	F. Moore.	,,	1857.	Cat. Lep. E. I. C. p. 128.
16.	,, Amymone	Godt.	Amboyna; Cochin-China.	1819.	Enc. Méth. ix. p. 179.
17.	,, Haworthii	Lucas.	Java.	1853.	Rev. et Mag. Zool. p. 317.

18.	Euplœa Tisiphone	Butler.	Phillippines.	1866.	Zool. Proc. part ii. p. 274.
19.	,, Ménétriesii	Felder.	Malayan Peninsula.	1860.	Wien. Ent. Monatschr. iv. p. 398.
20.	,, Alcathoë	Godt.	N. India.	1819.	Enc. Méth. ix. p. 178.
21.	,, *Felderi	Butler.	Sumatra.	1866.	Zool. Proc. part ii p. 275.
22.	,, Alecto	,,	Ceram.	1866.	,, ,, ,,
23.	,, Godartii	Lucas.	Java; Siam; Philippines.	1853.	Rev. et Mag. Zool. p. 319.
24.	,, Core	Cramer.	Ceylon.	1782.	Pap. Exot. iii. pl. cclxvi.
25.	,, Vermiculata	Butler.	N. India.	1866.	Zool. Proc. part ii. p. 276.
26.	,, Megæra	,,	Aru Islands.	1866.	,, ,, ,,
27.	,, Ægyptus	,,	Borneo; Sumatra.	1866.	,, ,, ,, p. 277.
28.	,, Crameri	Lucas.	Manilla; Borneo.	1853.	Rev. et Mag. Zool. p. 318.
	Var. Esperi	Felder.	Nikobar.	1862.	Cat. Nov. Voy. Verh. Wien. 482.
	Var. Frauenfeldi	,,	Ceylon.	1862.	,, ,, ,,
29.	,, Bremeri	,,	Malayan Peninsula; India.	1859.	Wien. Ent. Monatschr. iii. p. 267.
30.	,, Moorei	Butler.	Sumatra.	1866.	Zool. Proc. part ii. p. 277.
31.	,, Swainsonii	Godt.	Philippines.	1823.	Enc. Méth. ix. Suppl. p. 815.
32.	,, †Crassa	Butler.	Siam.	1866.	Zool. Proc. part ii. p. 278.
33.	,, Nox	,,	Aru Islands.	1866.	,, ,, ,,
34.	,, Gamelia	Hübn.	Java.	1806-27.	Samml. Exot. Schmett. ii. pl. 10.
35.	,, Margarita	Butler.	E. Indies.	1866.	Zool. Proc. part ii. p. 279.
36.	,, Deione	Westw.	Assam; Sylhet; Darjeeling.	1847.	Cab. Orient. Ent. p. 76, pl. 37.
37.	,, Scherzeri	Felder.	Ceylon; Sumatra.	1862.	Cat. Nov. Voy. Verh. Wien. 479.
38.	,, Wallacei	,,	Gilolo.	1860.	Wien. Ent. Monatschr. iv. p. 231.
39.	,, Melancholica	Butler.	Bouru; Amboyna.	1866.	Zool. Proc. part ii. p. 280.
40.	,, Erictemon	Hewits.	..	1866.	Exot. Butterf. iii. pl. vi.

* Possibly a local form of *Kinbergi*, Wallengren, n. 12.
† Possibly only a variety of *E. Klugii*, Moore, n. 11.

Fam. Danaidæ. Genus 1. Euplœa—*continued*.

	Name of Species.	Author.	Locality.	Date.	Typical Description.
41.	Euplœa Anthracina	Butler.	Amboyna.	1866.	Zool. Proc. pt. ii. p. 280.
42.	„ Climena	Cramer.	Amboyna; Ceram.	1782.	Pap. Exot. iv. pl. ccclxxxix.
43.	„ Melina	Godt.	New Guinea; Aru Islands; Ceram.	1819.	Enc. Méth. ix. p. 179.
44.	„ Morosa	Butler.	Gilolo.	1866.	Zool. Proc. pt. ii. p. 282.
45.	„ Duponchelii	Boisd.	Bouru.	1832.	Faune de l'Océanie, p. 97.
46.	„ Aglidice	„	Rawack.	1832.	„ „ p. 96.
47.	„ Lapeyrousei	„	Bouru; Aneiteum.	1832.	„ „ p. 97.
48.	„ Sepulchralis	Butler.	Java.	1866.	Zool. Proc. part ii. p. 282.
49.	„ Palla	„	Aru Islands.	1866.	„ „ „ p. 284.
50.	„ Tristis	„	Aneiteum.	1866.	„ „ „ „
51.	„ Mœsta	„	Dory; Sumatra.	1866.	„ „ „ „
52.	„ Æthiops	„	Waigiou.	1866.	„ „ „ p. 285.
53.	„ Usipetes	Hewits.	Aru Islands.	1858.	Exot. Butterf. ii. pl. xii.
54.	Confusa	Butler.	Waigiou.	1866.	Zool. Proc. part ii. p. 285.
55.	„ Eurypon	Hewits.	N. Ceram; Ké Island.	1858.	Exot. Butterf. ii. pl. xii.
56.	„ Hisme	Boisd.	Aru Islands.	1832.	Faune de l'Océanie, p. 95.
57.	„ Eunice	Godt.	Ceram; Java; Amboyna; Penang.	1819.	Enc. Méth. ix. p. 177.
58.	„ Iphianassa	Butler.	Aneiteum.	1866.	Zool. Proc. part ii. p. 287.
59.	„ Vestigiata	„	Java.	1866.	„ „ p. 288.
60.	„ Novaræ	Felder.	Nikobar.	1862.	Cat. Nov. Voy. Verh. Wien. p. 482.
61.	„ Gyllenhalii	Lucas.	Java.	1853.	Rev. et Mag. Zool. p. 316.
62.	„ Eleusine	Cramer.	„	1782.	Pap. Exot. iii. pl. cclxvi.
	Var. Darchia	M'Leay.	Australia.	1827.	King's Survey Austral. ii. App. 462.
63.	„ Adyte	Boisd.	New Caledonia.	1859.	Bull. Ent. Soc. p. 156.

64.	Euplœa	Mazares	F. Moore.	Java.	1857.	Cat. Lep. E. I. C. p. 127.
65.	,,	Pumila	Butler.	New Guinea.	1866.	Zool. Proc. part ii. p. 290.
66.	,,	Pollita	Erichs.	Philippines.	1834.	Nov. Act. Acad. Cur. xvi. pt. 2, t. 40.
67.	,,	Sylvester	Fabric.	Australia (?).	1793.	Ent. Syst. iii. 1, p. 41.
68.	,,	Tulliolus	,,	Australia; Aneiteum.	1793.	,, ,,
69.	,,	Dehaani	Lucas.	Java.	1853.	Rev. et Mag. Zool. p. 313.
70.	,,	Ledereri	Felder.	Malayan Penin.	1860.	Wien. Ent. Monatschr. iv. p. 397.
71.	,,	Priapus	Butler.	Australia.	1866.	Zool. Proc. part ii. p. 291.
72.	,,	Hyems	,,	Timor; Australia.	1866.	,, ,, p. 292.
73.	,,	Treitschkei	Boisd.	New Ireland.	1832.	Faune de l'Océanie, p. 98.
74.	,,	Doleschalii	Felder.	New Guinea.	1859.	Wien. Ent. Monatschr. iii. p. 267.
75.	,,	Swinhoei	Wallace.	Formosa.	1866.	Zool. Proc. part ii. p. 358.
76.	,,	Gloriosa	Butler.	Celebes.	1866.	,, ,, p. 293.
77.	,,	Diocletia	Hübn.	Philippines.	1806-27.	Samml. Exot. Schmett. ii.
78.	,,	*Dufresnii	Godt.	,,	1819.	Enc. Méth. ix. p. 815.
79.	,,	Dryasis	Fabric.	Indian Islands.	1793.	Ent. Syst. iv. 1, p. 39.
80.	,,	Midamus	Linn.	Java.	1767.	Syst. Nat. ii. p. 765.
		Var. a.	Butler.	Borneo.	1866.	Zool. Proc. part ii. p. 295, note.
		Var. b.	,,	Sumatra; India.	1866.	,, ,, ,,
81.	,,	Hewitsonii ♀	,,	Philippines.	1866.	,, ,, p. 295.
82.	,,	Kadu ♂	Eschsch.	,,	1821.	Reise in der Süd See, pl. vi. figs. 15a, 15b.
83.	,,	Viola	Butler.	Celebes.	1866.	Zool. Proc. part ii. p. 295.
84.	,,	Mniszechii	Felder.	,,	1859.	Wien. Ent. Monatschr. iii. p. 181.
85.	,,	Hyacinthus	Butler.	,,	1866.	Zool. Proc. part ii. p. 296.
86.	,,	Rhadamanthus	Fabric.	India; Java; Penang; Borneo.	1793.	Ent. Syst. iii. 1, p. 42.
87.	,,	♂ Eupator	Hewits.	Celebes.	1858.	Exot. Butterf. ii. pl. xii.
	,,	♀ ,,	,,	,,	1866.	,, ,, iii. pl. vi. f. 1.
88.	,,	Diana	Butler.	,,	1866.	Zool. Proc. part ii. p. 297.

* Identical with *E. lætifica*, Butler.

Fam. Danaidæ. Genus 1. Euplœa—*continued.*

	Name of Species.	Author.	Locality.	Date.	Typical Description.
89.	Euplœa Cratis	Butler.	Philippines.	1866.	Zool. Proc. part ii. p. 297.
90.	,, Abjecta	,,	,,	1866.	,, ,, ,, p. 299.
91.	,, Mitra	F. Moore.	——— (?)	1857.	Cat. Lep. E. I. C. 1, p. 128.
92.	,, Rogeri	Hübn.	,,	1806–27.	Samml. Exot. Schmett. Zutr. 947.
93.	,, Orope	Boisd.	Taiti; Timor.	1832.	Faune de l'Océanie, p. 100.
	,, *Var.*	Butler.	Sumatra.	1866.	Zool. Proc. part ii. p. 299.
94.	,, Helcita	Boisd.	New Caledonia.	1859.	Bull. Ent. Soc. p. 156.
95.	,, Eleutho	Quoy.	Taiti; Navigators' Islands.	1815.	Freyc. Voy. t. 83, f. 2.
	,, *Var.* a.	Butler.	——— (?)	1866.	Zool. Proc. part ii. p. 300.
	,, *Var.* b	,,	N. Australia.	1866.	,, ,, ,,
96.	,, Boisduvalii	Lucas.	Australia.	1853.	Rev. et Mag. Zool. p. 321.
97.	,, Proserpina	Butler.	Figi Islands.	1866.	Zool. Proc. part ii. p. 300.
98.	,, Pelor	Doubl.	N. W. Australia.	1847.	Gen. Diurn. Lepid. t. 11, f. 1.
99.	,, Melpomene	Butler.	N. Australia.	1866.	Zool. Proc. part ii. p. 300.
100.	,, Euphone	Fabric.	Mauritius.	1793.	Ent. Syst. Suppl. v. p. 423.
101.	,, Desjardinsii	Guér.	Rodriguez.	1829–44.	Icon. du Règne Animal, ii. p. 474.
102.	,, Goudotii	Boisd.	Mauritius.	1833.	Faune Ent. de Madag. t. 3, f. 2.
103.	,, Ebenina	Butler.	Aru Islands.	1866.	Zool. Proc. part ii. p. 301.
104.	,, Eurianassa	Hewits.	New Guinea.	1858.	Exot. Butterf. ii. pl. xii.
105.	,, Semperi	Felder.	Mindoro.	1867 (?)	Reise der Oest. Freg. Novara, p. 314, n. 425.
106.	,, Hopfferi	,,	Aru Islands.	,,	,, ,, p. 323, n. 441, tab. xli. f. 1.
107.	,, Configurata	,,	Celebes.	,,	,, ,, p. 326, n. 448, tab. xlii. f. 1, 2.
108.	,, Vollenhovei	,,	Gorontalo.	,,	,, ,, p. 327, n. 449.
109.	,, Harrisii	,,	Cochin-China.	,,	,, ,, p. 328, n. 451.
110.	,, Hopei	,,	N. India.	,,	,, ,, ,, n. 452.
111.	,, Payeni	,,	Aru Islands.	,,	,, ,, p. 329, n. 453.

112.	Euplœa Consimilis	Felder.	Java.	1867 (?)	Reise der Oest. Freg. Novara, p. 329, n. 454.
	Var. Montana .	,,	Ceylon; Rambodde.	,,	,, ,, ,, p. 330 ,,
113.	,, Pierretii	,,	New Guinea.	,,	,, ,, ,, p. 331, n. 457.
114.	,, Guérini	,,	Aru Islands.	,,	,, ,, ,, p. 332, n. 459.
115.	,, Leachii	,,	Celebes.	,,	,, ,, ,, p. 334, n. 462.
116.	,, Doubledayii	,,	N. India.	,,	,, ,, ,, p. 337, n. 467.
117.	,, Eyndhovii	,,	Java.	,,	,, ,, ,, p. 338, n. 468.
118.	,, Geyeri	,,	,,	,,	,, ,, ,, ,, n. 469.
119.	,, Grotei	,,	Cochin China.	,,	,, ,, ,, n. 470, tab. xli. f. 7.
120.	,, Lorquinii	,,	S. China.	,,	,, ,, ,, p. 340, n. 472.
121.	,, Donovani	,,	Celebes.	,,	,, ,, ,, p. 343, n. 475.
122.	,, Angasii	,,	,,	,,	,, ,, ,, ,, n. 476.

Amongst the above species described by the Felders, *E. Hopfferi* (which is figured), is certainly a good and distinct species, and is allied to my *E. Hyems*; *Grotei* appears to come near *Vermiculata*; *Configurata* may be the female of my *E. Tisiphone*, it is very distinct from anything that I have seen, though it is probably allied to *Midamus*; the remainder I cannot recognize. I am doubtful about the identity of the following:—

Name of Species.	Author.	Typical Description.	Locality.	
Euplœa Castelnaui	Felder.	Nov. Voy. p. 315, n. 427.	Malacca.	= ? Phœbus, *Butl.*
,, Bernsteinii	,,	,, p. 319, n. 433.	Aru Islands.	= ? Hisme, *Bdv.* var.
,, Staintonii	,,	,, ,, n. 434.	Waigiou.	= ? Eunice, *Godt.* var.
,, Macleayii	,,	,, p. 320, n. 436.	Figi Islands.	= ? ,, ,,
,, Forsteri............	,,	,, p. 322, n. 440.	,,	± ? Mazares, *Moore*, var.
,, Arisbe	,,	,, p. 323, n. 442.	Timor.	= ? Hyems, *Butl.* var.
,, Redtenbacheri	,,	,, p. 330, n. 455.	Aru Islands.	= ? Anthracina, *Butl.* var.
,, Batesii	,,	,, p. 331, n. 456.	Gilolo; Dodinga.	= ? Mœsta, *Butl.* var.

Fam. Danaidæ. Genus 1. Euplœa—*continued.*

Name of Species.	Author.	Typical Description.	Locality.	
Euplœa Zinckenii	Felder.	Nov. Voy. p. 335, n. 464.	Amboyna; Java.	= ? Æthiops, *Butl.* var.
„ Wallengrenii	„	„ p. 336, n. 465.	Java.	= ? Amymone, *Godart.*
„ Vicina	„	„ p. 337, n. 466.	Aru Islands.	= ? Eurypon, *Hew.* var.
„ Poeyi	„	„ p. 340, n. 471.	Assam.	= ? Margarita, ♀ *Butl.* var.

The remainder of the species I have, I believe, clearly made out: they stand as follows:—

Name of Species.	Author.	Typical Description.	Locality.	
„ Cuvieri	Felder.	Nov. Voy. p. 315, n. 426, tab. xxxix. f. 1, 2.	Gilolo.	= Semicirculus, *Butl.*
„ Euthoë	„	„ p. 316, n. 428.	Aru Islands.	= Callithoë, *Boisd.* var.
„ Westwoodii	„	„ „ n. 429, tab. xl. f. 1—3.	Celebes.	= Viola, *Butl.*
„ Novaræ	„	Verh. Wien. xii. (1862).	Nicobar.	= Vestigiata, *Butl.* var.
„ Ledereri	„	Wiener Monats. (1860).	Malacca.	= Inquinata, *Butl.*
„ Pasithea	„	Nov. Voy. p. 318, n. 432.	Amboyna.	= Eunice (*true*), *Godart.*
„ Stephensii..........	„	„ p. 320, n. 435.	Mysol.	= Mazares, *Moore* (local form).
„ Assimilata	„	„ p. 321, n. 437, tab. xli. f. 2, 3.	Aru Islands.	= Eurypon, *Hew.* ♂.
„ Fraterna	„	„ p. 321, n. 438.	„	= „ „ var.
„ Saundersii	„	„ p. 322, n. 439.	Java; Aru Islands.	= Tulliolus, *Fabr.* var.
„ Trimenii	„	„ p. 324, n. 443.	Gilolo.	= Pumila, *Butl.*
„ Erichsonii	„	„ p. 325, n. 444.	N. India; C. China.	= Crassa, *Butl.*
„ Kollari	„	„ „ n. 445.	?	= Klugii, *Moore*, var.
„ Rogenhoferi	„	„ „ n. 446.	N. India.	= Splendens, *Butl.*
„ Hewitsonii	„	„ p. 326, n. 447, tab. xl. f. 7.	Celebes.	= Hyacinthus, *Butl.*
„ Schlegelii	„	„ p. 327, n. 450, tab. xli. f. 5.	„	= Gloriosa, *Butl.*

Euplœa Dalmanii	Felder.	Nov. Voy. p. 332, n. 458.	Gilolo.	= Climena, *Cram.* var.
„ Horsfieldii	„	„ p. 333, n. 460, tab. xl. f. 4.	Celebes.	= Diana, *Butl.* var.
„ Kirbyi	„	„ p. 334, n. 461.	„	= „ „ (true).
„ Siamensis	„	„ p. 341, n. 473, tab. xli. f. 6.	Siam; Cochin China.	= Godartii, *Lucas*, var.
„ Frauenfeldii	„	„ p. 342, n. 474, tab. xli. f. 4.	Ceylon.	= Felderi, *Butl.*
„ Herrichii	„	„ p. 344, n. 477, tab. xxxix. f. 3, 4.	Figi Islands.	= Proserpina, *Butl.*
„ Lewinii	„	„ p. 345, n. 478.	N. Australia.	= Eleutho, *Quoy.* var.
„ Montrouzieri	„	„ „ n. 479.	New Caledonia.	= Helcita, *Boisd.*
„ Eschscholtzii	„	„ „ n. 480.	Figi Islands.	= „ „
„ Wallacei	„	Wien. Ent. Monats. (1860).	New Guinea.	= Wallacei, *Butl. Mon.*
„ Grayii	„	Nov. Voy. p. 346, n. 482.	Aru Islds.; Waigiou.	= Confusa, *Butl.*

Genus 2. Danais.

	Name of Species.	Author.	Locality.	Date.	Typical Description.
1.	Danais Phædon	Fabr.	Mauritius.	1793.	Ent. Syst. Suppl. v. p. 423.
2.	„ Echeria	Stoll.	South Africa.	1790.	Pap. Exot. t. xxix. p. 1, 1 a.
3.	„ Egialea	Cramer.	Ashanti.	1777.	„ t. cxcii. f. D.
4.	„ Damocles	Pal. de Beauv.	Sierra Leone; Ashanti; Angola.	1805.	Ins. Afr. et Am. Lép. p. 238.
	„ *Var.*	Butler.	Gaboon.	1866.	Zool. Proc. pt. i. p. 44.
5.	„ Hecate	„	Ashanti.	1866.	„ „ „ „
6.	„ Ochlea	Boisd.	Port Natal.		App. Voy. de Deless. p. 589.
7.	„ Niavius	Linn.	West Africa.	1767.	Syst. Nat. ii. p. 766.

Fam. Danaidæ. Genus 2. Danais—*continued.*

		Name of Species.	Author.	Locality.	Date.	Typical Description.
8.	Danais	Berenice	Cramer.	Georgia; Florida.	1780.	Pap. Exot. pl. ccv. f. E, F.
	,,	*Var.* Thersippus	Bates.	Panama.	1863.	Zool. Proc.
9.	,,	Strigosa	,,	Jamaica.	1864.	Ent. Month. Mag. i. p. 33.
10.	,,	Jamaicensis	,,	Jamaica; Guatemala.	1864.	,, ,, ,, [foot note].
11.	,,	Gilippus	Cramer.	Brazil.	1775.	Pap. Exot. pl. xxvi. f. E, F.
12.	,,	Eresimus	,,	Brazil; Venezuela.	1777.	,, ,, pl. clxxv. f. G, H.
13.	,,	Xanthippus	Felder.	Brazil.	1860.	Wien. Ent. Monatschr. iv. p. 100.
14.	,,	Cleothera	Godt.	Haiti; Honduras; Venezuela.	1819.	Enc. Méth. ix. p. 185.
15.	,,	Hermippus	Felder, MS.	Bogota.	1866.	(Zool. Proc. pt. ii. p. 171.)
16.	,,	Erippus	Cramer.	Brazil; Mexico; United States.	1775.	Pap. Exot. pl. iii. f. A, B.
17.	,,	Cleophile	Godt.	Haiti; Jamaica.	1819.	Enc. Méth. ix. p. 185.
18.	,,	Chrysippus	Linn.	Europe; Asia; Africa; Oceania.	1767.	Syst. Nat. ii. p. 767.
	,,	*Var.* Cratippus	Felder.	Amboyna.	1860.	Sitzungsber. Wien. Akad. Wiss. 40, p. 449.
19.	,,	Alcippus	Cramer.	Sierra Leone; Ashanti; Italy.	1779.	Pap. Exot. ii. pl. cxxvii. f. E, F.
20.	,,	Petilia	Stoll.	Australia.	1790.	Pap. Exot. pl. xxviii. f. 3.
21.	,,	Plexaure	Godt.	Brazil.	1819.	Enc. Méth. ix. p. 184.
22.	,,	Plexippus	Linn.	N. India; China.	1767.	Syst. Nat. ii. p. 767.
23.	,,	Philene	Cramer.	Java; Amboyna.	1782.	Pap. Exot. iv. pl. ccclxxv. f. A, B.
24.	,,	Nubila	Butler.	Gilolo.	1866.	Zool. Proc. pt. ii. p. 171.
25.	,,	Artenice	Cramer.	Java.	1782.	Pap. Exot. iv. pl. ccclxxv. f. C, D.

26.	,,	Mytilene	Felder.	Batchian; Dory.	1860.	Wien. Ent. Monatchr. iv. p. 232.
27.	,,	Chionippe	Hübn.	——— ?	1806-27.	Samml. Exot. Schmett. ii. pl. 6.
28.	,,	Affinis	Fabric.	Amboyna; Borneo	1793.	Ent. Syst. iii. pt. 1, p. 58.
29.	,,	Fulgurata	Butler.	Celebes.	1866.	Zool. Proc. pt. 1, p. 48.
30.	,,	Abigar	Eschsch.	——— ?	1830.	Kotzeb. Reise um die Welt.
31.	,,	Nesippus	Felder.	Sambelong.	1863.	Cat. Nov. Voy. p. 486, n. 123.
32.	,,	Conspicua	Butler.	Celebes.	1866.	Zool. Proc. pt. 1, p. 49.
33.		Melanippus	Cramer.	India; Sumatra; Java.	1779.	Pap. Exot. ii. pl. cxxvii. f. A, B.
34.	,,	Hegesippus	,,	Java.	1779.	,, pl. clxxx. f. A.
35.	,,	Lotis	,,	Amboyna; Borneo; Philippines.	1782.	,, iii. pl. ccxx. f. D, E.
36.	,,	Ismare	,,	Amboyna; N. Ceram.	1782.	,, pl. cclxxix. f. E, F.
37.	,,	Sobrina	Boisd.	New Guinea.	1832.	Faune de l'Océanie, ix. p. 103.
38.	,,	Similis	Linn.	China; Java; N. India.	1758.	Syst. Nat. i. p. 479.
		Var. Melissa	Doubl.	Singapore; North India.	1843.	List Lep. Brit. Mus. pt. 1, p. 49.
		Var. Chinensis	Felder.	China.	1863.	Cat. Nov. Voy. p. 486.
39.	,,	Meganira	Godt.	Java; Ceram; Philippines.	1819.	Enc. Méth. ix. p. 192.
40.	,,	Juventa	Cramer.	Oceania.	1782.	Pap. Exot. ii. pl. clxx.
41.	,,	Melissa	,,	Java; N. India.	1782.	,, iv. pl. ccclxxvii. f. C, D.
42.	,,	Limniacæ	,,	,, ,,	1775.	,, i. pl. lix.
		Var.	Butler.	Borneo.	1866.	Zool. Proc. pt. 1, p. 51.
		Var. Hamata	M'Leay.	Australia.	1827.	King's Surv. of Australia, ii. App. p. 10.
43.	,,	Leonora	Butler.	Angola.	1866.	Zool. Proc. pt. 1, p. 51.
44.	,,	Leopardus	,,	India.	1866.	,, ,, p. 52.
45.	,,	Australis	Blanch.	Raffles Bay.	?	Voy. au Pôle Sud, p. 388, pl. 2.
46.	,,	Choaspes	Butler.	Celebes.	1866.	Zool. Proc. pt. 1, p. 52.
47.	,,	Purpurata	,,	New Guinea.	1866.	,, ,,
48.	,,	Fumata	,,	Ceylon.	1866.	,, ,, p. 53.

Fam. Danaidæ. Genus 2. Danais—*continued.*

	Name of Species.	Author.	Locality.	Date.	Typical Description.
49.	Danais Phyle	Felder.	Philippines.	1863.	Wien. Ent. Monatschr. vii. p. 105.
50.	„ Luzonensis, *var.*?	„	„	1863.	„ „ „ p. 106, n. 61.
51.	„ Aglea	Cramer.	Java.	1782.	Pap. Exot. iv. pl. ccclxxvii. f. E.
52.	„ Agleoides	Felder.	Malayan Peninsula.	1860.	Wien. Ent. Monatschr. iv. p. 398.
53.	„ Ceylanica	„	Ceylon.	1863.	Cat. Nov. Voy. p. 479, n. 90.
54.	„ Grammica	Boisd.	Java.	1836.	Spéc. Gen. Lep. i. t. 11, f. 10.
55.	„ Melaneus	Cramer.	Java; China; Penang.	1775.	Pap. Exot. i. pl. xxx. f. B.
56.	„ Tytia	G. R. Gray.	N. India.	1846.	Lep. Ins. Nep. p. 9, t. 9, f. 2.
57.	„ Albata	Zinck. Som.	Java.	1831.	Nov. Act. Acad. Cur. xv. t. 16.
58.	„ Œnone	Butler.	Philippines.	1865-66.	Zool. Proc. p. 433, pl. xxv. (1865); p. 56 (1866).
59.	„ Vitrina	Felder.	„	1861.	Wien. Ent. Monatschr. p. 300.
60.	„ Gloriola	Butler.	Aru Islands.	1866.	Zool. Proc. pt. 1, p. 56.
	„ *Var.* ♀	„	Ké Island.	1866.	„ „ p. 57.
61.	„ Crocea	„	Java; India; Borneo.	1866.	„ „ „
62.	„ Philomela	Zink. Som.	Java; Nepaul.	1831.	Nov. Act. Acad. Cur. xv. t. 16.
63.	„ Cleona	Cramer.	Java; N. India; Borneo; Moluccas.	1782.	Pap. Exot. iv. t. ccclxxvii. f. F.
64.	„ Lutescens	Butler.	Ceram; Bouru.	1866.	Zool. Proc. pt. ii. p. 172.
65.	„ Pumila	Boisd.	New Caledonia.	1832.	Faune de l'Océanie, p. 107, pl. 3.
66.	„ Inuncta	Butler.	Waigiou.	1865-66.	Zool. Proc. p. 481 (65); p. 58, pl. iv (66).
67.	„ Chloris	Felder.	Celebes.	1860.	Wien. Ent. Monatschr. iv. p. 231.
68.	„ Vitrea	Blanch.	New Guinea; Celebes.	1853.	Voy. au Pôle Sud, p. 385, pl. 2.

69.	„ Anapis	Felder.	Philippines.	1861.	Wien. Ent. Monatschr. v. p. 300.
70.	„ Gaura	Horsf.	Java.	1829.	Coll. Lep. Mus. E. I. C. t. 6, f. 1.
71.	„ Daos	Boisd.	Singapore; Penang.	1836.	Sp. Gén. Lep. i. pl. 24.
72.	„ Hermippus	Felder.	New Grenada.	1867 (?)	Nov. Voy. ii. p. 348, n. 485.
73.	„ Larissa	„	Java, N.	1867 (?)	„ p. 349, n. 488.

The following species are described elsewhere :—

Name of Species.	Author.	Typical Description.	Locality.	
Danais Leucoglene	Felder.	Nov. Voy. p. 347, n. 485, tab. xliii. f. 2.	Celebes.	= Conspicua, *Butler.*
„ Taprobana	„	„ p. 349, n. 487, tab. xlii f. 4.	Ceylon.	= Fumata, *Butler.*
„ Neptunia	„	„ „ n. 489, tab. xliii. f. 1.	Figi Islands.	= Hamata, *M'Leay.*
„ Citrina	„	„ p. 350, n. 491, tab. xlii. fs. 5-7.	Ké Island.	= Gloriola, *Butler.*
„ Phaestis	„	„ p. 351, n. 493, tab. xliii. f. 5.	Waigiou.	= Inuncta, *Butler.*

Genus 3. Hestia.

	Name of Species.	Author.	Locality.	Date.	Typical Description.
1.	Hestia { Idea	Linn.	Amboyna; Ceram.	1749.	Amœn. Acad. 6, 405.
2.	„ { Aza	Boisd.	Bouru.	1832.	Faune de l'Océanie, p. 107, pl. 3.
3.	„ { Blanchardii ..	Marchal.	Borneo; Celebes.	1845.	Revue Zool. p. 168.

Fam. Danaidæ. Genus 3. Hestia—*continued.*

	Name of Species.	Author.	Locality.	Date.	Typical Description.
4.	Hestia D'Urvillei	Boisd.	New Guinea.	1832.	Faune de l'Océanie, p. 107, pl. 3.
5.	„ Leuconoë	Erichs.	Philippines; Borneo.	1834.	Nov. Act. Acad. Cur. xvi. p. 283.
6.	„ Clara................	Butler.	Java ?	1867.	Sp. nov. *ante*, p. 469.
7.	„ Belia................	Westw.	Java.	1848.	Cab. Orient. Ent. p. 75, pl. 37.
8.	„ Hypermnestra	„	Borneo.	1848.	„ „ „
	Var.	Van der Hoev.	—— ?	1860.	Tijdschr. voor Ent. p. 43.
9.	„ Jasonia	Westw.	Ceylon.	1848.	Cab. Orient. Ent. p. 87, pl. 42.
	Var.	Butler.	Ceylon.	1867.	*Ante*, p. 470.
10.	„ Agamarschana..........	Felder.	Andaman Islands.	1867 ?	Nov. Voy. ii. p. 351, n. 495; t. xliii. f. 1.
11.	„ Lynceus	Drury.	Penang; Sumatra.	1773.	Ill. ii. t. 7, f. 1.
	Var. Idea	Stoll.	Borneo.	1791.	Suppl. Pap. Ex. pl. 42, f. 1.
	Var. Idea	Hewits.	Malacca.	1847.	Gen. Diurn. Lepid. pl. 13, f. 1.

XVI. *On some Variations observed in* Bombyx Cynthia, *in* 1866. By Alexander Wallace, M.D, M.R.C.P.

[Read February 4, 1867.]

During the summer of 1866 I bred over 4,000 specimens of *Bombyx Cynthia.* My first specimen came out on May 30th when the weather was temperate, about 55°—60° F. during the day: the last one emerged on August 8th: there was thus a period of seventy-one days between the first and last emergence.

The cocoons were strung up in chaplets of fifty each, and suspended round the walls of a room which had an eastern aspect. Hence the sunshine fell during a portion of the day on some only of the cocoons. When the moths appeared, I noticed that the darkest and richest coloured specimens were invariably on the west wall, especially in the angle of the room which was the most remote from the light; one portion of cocoons, however, which had been allowed to retain their leafy covering produced the darkest specimens, whereas all the other cocoons had been denuded as far as possible of their leafy envelope. Hence I came to the conclusion that shade, during the pupa stage, is *cæteris paribus* most favourable to the production of the darker tints, whereas sunshine tends to diminish the intensity of coloration. The larvæ which had spun their cocoons were freely exposed to the sunshine in 1865, being fed in the open air on a plantation of Ailanthus trees on a railway bank near Colchester.

Another observation on coloration I was also able to make, that the earliest bred specimens were of a predominant olive-green ground-colour, whereas the later bred, and especially those that escaped from pupæ in September, not having passed a winter in cocoon, were of a predominant yellow tint. Specimens of these tints are brought for exhibition. The three first males in the box are of the dark summer hue, and the fourth is a later and lighter tinted specimen. Exceptions of course occur to this rule, but they are very few. It is hardly necessary to observe, that these tints closely resembled the shades of the Ailanthus leaflets, which assume a yellower tint as the season advances and the leaflets grow older.

Some specimens, bred late in the season, were small and evidently weakly; their coloration was very deficient. No. 5 is a specimen. These were greatly deficient in vigour, and if able to effect copulation and fertilize eggs, their progeny would doubtless be a very feeble race, whereas the richly-coloured specimens were very vigorous and wild, and produced healthy and fine offspring.

There are two specimens fed one on plum and the other on laburnum, both defective in size and coloration, and evidently weakened by an unnatural diet.

But the most curious specimens are the dwarfs. These were from the cocoons of a second brood, which were fed later in the autumn, after the Ailanthus leaves had failed, on celery leaves, indoors. They are very diminutive in size, some only measuring 3 inches in expanse, whereas the finer specimens measure some 6 inches from tip to tip; the dwarfs are also deficient in depth of coloration, their markings are less clearly defined, the shape of the wings is rounder and blunter at the tip, and the abdomen is covered with white prominent tufts. But what seemed to me the most singular point about them is, that although they spun up several months after the first brood, they were the first to emerge. On the 30th May a ♂ emerged from the small cocoons strung up; this was so unexpected, that I had failed to examine for several days some baskets wherein other small cocoons of the second brood had been placed; on searching in them I found another ♂ out, rather worn. On June 1st two ♀ emerged of the first brood; on the 2nd, one ♂ emerged of the first brood and three of the second brood; and so on, the dwarfs coming out rapidly.

I believe this will throw some light on the question of the prior appearance of males or females. It seems to me that in proportion as the individual is finer, so the time required for its metamorphosis is longer; and for this reason the female, which is the larger and heavier insect, from having to carry her numerous eggs, will be preceded by the male, which is smaller and has less to mature. Thus the dwarfs, carrying few eggs and those small, required less time for their metamorphosis and appeared as early as their uncles and aunts. If this idea be correct, and it has been suggested to me by the observations made on *Bombyx Cynthia*, and also on *B. Yamamai*, it will follow that, though we may as a rule expect the male to emerge first, there must be frequent exceptions, as, for instance, a half-starved female would precede a well-developed male, a stunted second brood would run a race with a full-fed first brood, and this will, to a certain extent, explain the difference in observations made on the same species by different observers.

This point, priority of appearance, is of considerable consequence in the culture of silkworms: the cultivators of *Bombyx Mori* use every endeavour to obtain the different moults and changes passed by all their stock on the same day. Hence if any linger behind they are thrown away, if any precede the others they are also got rid of; though it is confessed that they are the strongest and most vigorous worms. Hence as a result of this interference the cocoons are all spun up together, and the moths emerge on the same day; but this is the result of domestication and human manipulation, and the habit has been artificially induced by rejecting all those individuals that will not conform to it; but the same uniformity is not observed in the wild races. Thus in the case of *Bombyx Yamamai*, we find M. Personnat, in his book on that species, writing that the habit of the *Yamamai* is for the males to precede the females, so that males at the beginning of the season and females at the end are lost from want of mates. To prevent this, it is desirable to retard those which first change to pupæ, and to hasten the later ones, so as to equalize the interval; this is effected by placing the first cocoons in a cool, and the later ones in a warm place. M. Chavannes recommends only to retard the males, which have a propensity to emerge first: taking 100 cocoons and weighing them and dividing by 100 he ascertains the mean weight of a single cocoon; those that exceed the mean weight are females, those that fall short of it are males. Elsewhere M. Personnat declares that he can separate the male from the female larvæ after the last moult, by observing those which grow the fastest and eat the most; these he declares are males, and will spin up first; he proposes to retard these by giving them a somewhat scantier diet, and to hasten the others by supplying them with an abundance of fresh food; and thus he expects to equalize the time of spinning.

Now with regard to *B. Cynthia,* it must be borne in mind, that of the cocoons gathered in any year some at least give their moths in the autumn of the same year; these then are the earliest born of the brood. My first experience in the autumn of 1863 was with about twenty pupæ of *B. Cynthia;* of these two larvæ had been left at a higher temperature than the rest; these both spun up on the same day and emerged on the same day, and being of different sexes paired together. A month later one ♀ emerged; the rest passed the winter in pupa. In 1864, June 4th, one ♂ emerged from the cocoons of a late brood obtained from eggs from Paris in the autumn of 1863; on the 10th, a ♀; the 11th, a ♂; the 12th, a ♀; the 13th, a ♀; the 14th, a ♀; the 15th, two ♀; the 16th, two ♀; the 17th, two ♀; the 18th, four out, some were males. It was not till the 11th July* that one ♂ and one ♀ of the first brood appeared. In that autumn (Oct. 8th) a ♂ emerged from a cocoon spun in the summer in the open air; on the 15th, a ♂ and a ♀ emerged; on the 20th, a ♀; the 21st a ♀; the 23rd, a ♂; the 26th, a ♀, and so on. In 1865 a ♂ emerged on the 22nd May, one out of some pupæ which had been taken out of their cocoons and put to force; on the 23rd, a ♀; the 29th, a ♀; the 30th, three ♂; the 31st, a ♂; and so on. The summer of 1865 was very warm, and so on the 20th August a ♀ emerged (the cocoon was spun July 15th, thirty-six days previously); on the 21st, a ♀; on the 24th, a ♂; on the 26th eight were out; these had all been forced under glass at a high temperature during the larval and pupal states, to obtain a second brood, and in consequence were of a medium size. Of the brood placed as larvæ on trees in the open air, one ♂ emerged September 24th; on the 26th, six emerged; on the 28th, six more emerged; and so on; but I have not noted when so many emerged whether the males or females preponderated. In 1866, as before stated, the first two emerged (both males) on May 30th, being stunted specimens of the second brood; on June 1st, two ♀ emerged of the first brood; on the 2nd, two ♂; and about the 10th they began to burst out in quantities. In the autumn, November 7th and 8th, one ♂ emerged on each day; both these were medium-sized specimens. The emergence therefore of the ♂ first is as four to two. I may add, that invariably at the commencement of the burst the males largely preponderated in number over the females, while towards the end the reverse was the case. The conclusion, therefore, from these observations that I have come to is, that

* The first brood were from eggs sent to me by Lady Dorothy Neville, and having been for several years acclimatized in England, had become accustomed to one generation annually, and were by far the largest insects; the Paris brood were accustomed to two or three generations annually, according to temperature, and produced a smaller insect. Hence it is not possible to compare these two races together, as their antecedents were widely different.

cæteris paribus the smallest individuals emerge first, and that these are generally males.

I proceed now to make a few remarks on the specimens exhibited. The first two are fine ♀, measuring a little over 6 inches in expanse. No. 3 is a not uncommon variety, partially variegated with a tawny tint. No. 4 is a very fine male, measuring over 5 inches. Nos. 5 and 6 are splendid dark ♂ varieties of early summer. No. 7 is a tawny autumnal tinted specimen. No. 8, a ♂, deficient in size, tint and coloration, and during life was weakly; it emerged late, and the larva had probably been injured or was unhealthy. Nos. 9, 10, 11, 12, are remarkable for the variation in the colour of the tufts on their bodies, the two latter having very large tufts, so as almost to be called woolly. No. 13 is a ♀, remarkable for the rich olive-brown ground-colour. In this variety the wings seldom attain the full size of specimens Nos. 1 and 2. Two dwarfs of the stunted half-starved second brood of 1865 complete the series in that half of the box. These are remarkable for their small size (3 inches expanse) and their deficiency in coloration.

In the lid of the box we have Nos. 1, 2, 3, three ♂, remarkable for their white-tufted bodies and small size; No. 4, a small ♀ fed on laburnum, deficient in size and ground coloration; No. 5, a ♀ fed on plum, rather larger and better coloured, but in both respects rather below the average. Nos. 6 and 7 are remarkable for a broad black band across the dorsum of the abdomen, near its junction with the thorax. In No. 7, as also in Nos. 8, 9 and 10, a spot, or an approach to a spot, occurs at the inner aspect of the lunule of the upper wing. In Nos. 11, 12, 14 and 15 a similar curiosity is seen, the most marked in the last; this is caused evidently by the white marks approximating somewhat more closely than in the normally marked specimens; hence the space between the white lines is smaller, and instead of a patch we get a spot, more or less small. Nos. 12 and 13 are remarkable for having their upper wings not fully developed, one being on the left, the other on the right: a great many specimens were noted as presenting this appearance, and it was found to proceed from a want of space to extend the wing: if any contiguous object, either a cocoon or the wing of another insect, prevented the expanding wing from attaining its full dimensions by the resistance which was offered, the wing so opposed remained imperfectly developed, whilst the other wings attained their natural size. Nos. 16 and 17 are two ♀ dwarfs. Nos. 19, 20, 21 and 22 are dwarfs, having bodies more or less tufted with white, and wings with the coloration blurred, or less distinct than in the normal insect. Nos. 18 and 23 are specimens of the most vigorous and healthy dwarfs.

With these specimens before us, it is evident that great variation occurs in this species, dependent on food-plant, temperature, season of the year, and influence of light. It varies greatly in size and in coloration.

The question may be asked, Are *Bombyx Cynthia* and *B. Ricini* distinct species? There is also a third species or variety, *B. Guerinii*, described in Mr. Fred. Moore's Catalogue from a few specimens extant; but until we have many more examples of this insect sent over, with a description of the larva, showing that it differs from that of *B. Cynthia*, I should be inclined to believe it only a variety of that insect; for I can, I think, produce varieties of the latter, possessing some or all the traits of *B. Guerinii*, except the entire suppression of the lunule, and I expect some day to witness that among my dwarfs. Again, the differences recorded between *Ricini* and *Cynthia*, according to Mons. Guérin-Méneville, are as follows:—

1. "The egg of the true *Cynthia* is white, but its shell is covered with little brown or black particles of gum, which give it a spotted look. That of *Ricini* is entirely white, is smaller, and less heavy."

2. "The caterpillar of *Cynthia* has on each segment four black spots, and when full grown is of a beautiful emerald-green, with its head, claspers and the last segment beautifully marked with yellow. That of *Ricini* has no spots, and is uniformly of a pale azure."

3. "The cocoon of *Cynthia* is naturally of a hempen-grey colour; that of *Ricini* of a vivid red, and weighs less." (Yet I have had many cocoons of *Cynthia*, especially of the earlier and later growth, or if fed on other than Ailanthus leaves, and therefore not maturely developed, more or less of a rusty-red colour.)

4. "The imago of *Cynthia* is larger, its abdomen is yellow above, having little white separate tufts of scales. The large transverse white line beyond the middle of the wings is bordered externally by a broad rosy band. The transparent lunule in the four wings is greater, and the brown space above the lunules in the upper wings is much longer (often twice or thrice) than it is broad. In *Ricini* the belly is entirely white, instead of being rosy the transverse band is of a dull grey, the lunules are shorter, and the brown space above in the upper wings is shorter, hardly as long as it is broad. In order to complete the comparison, *Cynthia* has but

two generations in the year, and passes the winter inactive in cocoon: *Ricini* has from seven to twelve broods, and is in a state of constant reproduction, winter as well as summer."

All these differences summed up give to *Ricini* a smaller size than *Cynthia*, a suppression of coloration in the egg, larva and imago, some difference in the cocoon, an absence of spots in the larva of *Ricini* which are present in that of *Cynthia*, and a blurredness of marking in the imago, with the presence of numerous white woolly tufts on the abdomen. These two latter characteristics, together with a deficiency in size and an absence of coloration, have been exhibited in the varieties of *B. Cynthia* bred by me. Two other chief characteristics are, 1st, a difference in the cocoon, which is much more woolly in *Ricini*, harder and closer in *Cynthia;* but this is due to the presence of more gum (and that may be due to the influence of the food-plant) in the cocoon of *Cynthia*, which enables the larva to bind the threads down more closely; 2ndly, the absence of black dots in the larva of *Ricini* which are present in *Cynthia;* but unless some other stronger evidence is brought forward to show that the larvæ differ, I cannot admit that dermoid differences, which are the least of all to be depended upon in differentiating species, can alone constitute *Ricini* distinct from *Cynthia*.* As to the alleged habit of *B. Ricini* breeding five or eight times annually, or oftener, in Bengal, and *B. Cynthia* only once in Assam, England, &c, we have this fact, that in 1865, in Paris, there were four generations of *B. Cynthia*, which proved that under a suitable temperature that insect is, like *B. Ricini*, many-brooded. Looking to the habitat of *B. Ricini*, Bengal, and its food-plant, *Ricinus*, I see no ground for separating the species; I

* The more especially as, on referring to Mr. Moore's "Synopsis of Asiatic Silk-producing Moths," I find it stated, p. 32, that, according to Mr. Hugon, see "Journal A. S. Bengal," vi. pp. 23, 24, the caterpillar of the *Eria*, which is the local name for the *Bombyx Ricini*, "in a domesticated state in Assam, as it increases in size, becomes of an orange colour, with six black spots on each of the segments; after the second moult the colour of the body becomes lighter; in some approaching to white; in others to green, and the black spots gradually become of the colour of the body; after the fourth moult the colour is a dirty white or a dark-green; the white caterpillars invariably spin red silk, the green ones white. The *Eria* feeds on the *Ricinus communis*, and gives twelve broods in the year." If, then, we have a history of spots apparent at birth suppressed after an interval, the argument that *Cynthia* and *Ricini* larvæ are distinct, because the one has spots and the other has not, becomes considerably weakened. Again, M. Personnat states that larvæ of *B. Yamamai*, fresh from Japan, are flecked laterally with silver spots, whereas, when naturalized in France, they lose all metallic tint.

would rather, therefore, consider these as local varieties of *Cynthia*. Had the variety *Ricini*, perfecting its changes rapidly under a hot, moist climate, been larger and finer—had the coloration been more distinct, the markings more defined—I should have viewed the insect as a distinct species; but I regard size, intensity of coloration, distinctness of the markings, as clear evidence of abundant vitality—and this is corroborated by Capt. Hutton's views on the *B. Mori*, who states that the *vers zébrés*, or dark worms, are the healthiest and strongest individuals (*vide* Capt. Hutton on the Reversion and Restoration of the Silkworm, Trans. Ent. Soc. 3rd ser. vol. ii.) I must necessarily regard the converse, *i. e.*, smallness of size, blanched coloration, blurredness or indistinctness of markings, as indicative of diminished vitality; and these latter indications are precisely what I find in the specimens of *Ricini* and *Guerinii*.

Three other points I mention, in conclusion:—First. That in looking over the empty cocoons in the autumn of 1866, I found about twenty large living pupæ which had not hatched, and which, I suppose, are laying over to emerge in 1867.

Secondly. That a sound was frequently observed to proceed from the eggs, a sort of click, a single sound; this was generally in the second week, and I have been informed that a similar click had been observed to be emitted by the eggs of the Emperor moth. I attributed it to the parchment-like shell being pressed out with a spring by the effort of the larva within, and its returning to the concave form. This little creaking or clicking sound was very frequently heard by me, often daily every minute, while sitting writing at my desk in the same room with the eggs.

Thirdly. In two instances males at liberty paired with females put out to attract them at two miles distance from my house; and I found a worn female in my Ailanthery on the railway bank, resting by day on an Ailanthus tree.

XVII. *Notes on the Genus* Raphidia. *By* Dr. H. A. Hagen. (*Translated from the French, by* R. M'Lachlan, F.L.S.)

[Read 4th March, 1867.]

1. *Raphidia Schneiderii*, Ratzeburg.

The following description is made from a type (♀) communicated by Ratzeburg. The species is certainly good. In the form of the head it is intermediate between *R. xanthostigma* and *R. affinis;* in other respects, between *R. cognata* and *R. media.*

Head elongate-oval, as long again as broad; slightly contracted behind the eyes, the sides forming elongated curves; the neck short and contracted before the end; eyes larger and more prominent than in *R. xanthostigma.* The head is almost similar to that of *R. affinis*, but the sides are more strongly curved; above more convex, somewhat depressed beyond the eyes. Palpi yellowish; upper lip very small, yellowish; clypeus large, striated transversely, yellow, brownish at the base; the colour of the head shining black; the part between the eyes convex, rather strongly punctured, especially the transverse impressions situated behind the eyes; the points fewer on the sides towards the neck, absent in the middle, where there is a large smooth band running almost up to the transverse impressions. Ocelli approximating. The whole of the inferior surface of the head strongly punctured. Antennæ yellow; their apical half gradually brownish. Prothorax as long as the head; somewhat contracted and depressed a little before the middle; widened and inflated a little before the end; broadly yellowish at the sides, with short black hairs; narrowly bordered with yellow at the base and apex; above shining brownish-black, striated transversely, rugose; a narrow reddish band on the inflated portion; two reddish spots on the sides; beyond the middle is an appearance of reddish spots. Meso- and meta-thorax shining brownish-black, marked with yellow in the middle in front. Abdomen brown, the tips of the segments bordered with yellow; oviduct as long as the abdomen; the last ventral segment with its apical border rounded (fig. 3, *post*, p.

499). Legs yellowish-brown; femora above (the posterior altogether), and the tarsi, brown. Wings broad, oval; neuration clear yellow; 9 antecubital nervules, 4 discoidal areoles; pterostigma long, narrow, four times as long as broad, with one transverse veinlet in the middle; inner side nearly straight, outer somewhat oblique; the areole below the pterostigma exactly its length, pentagonal, commencing at the same point, or slightly later.

Length, wings included, 15 millimétres; of the upper wings, 10½ mill.

The female above described has perhaps not altogether attained its full coloration; but it is a good species, of almost the size of *R. affinis*, with which it cannot be confounded. It differs from *R. xanthostigma* by its size, and by the head being more convex and more inflated posteriorly, but the pterostigma is similar. *R. cognata* is smaller, has the head broader and shorter posteriorly, and has only three discoidal areoles. It is to be remarked that in Schneider's figure of *xanthostigma* the form of the head is incorrect, and applies better to *Schneiderii*.

2. *Raphidia ophiopsis*.

The insects described under this name by De Geer, Schummel, Schneider, Rambur and Ratzeburg (according to his type) are identical.

The colour, the form and largeness of the pterostigma, and the areole below it, are very remarkable and easily recognizable. In Rambur's type the pterostigma is clearer, not mature. The form of the areole below the pterostigma is variable according to Schneider. Zetterstedt's type of this name in my collection is *R. media*.

Male.—Penultimate abdominal segment as long again as broad; above with a narrow triangular excision in the apical half; beneath with the basal half inflated, split longitudinally to admit of the insertion of the penis, which is long, brown, slightly flattened, and divided beneath: the apical half of this segment is excised, so that nothing remains of it but the lateral borders, prolonged at the apex for the insertion of a long moveable crotchet, which is acute, black, curved upwardly, and covered by the last segment; this segment is entirely open above, rather short, very broad, triangular when viewed from the side, and elongated laterally into an obtuse point, with a sort of V-shaped crest.

Female.—With the last ventral segment excised at the middle, widened at the sides, with a tuft of hairs (fig. 1, *post*, p. 499).

3. *Raphidia media*, Burm.

R. media of Schneider and Rambur are identical according to the types.

12 to 15 antecubitals, and usually 5 discoidal areoles, marginal veins almost all twice-forked; areole beneath the pterostigma as in *R. notata*. *R. angustata* of Ratzeburg belongs here, according to a type.

Male.—Penultimate abdominal segment very short, the parts inserted beneath larger, very strong, triangular when viewed from the side, cylindrical and straight when viewed from beneath, the apex obtuse, with a little curved tooth within, two brown crotchets above before the apex; penis stout, black, convex above, triangular at the sides.

Female.—Last ventral segment slight, produced at the apex, truncated obliquely at the apex if viewed from the side.

4. *Raphidia xanthostigma*, Schummel.

Schneider, after an examination of the type of Rambur's *cognata*, of which the head is wanting, thought that species identical, probably erroneously, for he did not examine the genitals. The wings of *R. xanthostigma* are larger and more rounded than in *bætica* and *hispanica*. The areole below the pterostigma begins and ends at the same points as the pterostigma, and only by exception begins later or sooner; the subcosta finishes always very slightly before the pterostigma in the costa; the second vein in the posterior wing is not simply furcate, but one branch is again forked. *R. chalybocephala*, Ratzeburg, seems to be identical, according to the type.

Male.—Penultimate segment half as long again as broad, above with a very short apical excision, beneath broadly divided for the insertion of the penis, which is brown, slightly shorter than the segment, canaliculated, rounded at the apex; the sides of the segment rounded at the apex above and in the middle of their border, with a brown, acute, slightly-curved crotchet, scarcely longer than the segment. Terminal segment yellow at the apex, broader than long, open beneath, forming a quadrangular lobe when viewed laterally.

Female.—Last ventral segment quadrangular, truncated at the apex (fig. 2, *post*, p. 499).

5. *Raphidia affinis.*

According to Schneider the areole beneath the pterostigma is variable; it resembles *R. ophiopsis*, but the lower part of the outer side is different; the subcosta ends a little later on in the costa than in *ophiopsis*.

Male.—Penultimate segment very short, the inferior parts beneath very strong, triangular, large, truncated at the apex, with a small crotchet; penis large, canaliculated beneath, curved upwards. Last segment nearly absent, in form of a small border situated on the penultimate segment, recurved and open.

Female.—Last ventral segment produced at the apex, with the apical border ovoid.

6. *Raphidia bætica.*

The exact description of Rambur's type is given by Schneider in the Stett. Ent. Zeit. 1845, p. 253. The males of this and *R. hispanica* are not in my collection.

7. *Raphidia hispanica.*

According to Schneider this resembles *R. xanthostigma*, but differs by the broader head with the sides more rounded before the neck, a band and spots before the antennæ, red; ocelli equal; bifid spots by the side of the ocelli, and three bands on the prothorax posteriorly; wings very narrow, subcosta ending in the costa further from the pterostigma; the areole beneath commencing one half of its length before the pterostigma and ending in its middle, pentagonal, irregular; the first marginal vein starting from the end of the inferior side of the pterostigma.

8. *Raphidia notata.*

According to Schneider very similar to *R. media*, but with only 10 to 11 (rarely 13) antecubital nervules; 4 discoidal areoles, and the marginal veins simply forked; head more suddenly rounded behind; the areole below the pterostigma as in *R. major*. The types of *R. notata*, Ratzeburg, and *R. major*, Ratzeburg, are identical, and both *R. notata*.

Male.—The only male example known to me is not in a condition for a good examination of the anal parts; they seem analogous to those of *R. ophiopsis;* the last segment rather small.

Female.—Last ventral segment with a small circular excision in the middle of the apex.

9. *Raphidia corsica*, Hagen, (n. sp.).

Male.—Similar to *R. xanthostigma.* Penultimate abdominal segment with the sides elongate elliptical, the crotchet short;

last segment shorter than broad, rounded and elongate when viewed from above, triangular when viewed from the side.

Female.—Similar to *R. xanthostigma.*

10. *Raphidia taurica*, Hagen, (n. sp.).

Male.—Similar to *R. ophiopsis;* the triangular excision in the penultimate segment above broad, shorter; penis triangular, broad at the base, plain beneath; crotchets yellow, very large, almost longer than the last segment; the latter a little longer than broad, apical margin rounded, quadrangular when viewed from the side, with the apical margin obliquely excised.

11. *Raphidia armeniaca*, Hagen, (n. sp.).

Male.—Similar to *R. taurica;* the penis more elongate, narrower at the base; crotchets brown, shorter and stronger; last segment rounded when viewed from the side.

12. *Raphidia cognata*, Rambur.

Male.—Penultimate segment broader than long, scarcely excised at the apex above; sides excised at the apex, with a triangular plate inserted in the excision, ending internally in a black crotchet, curved upwards, short, stout at the base, and concealed under the last segment; still further inwards are two other crotchets, short, strongly inflated at the base, black; between these is the penis, which is somewhat cordate at the base, with an impressed line in the middle, canaliculated and narrow in the apical half; last segment as long as the preceding one, ovoid when viewed from the side, triangular when viewed from beneath, the margins rolled inwards.

Female.—Last ventral segment prolonged in the middle, with the apical border rounded.

13. *Raphidia bavarica*, Hagen, (n. sp.).

Male.—Penultimate segment much more elongated beneath than above, twice as long as broad; otherwise the arrangement is similar to *R. cognata.* The inserted plate larger and more elongate, with the crotchet shorter and black; the interior crotchets longer, brown, slender, curved inwardly at the apex, almost covered externally by membrane; penis narrow, slightly longer than the crotchets; last segment very small and short, with the border straightly cut when viewed from the side; beneath at the base with two black crotchets, curved downwards and backwards, and seeming to pertain to the articulation between the two segments.

14. *Raphidia cypricа*, Hagen, (n. sp.).

Male.—Penultimate segment almost as long as broad, greatly narrowed towards the apex, open beneath, the lateral border thickened at the base, pyriform; from each side an elongated thickened part, at the apex with a small crotchet concealed in the last segment; between these two parts an oval space showing the penis, which is broad and somewhat convex beneath; last segment small and short, almost cylindrical, split above, and cut obliquely at the apex.

Female.—Last ventral segment quadrangular, cut straightly at the apex, which is slightly inflated.

15. *Raphidia major.*

Female.—Similar to *R. media.*

Schneider, after having examined Ratzeburg's types, was not sure of their specific right; for my part, I remark only that my two females are very large, but I am not sure of their correct determination.

16. *Raphidia adnixa.*

17. *Raphidia oblita.*

The males of both these species have the parts analogous to *R. media.*

18. *Raphidia* (*Inocellia*) *crassicornis.*

Ratzeburg's and Schneider's types are identical.

As a rule it may be said that there are three types in the forms of the genital parts.

1. *R. ophiopsis*, varied and repeated in *xanthostigma*, *corsica*, *taurica*, *armeniaca* and *notata.*
2. *R. cognata*, repeated in *bavarica.*
3. *R. media*, varied and repeated in *affinis*, *cyprica*, *adnixa* and *oblita.*

In the female of *R. notata* the parts are altogether extraordinary.

It is very certain that the following European species are distinct, namely, *R. ophiopsis*, *xanthostigma*, *affinis*, *cognata*, *bavarica*, *corsica*, *media*, *notata*, *crassicornis*, and probably *Schneiderii*, (though this last may possibly be identical with *cognata*). *R. hispanica*, *bœtica*, and *major*, remain to be proved.

No species of *Raphidia* has been yet discovered in Africa, New Holland, Oceania, tropical Asia, or South America? (I think there is perhaps a species from Brazil in the Berlin Museum.)

Professor Ratzeburg wrote to me in 1851 on the unusual habit of the larva of a *Raphidia.* When collecting larvæ in moss in a pine-forest near Neustadt Eberswald, (probably in August or September,) he found cocoons of *Lophyrus pini* still intact and without the perforations of parasites. He opened several with a knife and found in one of them the larva of a *Raphidia.* It was very young, and 3 lines long. It seemed as if it had fed on a larva of *Lophyrus,* of which there was nothing more than the head in the cocoon. This habitat was somewhat extraordinary, for these larvæ live generally free under bark. Apparently the egg had been accidentally placed in the cocoon, or the larva had entered when newly emerged at the time the sawfly larva was finishing it, and was afterwards unable to escape; for we cannot presume that the parent *Raphidia* had placed the egg there intentionally.

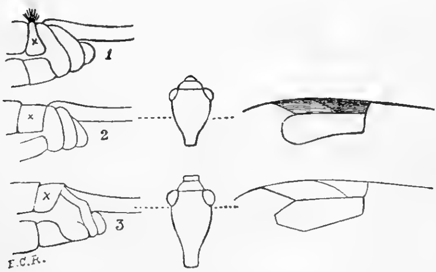


Fig. 1. *Raphidia ophiopsis,* ♀, terminal segment of abdomen.
2. *R. xanthostigma,* head, pterostigma and underlying cellule; and terminal segment of abdomen, ♀.
3. *R. Schneiderii,* ditto ditto.

XVIII. *Descriptions of new Species of* Mantispidæ *in the Oxford and British Museums.* By J. O. Westwood, M.A., F.L.S., &c.

[Read 1st April, 1867.]

I beg, by way of supplement to my memoir on the *Mantispidæ* (Trans. Ent. Soc. 2nd ser. vol. i. p. 252) to offer to the Society descriptions of several new species, chiefly belonging to the curious sub-genus *Trichoscelia*, mostly collected on the Amazons by Mr. Bates, and contained in the Hopeian Collection at the Oxford Museum. I find that the species of this little group differ considerably in the thickness and setose clothing of the hind tibiæ, varying in this respect in the opposite sexes of the same species.

To these I have added several other species of *Mantispa*, two of which are in the British Museum, and a fine new species of *Nemoptera*, in the same collection.

1. Mantispa (*Trichoscelia*) Partheniella, Westw.

Fusco-fulvescens; antennis nigris, basi subtus articulisque subapicalibus fulvis; prothorace nigro, margine antico flavo; meso- et meta-noto flavo-variis; pedibus anticis flavis; coxis infra macula magna nigra, femoribus supra nigris, tibiis apice castaneis; pedibus 4 posticis brevibus, fulvis, setosis; tibiis intermediis supra castaneis, posticis crassissimis (præsertim in mare), fulvis, dimidio apicali supra nigris; alis hyalinis, venis anticarum castaneis, versus basin, ante medium et ex medio sub stigmate flavido-subfasciatis, stigmate brevi brunneo, posticarum longo fusco; cellulis obliquis 8 in alis anticis. (Mas et fœm.) (*M. Nothæ* proxima.)

Long. corp. lin. 4. Expans. alar. ant. lin. 10.

Habitat in Amazonia. D. Bates. In Mus. Oxon.

2. Mantispa (*Trichoscelia*) Eurydella, Westw.

Capite luteo, vertice fusco; antennis nigris; prothorace flavo, margine postico nigro; mesonoto nigro, nitido, postice fulvo; metanoto nigro fulvoque vario; abdomine fulvescente, segmento secundo supra flavido; coxis anticis flavis, infra (nisi ad apicem) nigris; pedibus 4 posticis fulvis, tibiis intermediis apice obscurioribus; posticis subincrassatis, nigris, hirsutis, basi flavis; alis hyalinis, anticis versus basin subfulvis, stigmate brevi castaneo, extus flavo, in alis posticis subelongato et nigricante; cellulis obliquis 6 in alis anticis; oviductu longo, recurvo. (Fœm.)

Long. corp. lin. $2\frac{1}{2}$. Expans. alar. ant. lin. 8.

Habitat in Amazonia. D. Bates. In Mus. Oxon.

3. MANTISPA (*Trichoscelia*) BELLA, Westw.

Badia; capite infra antennas fulvo; antennis fuscis, basi et articulis subapicalibus flavis; pronoti margine antico et lateribus flavis; meso- et meta-noto cum abdomine fulvo-variis; pedibus fulvis; coxis et femoribus anticis fusco-suffusis; tibiis flavis, ultra medium fuscis; tibiis 4 posticis pone medium supra fuscis, dilatatis et setosis; alis hyalinis, venis pallide fuscis, anticis ad basin marginis postici fuscis, nebulisque fulvescentibus prope basin, una ante medium, altera abbreviata sub stigmate positis; stigmate in alis anticis brevi, fulvo, apice pallido, in alis posticis longo, obscure fulvo; oviductu longo, recurvo, fulvo. (Fœm.)

Long. corp. lin. $2\frac{1}{4}$. Expans. alar. ant. lin. 7.

Habitat in Amazonia. D. Bates. In Mus. Oxon.

4. MANTISPA (*Trichoscelia*) EGELLA, Westw.

Fulva; capite cum antennis et pronoto (nisi margine postico) nigris; meso- et meta-thorace cum abdomine (apice nigro excepto) fulvis; alis hyalinis, stigmate in omnibus longo, nigro, nubila parva nigricanti ad basin stigmatis in alis anticis interdum adjecta; cellulis sex obliquis in alis anticis; venis in medio alarum anticarum nigricantibus, aliter fulvis; pedibus fulvis, tibiis 2 anticis subfuscescentibus, 2 posticis nigris, hirsutis, parum dilatatis. (2 ind. masc.)

Long. corp. lin. 3. Expans. alar. ant. lin. 7.

Habitat apud Egam ad ripas Amazoniæ flum. D. Bates. In Mus. Britann.

Obs.—There are two males of this species in the British Museum; they very closely resemble the unique male of *M.* (*Trich.*) *fenella* in the same collection,* but are smaller in size and paler

* In the figure of this insect given in my monograph (Trans. Ent. Soc. 2nd ser. i. 269, pl. xviii. fig. 7), the hind tibiæ are represented too robust.

in colour. There is a female of *fenella* in the Hopeian Collection.

5. Mantispa (*Trichoscelia*) sequella, Westw.

Capite valde convexo, badio; antennis nigris; prothorace brunneo, lateribus luteis; meso- et meta-thorace supra badiis; abdomine nigro, supra flavo-cingulato; corpore subtus pedibusque luteo-fulvis; tibiis anticis et basi tibiarum quatuor posticarum obscurioribus, his parum dilatatis et setosis; alis hyalinis, venis nigris, stigmate in omnibus alis elongato, nigro; cellulis obliquis 7 in alis anticis. (Fœm.)

Long. corp. lin. $2\frac{1}{2}$. Expans. alar. ant. lin. 7.

Habitat in Amazonia. D. Bates. In Mus. Oxon.

6. Mantispa (*Trichoscelia*) fasciatella, Westw.

Læte fulva; capite nitido, antennis, tibiis omnibus (basi excepta), tarsis 4 posticis, et apice abdominis nigris; femoribus anticis serrulatis, haud spinigeris; tibiis 2 posticis (in individuo nostro unico) 2 intermediis non multo crassioribus; alis anticis pallido-fulvo tinctis, macula marginis interni ad basin alarum, fascia media apiceque late nigricantibus; cellulis obliquis discoidalibus 8; stigmate fulvescente; alis posticis pallidioribus, fere hyalinis, stigmate longo, basi fusco, apice fulvescente nubilaque apicali fusca notatis. (Fœm.)

Long. corp. lin. 4. Expans. alar. ant. lin. 11.

Habitat apud Sanctam Martham, Venezuelæ. In Mus. Oxon.

Obs.—Cum hoc insecto volat species Dipterorum e familia *Syrphidarum*, coloribus et magnitudine omnino simillima, ut vix primo intuitu distingui potest.

7. Mantispa (*Trichoscelia*) iridella, Westw.

Nigra, flavo-varia; antennis nigris; pronoto subtus lateribusque flavo-maculatis; abdomine flavescente, articulis basalibus macula nigra postica notatis, reliquis nigro supra cingulatis; alis hyalinis, valde iridescentibus; stigmate alarum omnium elongato, albido, basi nigro; cellulis obliquis in alis anticis 9; venis nigris, anticis lutescente vix variegatis; pedibus anticis obscure luteis; coxis fusco-nigris, medio femorum tibiisque obscuris; pedibus 4 posticis flavidis, tibiis (apicibus exceptis) nigricantibus, elongatis, parum dilatatis et sulcatis; oviductu luteo. (Mas et fœm.)

Long. corp. lin. 3. Expans. alar. ant. lin. $9\frac{1}{2}$.

Habitat in Amazonia. D. Bates. In Muss. Brit. et Oxon.

Obs.—The iridescence on the fore wings is tinged with purplish-copper, with green shades towards the costa.

8. MANTISPA (*Trichoscelia*) BASELLA, Westw.

M. Iridellæ magnitudine et forma simillima. Fulvo-lutescens; antennis, capitis vertice, plaga oblonga dorsali pronoti, meso- et meta-noti disco nigricantibus, hoc linea tenui angulata flava in medio dorsi; abdomine supra obscuro, segmentorum basi utrinque macula parva subtrigona lutescenti notata; pedibus omnibus cum coxis anticis fulvo-lutescentibus, femoribus anticis extus vitta tenui brunnea, tibiis 4 posticis ad basin tantum fuscescentibus; tibiis 2 anticis obscuris; alis hyalinis, cupreo et virescenti iridescentibus, stigmate elongato, luteo, ad basin fusco parum tincto; cellulis obliquis discoidalibus 8 vel 9; venis fuscis luteo-variis; tibiis 2 posticis vix dilatatis, apicibus attenuatis. (Mas.)

Long. corp. lin. 3. Expans. alar. ant. lin. $9\frac{1}{2}$.

Habitat in Amazonia. D. Bates. In Mus. Oxon.

9. MANTISPA (*Trichoscelia*) FUMOSELLA, Westw.

Nigra; antennis apice piceis; capite infra oculos fulvo; coxarum anticarum apice et femorum anticorum basi luteo subnotatis; abdomine subtus ad basin et margine tenui apicali segmentorum intermediorum flavis; tibiis 4 posticis fulvis, cum tarsis supra striola nigra notatis, in pedibus posticis elongatis, subdilatatis, subsetosis, extus canali tenui longitudinali instructis; alis pallidissime fuscis, anticis plaga magna antica fumosa, margine hyalino ad basin costæ relicto; stigmate alarum posticarum elongato, fusco; cellulis 9 vel 10 obliquis in alis anticis. (Mas.)

Long. corp. lin. 5. Expans. alar. ant. lin. 14.

Habitat in Amazonia. D. Bates. In Mus. Oxon.

10. MANTISPA HAGENELLA, Westw.

Griseo-lutea; capite fere unicolori; antennis gracilibus, luridis, articulo 2ndo nigro, articulis ultra medium nigris fascia pallida; prothoracis lateribus infuscatis, meso- et meta-noto nigricante variis; abdomine nigro, segmentis 2ndo, 5to et 6to, fulvis; pedibus fulvo-lutescentibus, anticorum coxis antice fusco-binotatis; femoribus intus longe nigro-maculatis, extus rugosis, nigro-irroratis; tibiis nigro-4-annulatis; tarsis articulo basali in spinam longam producto; femoribus tibiisque 4 posticis nigro-subannulatis, his gracilibus, cylindricis, setosis; alis hyalinis, venis nigro albidoque variis; stigmate in medio albido, antice et postice nigro, ejusdem magnitudinis in omnibus alis; cellulis 9 vel 10 obliquis in alis anticis, margine postico in anticis nebulis 5 parvis subfuscescentibus notato. (Mas.)

Long. corp. lin. 5. Expans. alar. ant. lin. 14.

Habitat in Amazonia. D. Bates. In Mus. Oxon.

Obs.—This species is very nearly allied to *M. Chilensis*, Hagen, Stett. Ent. Zeit. xx. 408, which Dr. Hagen appears to be disposed to unite with *Trichoscelia.* In that species (for a specimen of which—of the male sex—I am indebted to that distinguished author) the cells of the wings are less numerous (6 or 7 oblique ones in the fore wings) than in the specimen above described, and the anterior femora are armed with very strong spines, which are wanting in my species. It does not appear to me, however, advisable to unite *M. Chilensis* and the present and next described insects with *Trichoscelia.* The cylindrical tibiæ of the four hind legs, and the increased size of the hind wings (although not so large, as compared with the fore wings, as in the typical *Mantispæ*) remove them from the true *Trichosceliæ*, but then the ovate form of the fore wings constitutes them a distinct section in the genus *Mantispa.* The following are descriptions of two more species belonging to the same section.

11. Mantispa Myrapetrella, Westw.

Griseo-lutea; capitis vertice circulo irregulari nigro notato; antennis gracilibus, nigricantibus, basi extrema articuli 1mi lutea; prothorace obconico, antice capite dimidio angustiori, dorso irregulariter nigro; mesonoto luteo, macula magna dorsali alteraque minuta utrinque nigris; metanoti medio nigro, macula antica triangulari lutea; abdominis segmentis nigro-luteo variis; coxis pedum anticorum luteis, macula parva basali, altera ante medium, 3tiaque apicali in margine antico; femoribus anticis extus maculis 2 fuscis interdum confluentibus luteoque irroratis, absque spina magna marginis antici; coxis 4 posticis nigris, basi flavis; femoribus intermediis fascia ante medium nigra; tibiis 4 posticis cylindricis, ad basin fascia nigra notatis; alis ovalibus, hyalinis, venis nigro luteoque variis, in anticis venis nonnullis prope basin nigro-dilatatis, cellulisque 7 vel 8 obliquis instructis; stigmate longo albido, antice et postice nigro. (Mas et fœm.)

Long. corp. lin. $3\frac{1}{2}$. Expans. alar. ant. lin. 9.

Habitat in nidis vespæ (*Myrapetræ scutellaris*) Americæ meridionalis. Vide White in Ann. Nat. Hist. vii. p. 322. In Muss. Brit. et Oxon.

Obs.—Dr. Hagen states that Mr. Walker has described a species of the *Trichoscelian* group of *Mantispa* under the name of *Raphidia! varia.* The description, however, of that insect as given in the British Museum Catalogue of Neuropterous insects, part ii. p. 212, cannot possibly be intended for the insect before me, being "Nigra, antennæ robustæ basi ferrugineæ; prothorax linearis; pedes rufescentes. Black, head hardly longer than broad. Appears to connect *Raphidia* with the *Hemerobii.*" If, contrary to reasonable expectation, it should prove that the insect above described is identical with that described by Mr. Walker, I maintain that his description is so erroneous that it is virtually worthless, and that no Entomologist is bound to adopt the specific name prefixed to it.

12. Mantispa cognatella, Westw.

M. Myrapetrellæ omnino simillima, differt solummodo magnitudine paullo majori, antennis prope apicem albido-fasciatis, tibiis 4 posticis pluries fusco-annulatis, alis anticis ad marginem posticum nebulis circiter 6 minutis infumatis, capiteque supra fusco magis notato.

Long. corp. lin. $3\frac{1}{2}$. Expans. alar. ant. lin. 9.

Habitat apud Sanctam Martham, Venezuelæ. In Mus. Oxon.

13. Mantispa Hamiltonella, Westw.

Luteo-albida; facie in medio fasciata; antennis gracilibus, nigris; prothorace longo, gracili, versus caput dilatato, parte antica supra fusca linea tenui dorsali lutea, parte postica gracili impressionibus 9 transversis; mesonoto flavo, antice et lateribus nigris; mesosterno circulo nigro notato; abdominis segmentis in medio dorsi obscuris; pedibus luteo-albidis, femoribus tibiisque obscurioribus, immaculatis; alis longis hyalinis, regione costali pone medium tenui albida; stigmate rufo, venis gracillimis, nigris (ultra stigmata rufis); cellulis obliquis 16 in alis anticis.

Long. corp. lin. 9. Expans. alar. ant. lin. 19.

Habitat in India orientali. Dna. Hamilton. In Mus. Oxon.

Obs.—This Indian species closely resembles *M. areolaris,* Westw., Trans. Ent. Soc. 2nd ser. i. 265, from Brazil.

14. Mantispa Batesella, Westw.

Luteo-fulva; antennis gracilibus, brunneis, basi rufescentibus; prothorace elongato, subcylindrico, versus caput dilatato, dorso obscure transversim rugoso et lineis fuscis notato, meso- et meta-noto concoloribus vel plus minusve fusco-variis; abdomine obscuro, segmentis basalibus fulvo-variis; pedibus concoloribus, anticorum femoribus elongato-trigonis, spina magna armatis; alis elongatis, hyalinis, costa (cum stigmate confluenti) et regione postcostali in alis anticis (e basi ad medium alæ extensa) fulvo-rufis; cellulis 18 obliquis in alis anticis. (Mas et fœm.)

Long. corp. unc. 1. Expans. alar. ant. unc. 2.

Habitat in Amazonia. D. Bates. In Mus. Oxon.

Obs.—This large species very closely resembles *M. areolaris,* both in size and in the arrangement of the veins of the wings.

15. Mantispa Burmanella, Westw.

Piceo-nigra, opaca, crassa; prothorace brevi, in medio abrupte constricto, macula flavida ante marginem posticum; abdominis basi sub-lurida; oculis opalinis; antennis brevibus, crassis; pedibus nigris, femoribus anticis crassis, extus subscabris, spinis validis armatis; unguibus tarsorum posticorum rufis, ad apicem latis, 4-denticulatis; alis anticis fuscis, nitidis, costa obscuriori, cellulis obliquis discoidalibus 17 vel 18; alis posticis fuscis, dimidio postico pallidiori.

Long. corp. lin. 7. Expans. alar. ant. lin. 19.

Habitat in Burmah. In Mus. Brit.

I take the opportunity of adding a new and very fine species of *Nemoptera,* supplementary to my monograph of that genus in the Proceedings of the Zoological Society.

Nemoptera imperatrix, Westw.

Albido-lutea, abdomine et medio thoracis obscurioribus; rostro vix capitis latitudine longiori; pedibus obscuris; alis anticis hyalinis, macula minuta fusca in loco stigmatis, venis brevibus transversis in medio longitudinali alarum nigro parum suffusis; alis posticis valde elongatis, filiformibus, apicibus in spatulam oblongo-ovalem dilatatis, cujus dimidio basali fusco, apicali albido.

Long. corp. unc. $\frac{5}{6}$. Expans. alar. ant. unc. $2\frac{3}{4}$; alar. post. unc. $3\frac{1}{6}$.

Habitat in Africa occidentali tropicali. In Mus. Brit.

XIX. *Notes on Rare and Descriptions of New Species of* Buprestidæ *collected by* Mr. JAMES LAMB *in* Penang. By EDWARD SAUNDERS.

[Read 18th February, 1867.]

THE present paper contains descriptions of the new species of *Buprestidæ* collected by Mr. Lamb in Penang, with notes of previously known but rare species. Many of Mr. Lamb's captures are specifically identical with species discovered by Mr. Wallace, and in cases where the insects are already common in collections, they have not been mentioned. The number of new species amounts to fifteen; of one of these has been formed a new genus, under the name of *Xenopsis*. I have to thank my kind friend Mr. Pascoe, in whose care Mr. Lamb's collections are at present placed, for lending me the insects here described.

Chrysochroa Castelnaudi, H. Deyr.

Ann. Soc. Ent. France, 1862, p. 537, pl. II. fig. 4.

Two specimens of this rare species have been captured by Mr. Lamb, one of which is very darkly coloured, and slightly deformed.

Chrysochroa ocellata, Fabr., Var. *ephippigera*, White.

(Pl. XXV. fig. 1.)

Ann. Nat. History, xii. p. 342.

I was at first inclined to think that this was a distinct species, but I have lately received some specimens of *ocellata* in which the spots have lost their circular form and almost touch the suture and lateral margins, and therefore have no doubt that it is a mere variety.

Philocteanus flammeus, Thoms.

Arch. Ent. i. p. 110.

Several specimens of this species are contained in the collection, all of which are of a remarkably golden hue.

Chrysodema pyrostictica, Vollenh.

Tijdschrift voor Ent., 1864, p. 162, pl. xi. fig. 4.

C. viridimicans, H. Deyr. Ann. Soc. Ent. Belg. viii. 17, var.

The only specimen received of this pretty species is unusually large, and the fiery spots on the elytra are scarcely visible.

Chrysodema purpureo-impressa, H. Deyr.

Ann. Soc. Ent. Belgique, viii. p. 18.

Two specimens, one of which is covered with a greenish powder.

Chrysodema Lambii, n. s. (Pl. XXV. fig. 2.)

Viridis. *Caput* rugose punctatum. *Elytra* punctata, striata, utrinque tribus lineis elevatis et duabus impressionibus igneo-cupreis. Subtus punctata.

Head golden, vertex with a green dorsal line. Thorax green with purple reflections, on each side of the dorsal line is a golden one, and the depressed portions of the surface are covered with a yellow powdery pubescence. Elytra greenish, with red reflections on their basal half and apex; disk of each with two coppery red foveæ, and a small spot of the same colour behind the shoulder. In fresh examples the foveæ would evidently be filled with yellow mealy pubescence. Beneath, and legs, golden green. Antennæ blue-black, their three basal joints green.

Head rugosely punctured, broadly excavated between the eyes. Thorax a quarter as broad again as long; anterior margin nearly straight, three quarters the length of the base, its angles produced; sides and base straight; disk deeply punctate, with a broad smooth dorsal line; near the posterior angles, on either side, is an irregular somewhat longitudinal fovea; there is another shallower transverse one near the anterior margin. Elytra twice as long as broad; sides sinuate below the shoulders; apex rounded, posterior margin denticulate; disk punctured, each elytron with three elevated longitudinal lines, and two foveæ, one situated not quite one-third of the entire length of the elytra from their base, the second a larger one, near the margin, a little less than half their length from the apex. Beneath and legs deeply punctured; sides of each abdominal segment with a shallow impression.

Length 11 lines; breadth 4 lines.

Iridotænia obscura, n. s. (Pl. XXV. fig. 3.)

Subænea; subtus aureo-viridis. *Caput* profunde excavatum. *Thorax* lineâ longitudinali impressâ utrinque prope angulos posticos. *Elytra* punctato-striata. Subtus punctata.

Above, dull bronze, with coppery reflections; beneath, golden green.

Head very largely and deeply punctured with a deeply impressed longitudinal fovea. Thorax half as broad again as long; anterior margin nearly straight, three quarters the length of the base; sides very slightly swollen above the middle; base straight; disk deeply punctured, sides rugose, dorsal line deeply impressed at the base and in front but scarcely visible in the centre; near the posterior angles, on each side, is a deeply-cut somewhat curved longitudinal line, not quite half way up the side of thorax. Elytra wider than the thorax, widest behind the middle; a little more than twice as long as wide, sides very slightly sinuate below the shoulders, apex attenuate, posterior margin denticulate; disk deeply and closely punctate-striate, the punctures on the sides rather irregular. Beneath and legs punctured, covered with fine hairs.

Length 10 lines; breadth $3\frac{1}{2}$ lines.

Asemochrysus rugulosus, H. Deyr.

Ann. Soc. Ent. Belgique, viii. p. 48, pl. ii. fig. 1.

Aprosopus rugifrons, H. Deyr.

Ann. Soc. Ent. Belgique, viii. p. 51, pl. ii. fig. 3.

Pœcilonota psilopteroides, H. Deyr.

Ann. Soc. Ent. Belgique, viii. p. 59.

Pœcilonota nigrofasciata, n. s.

Aureo-brunnea. *Thorax* linea dorsali maculisque duabus utrinque nigris. *Elytra* punctato-striata, nigro sparsa, fascia infra mediam partem apicibusque nigris. Subtus punctata.

Golden-brown. Thorax with the dorsal line and four small irregular spots, black. Elytra scattered over with small black spots, their apex, and a band interrupted at the suture, situated about three-fifths of their entire length from the base, of the same colour. Beneath, with a few scattered black spots on the sides.

Head punctured, with an oval impression between the eyes. Thorax at the base half as broad again as long; sides rounded, base slightly lobed; disk deeply punctured, the puncturation of the sides deeper. Elytra punctured and deeply striate; twice as long as wide; sides subparallel for nearly two-thirds of their length; posterior margins finely denticulate and ciliate, apex of each with a short spine. Beneath and legs punctured.

Length 5 lines; breadth 2 lines.

Melobasis purpuriceps, n. s. (Pl. XXV. fig. 6.)

Caput et *thorax* purpureo-brunnei, hujus basis viridis. *Elytra* punctato-striata, viridia; maculâ infra basin ovali, fasciâ juxta mediam partem, et apice cyaneis. Subtus viridis.

Head and thorax of a purplish-brown colour, the base and posterior angles of the latter golden-green. Elytra golden-green; with an elongate oval spot on each, just below the base, a transverse band which is much produced in its centre along the suture, and again slightly in the centre of each elytron, and the apex, for a third of the entire length of the elytra, dark cyaneous. Beneath, green; legs golden. Antennæ of the same colour as the head.

Head deeply punctured. Thorax, three quarters as long again as broad; anterior margin straight, three quarters the length of the base, sides slightly rounded, posterior angles acute; base nearly straight; disk punctured, with a faint dorsal line, met at the base by a transverse impression; (in this specimen there is a puncture on its left side, but without a corresponding one on the right); on each side near the posterior angles, and almost touching the lateral margin, is a round impression. Elytra twice as long as wide; sides slightly sinuate above the middle, posterior margins strongly denticulate for two-fifths of the entire length of the elytra; apex emarginate, with two external teeth; disk deeply and regularly punctate-striate. Beneath, covered with wavy longitudinal lines; legs punctured, with a few short scattered hairs.

Length 4 lines; breadth $1\frac{3}{4}$ line.

Allied to *M. Chrysobothroides*, H. Deyr., but easily distinguished by the colour of the head and thorax, as well as by the shape of the latter, and by its dorsal line being met at the base by a transverse impression.

Philanthaxia curta, H. Deyr.

Ann. Soc. Ent. Belgique, viii. p. 73, pl. ii. fig. 8.

Three specimens of this rare little species are contained in the collection.

Philanthaxia aureoviridis, n. s.

Caput cyaneum, depressum et punctatum. *Thorax* transverse striatus, aureoviridis. *Elytra* punctato-striata, transverse rugosa, aureoviridia.

Head blue; thorax and elytra golden-green; scutellum slightly darker; beneath bronzy-green.

Head depressed in front, largely punctured. Thorax twice as broad as long; anterior margin slightly produced in the centre and at the angles; sides gradually rounded, base straight; disk largely punctured, the punctures so arranged as to leave numerous curved transverse ridges; sides near the posterior angles slightly depressed. Elytra twice as long as wide, impressed at the base; sides slightly sinuate below the shoulders; apex rounded; disk deeply and regularly striate, the interstices transversely rugose. Beneath and legs punctured, covered with whitish hairs.

Length 4 lines; breadth 2 lines.

Castalia auromaculata, n. s. (Pl. XXV. fig. 4.)

Viridis. *Caput* punctatum. *Thorax* punctatus, lateribus cupreo-aureis, lineâ dorsali impressâ. *Elytra* costis utrinque quinque elevatis. Subtus cuprea, punctata.

Green, with blue reflections; sides of the thorax and underneath coppery-gold. Centre of thorax, the posterior margin of each abdominal segment beneath, and legs, blue.

Head punctured, hairy, with a slight dorsal furrow. Thorax not quite twice as broad as long; anterior margin straight, slightly elevated, three-fifths the length of the base; sides diverging rapidly for one-third of their length, then straight to the posterior angles; base slightly bilobed; disk deeply punctured, with an impressed dorsal line, which widens considerably as it approaches the base, puncturation of the sides deeper. Elytra a little more than twice as long as wide, sides subparallel for not quite two-thirds of their length, then rounded to the apex, which is denticulate; disk punctured with five longitudinal ridges, between which are a few others less strongly raised. Beneath and legs largely punctured, covered with very short hairs.

Length 8 lines; breadth $2\frac{3}{4}$ lines.

Xenopsis, n. g.

Oculi magni; cavitates antennarum minutæ. *Corpus* cylindricum, nitidum. *Elytra* apicibus subtruncatis. *Tarsi* dilati, articulo primo pyriformi, secundo breviori, tertio et quarto brevissimis.

Head round, convex in front; epistome deeply emarginate; antennary cavities small; eyes not projecting. Antennæ with the first joint as long as the second and third together, the second being very short, the rest subequal; becoming serrate at the fourth article, the three apical joints scarcely so. Body cylindrical; apex of elytra slightly truncate; prosternum flat, slightly swollen in front. Tarsi with the first joint pyriform, the second slightly shorter, the third and fourth nearly equal, much dilated and very short. Scutellum small, somewhat square.

Closely allied to *Castalia*, but differing much in general facies, antennæ and scutellum.

Xenopsis lævis, n. s. (Pl. XXV. fig. 9.)

Cupreo-purpurea, punctata, et nigro-pilosa. *Elytra* punctato-striata, apicibus tridentatis. Subtus punctata.

Coppery-purple, shining with blue reflections. Head deeply punctured, covered with recurved black hairs. Thorax twice as wide as long, anterior margin straight, sides rounded, base straight; posterior angles acute; disk punctured, covered with short black hairs. Elytra twice as long as wide; punctate-striate, with short hairs; sides subparallel, slightly curved below the middle, apex of each tridentate, the third tooth being on the lateral margin.

Beneath and legs punctured, with short scattered black hairs.

Length 6 lines; breadth $2\frac{1}{4}$ lines.

Chrysobothris longula, n. s.

Caput cupreum; fronte circulatim striatâ. *Thorax* transverse costatus, purpureo-niger, angulis posticis rufo-cupreis; margine antico et macula prope lineam dorsalem utrinque viridibus. *Elytra* purpureo-nigra, maculis tribus utrinque parvis viridibus. Subtus punctata.

Head coppery. Thorax blackish-purple, posterior angles fiery red, the red extending along the sides for about a third of their entire length; anterior margin and a triangular spot on each side of the disk green. Elytra purple-black, each with three green spots, one at the base, the second above the middle, the third just below it. Beneath coppery; prosternum green.

Head hairy, deeply punctured on the vertex, which is limited in front by a semicircular carina; the forehead is depressed, covered with circular striæ, and limited posteriorly by a strong well-marked straight elevation, which has a slight emargination in its centre. Thorax twice as broad as long; anterior margin slightly emarginate, three quarters the length of the base; sides rounded; base bisinuate; disk deeply punctured and transversely ridged, punctures closer together on the sides. Elytra closely punctured, wider than the thorax, twice as long as wide; sides subparallel for two-thirds of their length; posterior margin denticulate; disk of each with three foveæ placed as mentioned above. Beneath punctured, with a few scattered hairs; apical segment of the abdomen longitudinally carinated.

Length 6 lines; breadth $2\frac{1}{2}$ lines.

Chrysobothris discicollis, n. s. (Pl. XXV. fig. 7.)

Caput fronte purpureâ, punctatum et transverse striatum. *Thorax* transverse costatus, mediâ parte cupreus, marginibus late bronzeo-brunneis. *Elytra* minute rugosa et purpureo-nigra, maculis quatuor utrinque parvis viridibus. Subtus punctata.

Head green on the vertex, purple in front. Thorax coppery, anterior margin, sides and base brownish-bronze, the colour of the base is produced towards the centre of the thorax in a semicircular arc. Elytra purplish-black, each with four small green spots, one at the base, the second distant about a third of the length of the elytra from the first, the third about two-thirds, near the lateral margin; the fourth is formed by a longish dash behind the shoulder. Beneath, green; posterior margin of each abdominal segment purple; legs green, anterior femora purple.

Head deeply punctured on the sides, the punctures in the centre finer, mixed with a few transverse lines; vertex very slightly overhanging the forehead, with an elevated line down the centre, met in front by a raised curved transverse line. Thorax three quarters as broad again as long, widest in front; anterior margin of the same length as the base, sides diverging rapidly on leaving the anterior angles for a quarter of their length, then converging to the base so as to give the anterior angles the appearance of being cut off; base bisinuate; disk punctured, covered with transverse ridges, ridges on the sides longitudinal. Elytra finely rugose, much wider than the thorax; two thirds as long again as wide; sides slightly sinuate below the shoulders; posterior margin denticulate; disk with four green impressions, situated as mentioned above. Beneath punctured, with a few white hairs; anal segment carinated longitudinally.

Length 5 lines; breadth $2\frac{1}{4}$ lines.

Chrysobothris foveiceps, n. s. (Pl. XXV. fig. 8.)

Caput punctatum, viride. *Thorax* viridis, angulis posticis rufis. *Elytra* cyanea, viridi sublucentia, fortiter punctata, marginibus posticis denticulatis. Subtus punctata.

Head and thorax green, the latter with a small coppery spot near the posterior angles. Elytra dark blue, with greenish reflections. Beneath and legs green, femora of the fore-legs coppery at the base.

Head deeply punctured, with a deep triangular impression between the eyes; the angles of the triangle rounded, the surface of the impression shining with numerous transverse somewhat concentric lines. Thorax widest before the middle, twice as broad as long at the base; anterior margin slightly produced, three quarters the length of the base; sides diverging rapidly for a quarter of their length, then straight and slightly converging to the posterior angles; base deeply bisinuate; disk deeply punctate, and transversely ridged, sides with a slight impression near the posterior angles. Elytra deeply punctured, half as long again as broad, widest at the shoulders, which are slightly prominent; posterior margins denticulate, apex rounded; base of each with two impressions; there is also another slight one on each disk, situated not quite half their entire length from the base. Beneath and legs punctured.

Length $3\frac{1}{2}$ lines; breadth 2 lines.

Chrysobothris similis, n. s.

Viridis, nitens. *Caput* punctatum, impressione inter oculos quadratâ. *Thorax* transverse rugosus, apud angulos posticos aureo-maculatus. *Elytra* maculis cyaneo-nigris tribus utrinque punctata. Subtus punctata.

Bright green; a spot on each side of the base of the thorax, near the posterior angles, golden. Each elytron with three cyaneous-black spots; one near the base, of an irregular oval shape; the second, about the middle, somewhat transverse; and the third, a long one of a somewhat sagittate form, not quite touching the apex. Beneath golden-bronze; legs greenish, anterior femora coppery.

Head deeply punctured, vertex projecting over the forehead; between the eyes is a somewhat square impression, deeply and irregularly striated transversely, covered with short scattered hairs. Thorax widest at the base, twice as wide as long; anterior margin emarginate, three-quarters the length of the base; sides diverging rapidly from the anterior angles for about one-sixth of the entire length of the thorax, thence nearly straight to the posterior angles; base deeply bisinuate; disk punctured deeply, ridged transversely, the ridges intersecting each other so as to form a sort of transverse net-work; those on the sides are longitudinal; near the posterior angles on each side is a slight impression. Elytra half as long again as wide, deeply punctured; shoulders slightly prominent; posterior margin denticulate; base with an impression on each side of the scutellum. Beneath and legs punctured with a few scattered short hairs.

Length $3\frac{1}{2}$ lines; breadth 2 lines.

At first sight somewhat resembling the preceding species.

Corœbus Pascoei, n. s. (Pl. XXV. fig. 5.)

Nigro-velutinus, griseo pubescens. *Caput* duobus fasciculis comarum longarum ornatum. *Elytra* minute rugosa, fasciâ nigrâ infra mediam partem sitâ, apice denticulato horridisque capillis vestito.

Velvety-black, ornamented with a design of ashy-grey pubescence, leaving a broad band of black, situated not quite a third of the entire length of the elytra from the apex, which, with numerous irregular spots scattered over the surface, is of the same colour. Beneath purplish, with a stripe of grey pubescence on each side.

Head deeply punctured; vertex with two fascicles of short bristly hairs; above the antennary cavities is a smooth elevated line, extending across the head. Thorax not quite two-thirds as broad again as long, widest about its middle; anterior margin three-quarters the length of the base, produced slightly in the middle, its angles produced right under the head; sides much rounded; base angularly bisinuate; disk tuberculose; dorsal line only visible near the anterior margin, where it is raised and smooth; on the denuded parts of the thorax concentric punctured striæ are visible. Elytra flat, finely rugose; twice and a third as long as wide; sides slightly sinuate below the shoulders; apex furcillate, rounded, denticulate, and clothed with bristly hairs. Beneath punctured, the punctures arranged in transverse lines; apical segment of the abdomen transversely canaliculate.

Length 8 lines; breadth $2\frac{1}{2}$ lines.

I have named this species in honour of Mr. Pascoe, to whose kindness I am indebted for the pleasure of describing and figuring the species contained in this paper.

Corœbus analis, n. s.

Caput in medio fere denudatum, alibi flavo-pubescens. *Thorax* griseus. *Elytra* grisea, apice flavo. Subtus griseus, pubescens.

Black. Head covered with orange-yellow pubescence.

Thorax with a slight greyish pubescence on the base and disk; anterior angles, and two or three spots on the margin, of the same colour as the head. Elytra covered with pubescence of the same colour as that of the thorax, the apex for a quarter of the entire length of the elytra orange-yellow, with a darker band traversing it above its centre; above the orange apex is a narrow black band, separating it from the grey pubescence above. Beneath, and legs, black, with a greyish pubescence; three apical segments, orange-yellow.

Head with a triangular spot between the eyes, nearly denuded of pubescence, and apparently punctured. Thorax half as broad again as long; anterior margin produced, two-thirds the length of the base, its angles almost inclosing the eyes; sides rounded; base bisinuate, with a deep central lobe; disk elevated in front; base slightly, and sides very much depressed, the depressions of the sides in the form of two curved foveæ; surface punctured, pubescent, with a transverse scaly appearance. Elytra twice as long as wide; sides subparallel till past the middle, when they slightly swell out; apex largely rounded, finely denticulate; surface, where visible, punctured, with a scaly appearance. Beneath scaly, like the elytra; legs and antennæ punctured.

Length 5 lines; breadth 2 lines.

Agrilus pauciguttatus, n. s.

Bronzeo-brunneus. *Thorax* transverse costatus; lateribus maculâ pubescente prope angulos anticos. *Elytra* minute rugosa, maculâ suturali prope apicem. Subtus, cum pedibus, punctatus.

Dull bronzy brown. Head just above the mouth, the sides of the thorax near the anterior angles, a spot on each elytron situated about a third of their entire length from the apex, and a spot on each of the two first abdominal segments above, covered with ochraceous pubescence. Beneath, and legs, bronzy, with an ochraceous spot on each side of the breast.

Head deeply channelled and punctured, the punctures arranged in transverse lines; sides of the channel rather elevated, so as to form two carinæ on the inside of the eyes. Thorax half as broad again as long; anterior margin nearly straight, about the same length as the base, its angles produced round the head; sides slightly rounded, lateral carinæ very straight, and near the margin; base bisinuate, central lobe straight at the base; disk transversely ridged and punctured, sides each with an impression near the anterior angles; base with a broad impression on the median lobe. Elytra twice and a half as long as wide; sides nearly parallel for two-thirds of their length; apex of each with a sharp central spine; disk covered with fine scale-like rugosities; the suture elevated for about one-third of their length from the apex. Abdomen bordering the elytra on each side about their middle exhibiting the sides of the two first segments. Beneath and legs punctured, covered with a short cinereous pubescence.

Length 5 lines; breadth 1½ line.

Agrilus cupricauda, n. s.

Viridis. *Caput* aureum, punctatum, fronte obtuse bituberculata. *Thorax* transverse costatus. *Elytra* minute rugosa, apice cupreo.

Green. Head golden. Elytra with a few piliferous irregular lines and spots; the apex fiery copper. Abdomen above, bright blue; beneath, and legs, bronzy.

Head swollen, with an impressed dorsal line; front punctured, with two largely rounded tubercles near the vertex, and two smaller elevations below them. Thorax a quarter as broad again as long; anterior margin rounded, almost equalling the base in length, its angles produced round the sides of the head; sides nearly straight; base bisinuate, central lobe emarginate; disk punctured and transversely ridged, with two dorsal impressions, a large one on the central lobe, and a smaller shallower one above it; ridges longitudinal on the sides, lateral carinæ straight in front, much arcuate near the posterior angles. Elytra twice and a quarter as long as wide: shoulders rather elevated, sides sinuate above the middle; apex rounded, and finely denticulate; surface covered with fine scale-like rugosities, posterior suture elevated. Beneath and legs punctured, finely pubescent.

Length 3½ lines; breadth 1¼ line.

Endelus empyreus, H. Deyr.

Ann. Soc. Ent. Belgique, viii. p. 230, pl. iii. fig. 7.

EXPLANATION OF PLATE XXV.

Fig. 1. *Chrysochroa ocellata*, var. *ephippigera*.
2. *Chrysodema Lambii.*
3. *Irodotænia obscura.*
4. *Castalia auromaculata.*
5. *Coræbus Pascoei.*
6. *Melobasis pupuriceps.*
7. *Chrysobothris discicollis.*
8. *Chrysobothris foveiceps.*
9. *Xenopsis lævis.*

XX. *Descriptions of New Species of* Cryptoceridæ. By FREDERICK SMITH, V.P., and late Pres. Ent. Soc.

[Read 18th March, 1867.]

THE present communication contains descriptions of four new species of the genus *Cryptocerus*, with references to seven others recently described by Dr. Mayr, and one by Dr. Roger; these, added to those previously enumerated, increase the number of the species of that genus, at present known, to forty-five.

Of the genus *Meranoplus*, three new species are described, increasing the number of that genus to sixteen species; whilst the genus *Cataulacus* is increased to ten species by the new one now added.

The new species of *Meranoplus* are from Champion Bay, Western Australia, only two having been previously described from that country; there can be little doubt that when the ants of that continent are carefully collected, many additional species will be discovered.

The forms of the species of the *Cryptoceridæ* are so varied and eccentric, that it is absolutely necessary to figure each species as well as to describe it; and in those cases in which the three forms are known, I am convinced of the necessity of figuring each sex, the differences between the male, female, and worker being so great, that direct observation of the insects in their formicarium can alone, in the majority of cases, enable naturalists to unite them. Mr. Bates has in this respect added more to our knowledge of this group than any previous traveller. In the Transactions of this Society will be found no less than fifty-two figures illustrative of the species of the *Cryptoceridæ*.

Fam. FORMICIDÆ.

Sub-fam. CRYPTOCERIDÆ.

Gen. CRYPTOCERUS.

1. *Cryptocerus conspersus*, n. sp. (Pl. XXVI. fig. 1.)

C. ater, thorace petioloque spinosis, tibiis femorumque apicibus rufo-testaceis, abdomine marginibus ferrugineo.

Worker. Length, 1½ line. Black, and sprinkled with short bright silvery setæ; head wider than the thorax, the sides, before the eyes, broadly pale testaceous; the eyes prominent; the scape and basal joints of the flagellum ferruginous. Thorax: rounded anteriorly, gradually narrowed posteriorly; the posterior margin of the metathorax deeply emarginate; the sides armed with six teeth; the apical half of the femora rufo-testaceous, as well as the tibiæ and claw-joint of the tarsi. Abdomen; the margins broadly rufo-testaceous; the nodes of the peduncle with a bent spine on each side.

Hab. Amazon.

This most closely resembles the worker of *C. minutus*, but the form of the metathorax will at once show that it is a very distinct species; I have only seen a single specimen, which is in the collection of W. Wilson Saunders, Esq.

2. *Cryptocerus exiguus*, n. sp. (Pl. XXVI. fig. 4.)

C. ater, thorace subspinoso postice bispinoso, capite ante oculos utrinque testaceo.

Worker. Length, $1\frac{1}{2}$ line. Black; the head and thorax with shallow punctures, the punctures having each a silvery white seta; the margins of the head, before the eyes, pale testaceous; the antennæ pale ferruginous. Thorax: the anterior margin rounded; the sides narrowed to the metathorax, with two short spines anteriorly; the metathorax with a short spine on each side at the base, and a longer curved one at the apical angles; the tips of the femora, the tibiæ, and the tarsi, ferruginous. Abdomen ovate, the margin, at the base, slightly pale; the nodes of the peduncle with a short spine on each side.

This species also resembles *C. minutus*, but a reference to the figure will show the difference in the form of the head and the nodes of the peduncle.

Hab. Mexico.

In the collection of W. Wilson Saunders, Esq.

3. *Cryptocerus scutulatus*, n. sp. (Pl. XXVI. fig. 3, 3 a.)

C. rufo-testaceus, capite thoraceque punctatis, abdomine brunneo-maculato.

Worker. Length, $2\frac{1}{3}$ lines. Rufo-testaceous; head wider than the thorax, the margins raised, dish-shaped above; the margins pale and crenulated; the disk with scattered punctures, in each of which is a minute shining seta. Thorax arched anteriorly, and having a short tooth in the middle of the sides, which narrow considerably towards the metathorax; the sides of the thorax pale; above, regularly punctured, each puncture with a shining seta; legs stout; the tibiæ pale outside. Abdomen: the margins broadly pale-testaceous, finely punctured, the punctures with minute glittering setæ.

Hab. Mexico.

In the collection of W. Wilson Saunders, Esq.

4. *Cryptocerus angulosus*, n. sp. (Pl. XXVI. fig. 7.)

C. niger, thorace spinoso, capite ante oculos utrinque testaceo; antennis pedibusque pallide rufescentibus.

Worker. Length, $1\frac{3}{4}$ line. Black; punctured, each puncture with a short shining pale seta; the margins of the head, before the eyes, and the posterior angles, pale testaceous; the antennæ rufo-testaceous. Thorax: arched in front, and gradually narrowed to the metathorax, which is broadly emarginate posteriorly; the anterior and posterior angles acute; the sides pale testaceous, notched in the middle, with a short tooth in the notch; the tips of the femora, the tibiæ, and tarsi, pale rufo-testaceous. Abdomen ovate, and deeply emarginate in front; the margin pale anteriorly; the nodes of the peduncle produced on each side into a bent spine, which is pale at the tip.

Hab. Mexico.

In the collection of W. Wilson Saunders, Esq.

5. *Cryptocerus angustus*, Mayr, Sitzungsb. kais. Akad. Wissenschaft. 1866, p. 32, ☿.

Hab.————?

In the Museum of Halle.

6. *Cryptocerus crenaticeps*, Mayr, Sitzungsb. kais. Akad. Wissenschaft. 1866, p. 32, fig. 15, ♀.

Hab. Columbia.

In the Museum of Halle.

7. *Cryptocerus patellaris*, Mayr, Verhandl. k. k. zool.-botan. Gesell. Wien, xvi. 907, tab. xx. fig. 15, ♀ (1866).

Hab. Brazil.

8. *Cryptocerus notatus*, Mayr, *ibid.* fig. 16, ♀.
Hab. Brazil.

9. *Cryptocerus hamulus*, Roger, Berl. Ent. Zeitsch. (1863) sp. 103.
Hab. St. Domingo.

10. *Cryptocerus flavomaculatus*, Mayr, Verhandl. k. k. zool.-botan. Gesell. Wien, xii. 757. (1862).
Hab. Brazil.

11. *Cryptocerus punctatus*, Mayr, *lib. cit.*, p. 762.
Hab. Amazon.

12. *Cryptocerus spinosus*, Mayr, *lib. cit.*, p. 761.
Hab. Amazon.

Genus Meranoplus, Smith.

1. *Meranoplus fenestratus*, n. sp. (Pl. XXVI. fig. 6.)

M. thorace spinoso, quadrimaculato, abdomine ovato.

Worker. Length, 2 lines. Ferruginous, the head and thorax finely shagreened, and with a series of longitudinal carinæ; the thorax with four sub-ovate translucent spots, the posterior pair largest; the anterior margin rounded, the posterior emarginate, with a rounded notch in the middle of the emargination; the anterior angles slightly produced and acute, the posterior spinose, and a minute tooth at the sides a little beyond the middle; the metathorax truncate, and with a long acute spine on each side at the margin; the legs, margins of the head before the eyes, and the antennæ, paler than the body, the club fuscous; the eyes black, the antennæ nine-jointed. Abdomen ovate, and very delicately shagreened; the nodes of the petiole coarsely rugose, the first node sub-ovate, the second transverse; the entire insect thinly sprinkled with erect hairs.

Hab. Champion Bay.

In the British Museum. Captured by Mr. F. H. Du Boulay.

2. *Meranoplus diversus*, n. sp. (Pl. XXVI. fig. 2.)

M. rufo-brunneus, capite thoraceque longitudinaliter rugosis, thorace spinoso; abdomine cordato.

Worker. Length, 3 lines. Reddish-brown; the head rounded behind at the angles, the margins produced anteriorly into a blunt spinose process, the clypeus being sunk into a deep fossulet, and bidentate at the anterior margin, which is deeply emarginate, and fringed with long hairs; the antennæ and legs paler than the body; the antennæ nine-jointed. The thorax with acute lateral angles anteriorly, the sides with two blunt spines; the posterior margin with two short blunt spines in the middle; the metathorax abruptly truncate, with a long acute spine on each side at the margin. Abdomen heart-shaped, and with a black longitudinal spot on the basal segment; the nodes of the petiole rugose, the anterior one wedge-shaped, the second sub-ovate. The insect sprinkled with erect hairs.

Hab. Champion Bay.

In the British Museum. Captured by Mr. F. H. Du Boulay.

3. *Meranoplus dimidiatus*, n. sp. (Pl. XXVI. fig. 8.)

M. capite thoraceque nigris, abdomine castaneo-rufo, antennis pedibusque ferrugineis.

Worker. Length, 2 lines. Head and thorax black, and coarsely punctured; the head longitudinally carinated, with punctures more or less strongly impressed between the carinæ; the tips of the mandibles, the legs, and antennæ ferruginous, the scape more or less obscure above; the lateral margins of the head anteriorly are slightly elevated and obscurely ferruginous. The thorax nearly quadrate above, the anterior margin rounded, and produced laterally into prominent acute angles or spines; at the sides an angular shape or tooth, produced in the middle; the posterior margin emarginate, the lateral angles produced into blunt spines; the metathorax abruptly concave-truncate, with an elongate acute spine on each side in the middle of the lateral margin. Abdomen smooth, shining, chestnut-red; the first node of the petiole subquadrate, the second transverse.

Hab. Champion Bay.

In the British Museum. Captured by Mr. F. H. Du Boulay.

Genus Cataulacus, Smith.

1. *Cataulacus prætextus*, n. sp. (Pl. XXVI. fig. 5.)

C. capite thoraceque nigris, abdomine obscure ferrugineo, scapo pedibusque ferrugineis.

Worker. Length, 2 lines. Black: reticulated, the abdomen more finely so than the head and thorax; the margins of the head and thorax crenate; the margins of the head, before the eyes, narrowly pale ferruginous, the scape and basal joint of the flagellum of the same colour. Thorax: rounded anteriorly, gradually narrowed to the apex of the metathorax, which is emarginate posteriorly, and terminates at the posterior angles in acute spines; the legs ferruginous, the base of the femora obscure. Abdomen oblong-ovate; the base, with the margins, narrowly testaceous.

Hab. Borneo.

In the collection of W. Wilson Saunders, Esq.

EXPLANATION OF PLATE XXVI.

Fig. 1. *Cryptocerus conspersus*, worker.
2. *Meranoplus diversus*, worker.
3. *Cryptocerus scutulatus*, worker.
4. *Cryptocerus exiguus*, worker.
5. *Cataulacus prætextus*, worker.
6. *Meranoplus fenestratus*, worker.
7. *Cryptocerus angulosus*, worker.
8. *Meranoplus dimidiatus*, worker.

XXI. *Description of a New Carabideous Insect from Japan.* By CHAS. O. WATERHOUSE, Assistant in the Zoological Department of the British Museum.

[Read 4th March, 1867.]

Genus DAMASTER, Kollar.

Damaster auricollis, spec. nov. (Tab. XXVII. fig. 1.)

D. elongatus, angustatus, sat nitidus, violaceus; capite thoraceque aureo-viridibus; thoracis disco subtiliter transversim striguloso; elytris granulosis, apice non producto.

Long. 14½ lines.

Hab. Japan (Hakodadi).

In form approaching *D. Fortunei*, but the head and thorax are relatively shorter.

Head narrower than the thorax, cylindrical, golden-green, with a deep furrow on each side, reaching from the eyes nearly to the anterior margin (deeper than in *D. Fortunei*, and terminating more abruptly); the part of the head in front of the antennæ is black and glossy, the hinder part somewhat thickly punctured with irregularly shaped punctures. Thorax with a delicate central furrow, golden-green, narrow in front, without anterior angles, gradually broadening to the middle, then gradually contracted; at the posterior angles somewhat abruptly dilated, the angles somewhat acute; lateral margins gently reflexed; sides rugulose, hinder margin more strongly rugose-punctate, the disk covered with fine transverse scratches. Elytra elongate-ovate, violaceous, not, or but scarcely, produced at the apex, somewhat strongly rugosely punctured, the raised parts forming some indistinct longitudinal lines. Underside violaceous, glossy, except the sides of the thorax, which are somewhat dull golden-green, and the apex of the abdomen, which is rugulose-punctate. Tibiæ, tarsi, palpi, and antennæ, black; the last having the four basal joints glossy, the others covered with fuscous hair.

There is considerable difference in form between the males and females of these insects, the males being much narrower. The specimens of *D. Fortunei* before me differ also in the sculpturing of the thorax, the punctuation being rugulose in some, and every puncture being distinct in others, but I have little doubt that they are all the same species; one variety has the thorax blue.

The comparatively short head and thorax, and the rugosely punctured elytra will easily separate *D. auricollis* from *D. Fortunei*, whilst the absence of any production to the apex of the elytra will separate it from both *D. Fortunei* and *D. blaptoides*.

XXII. *Note on a Genus of Dynastid-Lamellicorns belonging to the family* Pimelopidæ. By Chas. O. Waterhouse.

[Read 4th March, 1867.]

Many years since Mr. Hope founded a genus of *Pimelopidæ,* which he called *Dipelicus,* upon an insect the male of which was then unknown. As I have now before me both males and females, I have thought it advisable, in addition to describing the male, to re-characterize the genus, as some doubts have been entertained as to its proper position, on account of the imperfect description given of it by Mr. Hope.

Genus Dipelicus, Hope.

(Trans. Ent. Soc. iv. 7.)

Mentum subparallel, very slightly contracted in front, and rounded. Maxillæ on the inner side tridentate, the apical tooth bifid, the basal one trifid. Apical joint of the labial palpi very large, securiform, deeply impressed on the front; maxillary palpi of the common form. Mandibles bluntly bidentate on the outside, deeply impressed on the inner side, unarmed. Head triangular in front, furnished with an elongate (♂), or triangular (♀), horn. Antennæ ten-jointed. Thorax ample, sides rounded, posterior angles obtuse, with a large central lobe at the base. Elytra oblong, parallel, each with four longitudinal striæ, formed of double rows of punctures, sometimes very indistinct. Legs very robust, the anterior tibiæ armed with three teeth on the outside, the spur on the inner side long; posterior tibiæ very short, with two ciliated carinæ on the outside, truncate, very finely denticulate and ciliated at the apex; anterior tarsi linear, the four posterior with the basal joint much dilated, notched above near the apex; spurs to the posterior tibiæ much enlarged. Propygidium triangularly produced over the pygidium. Stridulating organs situated on the middle of the propygidium. Mesothoracic epimera visible above.

The genus *Dipelicus* has close relationship with *Horonotus.* The parts of the mouth are the same in structure, except the mentum, which, in *Horonotus,* is contracted in front, the labium being truncate, and the apical joint of the labial palpi is enlarged, globose, and without any impression. The mandibles in *Horonotus* are described as being obtusely bidentate at the apex; in both genera I find a slight impression at the apex, but I think it can scarcely be said to be bidentate. The cilia to the edge of the truncature of the posterior tibiæ are extremely fine, their length in the largest specimens of *Dipelicus* (21 lin.) not exceeding that in a small *Horonotus* (10 lin.)

1. *Dipelicus Cantori*, Hope. (Pl. XXVII. fig. 2, ♂). (Trans. Ent. Soc. iv. 7, pl. i. fig. 1, ♀).

♂. Oblong-ovate, convex, pitchy-black or fuscous; underside paler. Head triangular in front, surmounted by a gradually attenuating and but little curved horn, rising to a level with the back of the thorax. Thorax convex, with the sides rounded, thickly and irregularly punctured, with gently reflexed margin; anterior angles not prominent; posterior angles rounded; a deep, somewhat circular, glossy excavation occupies rather more than half the width of the thorax, and extends to the anterior margin; the posterior margin produced in the middle into a lobe, which is raised above the level of the elytra; it projects over the scutellum, where there is a small incision, and has a flat summit, somewhat thickly and deeply punctured; the fore part of the lobe armed with two projecting tubercles; above each of the anterior angles, at the front of the excavation, is a broad flat horn, acuminated above the middle. Scutellum punctured. Elytra very little enlarged posteriorly, with four slightly irregular oblique striæ formed of double rows of punctures, and one sutural punctate stria; interstices strongly and irregularly punctured; shoulders and suture smooth. Propygidium produced triangularly over the pygidium, with the central part occupied by the stridulating organs; pygidium granulose. Underside very little punctured. Anterior tibiæ tridentate, rugosely punctured on the outside. Posterior tibiæ in the form of an elongate triangle, with two ciliated carinæ on the outside, the basal one small; apex semicircular, furnished with about thirty very small blunt teeth on the outer edge, with a very short hair or bristle between each; spurs elongate, lamelliform. Anterior tarsi long, slender; posterior, with the basal joint very large, with a small notch above, near the apex.

Long. 21 lines.

♀. Horn on the head short, triangular. Thorax convex, unarmed; in front transversely rugulose-punctate, sides less so; behind thickly and strongly punctured. Elytra with the striæ indistinct, interstices less strongly punctured. Propygidium less produced than in the male.

Long. 18-19½ lines.

Hab. Java, China.

2. *Dipelicus (Geotrupes) Geryon*, Fabr.

(Figured by Olivier, Entomol. I. 3, Pl. 24, fig. 208.)

♂. The specimen of this insect before me, labelled "Java," differs considerably from *D. Cantori* in the armature of the thorax, as well as in form. It is of a chestnut-brown. The horn on the head is slightly more recurved than in *D. Cantori*. The thorax is slightly angular on the sides; the anterior angles are slightly produced, acute; the posterior are less rounded. The excavation of the thorax is much greater; the posterior lobe is proportionally smaller, its posterior incision is almost circular; the fore part of the lobe is furnished with a single compressed projecting horn, contracted at the apical half; the horns at the anterior angles are compressed, broad, projecting forward, truncate at the apex, and much prolonged posteriorly into a point, the front angle with a small perpendicular projection. The elytra have the sides more parallel than in *D. Cantori*.

I have not yet seen the female of this insect.

EXPLANATION OF PLATE XXVII.

Fig. 1. *Damaster auricollis*, C. O. Waterh. (*ante*, p. 529).

2. *Dipelicus Cantori*, Hope, ♂.

3. *Dipelicus Cantori*, side view of upper portion of the head and thorax of ♂.

4. *Dipelicus Geryon*, Fabr., side view of upper portion of the head and thorax of ♂.

XXIII. *On a Collection of Butterflies formed by* Thomas Belt, Esq., *in the interior of the Province of Maranham, Brazil.* By H. W. Bates, F.Z.S.

[Read 6th May, 1867.]

The collection on which these observations are founded is the first of the kind, so far as I am aware, that has been made in the Province of Maranham, and Lepidopterists will be glad to learn what light it may throw on the distribution and local variation of species in Northern Brazil, especially as we are so well acquainted with the productions of the adjoining country of Pará. The collection was made by Mr. Thomas Belt, who spent three months of the year 1866 at the gold mines of Montes Aureos, in the interior of the province. It may give some idea of the Lepidopterous riches of the country to state, that Mr. Belt obtained in this short time, during the hours of leisure he was able to spare from other duties, no less than 364 species of butterflies. I am indebted to Mr. Belt for the following short account of the geographical position and physical features of the locality :—

"The gold mines of Montes Aureos are situated about midway between the rivers Gurupy and Maracassumé, (2° S. of the Equator, and 160 miles in a straight line E.S.E. of Pará) about fifty miles from the sea-coast. They lie in the midst of the dense equatorial forest, which extends unbroken, as far as has been explored, on every side. The rocks of the district are soft decomposing granite, gneiss, and ferruginous slates, traversed by quartz veins, and forming low rounded hills. The hills are often capped with beds of conglomerate, and clays and gravels occupy the valleys. From the banks of the rivers already mentioned, roads were cut to the mines through the forest, and it was along these paths that the butterflies were taken. It is necessary to state that some portion of the collection was formed at a place called Vizeu, near the mouth of the Gurupy, on the Atlantic coast, about half-way between the city of Maranham and the mouth of the Pará river."

Having been favoured by Mr. Belt with an opportunity of examining the whole of his collection, and comparing the species with those I collected in the neighbourhood of Pará, and on the Amazons, I find that with very few exceptions (about ten) the species are the same as those inhabiting the alluvial plain of the Amazons and its margins; the resemblance being greatest, as was naturally to be expected, to the Pará productions. None of the peculiar forms of Southern or Middle Brazil are represented in the collection, although the physical features of the district more nearly resemble those of Brazil proper than the plain of the Amazons, and there is no known barrier to migration from the South. Some of the undescribed species (e. g. *Heliconius paraplesius* and *Olina Stalachtoides*) had been found long ago in the province of Pará, by Mr. Wallace, probably on his excursion up the Capim river, which flows from the district of Montes Aureos. The new *Hesperiidæ* and *Theclæ* will be described and figured by Mr. Hewitson, who is at present engaged on those groups. Two other gentlemen engaged at the mines also formed collections, and whilst preparing this paper I have had an opportunity of seeing them; they do not add much to Mr. Belt's list of species, but amongst the additions are a fine *Papilio*, quite new to science, a new *Callithomia*, and an *Ithomia* (*I. Hippodamia*) interesting as being a Cayenne and Surinam species, not found in the intermediate valley of the Amazons.

Before describing the new species, a few interesting facts in distribution and variation supplied by these collections merit a few words of notice:—

Leptalis Theonoë and *Orise*.

In the midst of a series of *Ithomia Flora* and its varieties, in Mr. Belt's boxes, I detected four specimens of my old friend the mimicking *Leptalis Theonoë*; and in the same way, amongst a fine set of *Methona Psidii* and *Themisto*, was a specimen of the still rarer *Leptalis Orise*. They had deceived the keen eyes of Mr. Belt, who, although no novice, for he had collected butterflies in other countries, and had given much attention to the varieties of *Heliconiidæ*, had not noticed any difference between these *Leptalides* and their associates. The occurrence of these insects in this district is so far interesting, that it confirms the rule I have pointed out in the paper I have elsewhere published on the *Heliconiidæ* (Trans. Linn. Soc. xxiii. 495), namely, that the mimicking *Leptalides* are found only where the species of *Heliconiidæ* occur which they mimic, and become modified when their associates are replaced by other species or races, so as to maintain their close resemblance to them. I have stated in my paper, that in localities where *Ithomia Flora* was not present, but was represented by one or more allied species of very different colours, the *Leptalis* of the locality had assumed the same colours to suit these changed species. Montes Aureos lies within the area of the typical *Ithomia Flora*, and it is therefore the *Theonoë* form of the *Leptalis*, or that which most closely resembles *I. Flora*, which is here found. But an interesting variety of *Leptalis Theonoë* occurred in the same locality, differing from the type in having a reddish stripe within the black margin of the hind wing; this resembles closely a common variety of the *Ithomia* inhabiting this and other districts. In fact, *Ithomia Flora* is generally found to occur under two forms or varieties, and both of them are imitated by corresponding varieties of the *Leptalis*.

Heliconius Erato and *Doris*.

These two forms are still kept separate in some collections, on account of their striking difference in colours, the one red and the other blue. I bred, however, on one occasion, a large number of both from one set of caterpillars, found feeding socially on leaves of the same branch of a tree, and, apparently, belonging to one and the same brood. Mr. Salvin also captured the two forms *in copulâ*. The difference in colour occurs in both sexes, and, in most localities on the Amazons, there is no trace of connecting links of variation. It is a case, in fact, of dimorphism, and interesting on account of its persisting throughout two distinct local races of the species, one found in New Granada and the Isthmus of Panamá, and the other in Guatemala. The difference between the two forms is not simply a substitution of one colour for another, for there is a marked difference also in pattern, and in the glossiness of the surface; the differences, however, relate only to the upper surface of the wings. The fine series of specimens brought home by Mr. Belt show that this *Heliconius* has almost lost its dimorphism in the Montes Aureos district, as he found nearly all passages in coloration and pattern between one form and the other. In the neighbourhood of Pará examples occur of *Erato* (the red form) with the red colour at the base of the anterior wing nearly obsolete, and traces of glossy blue on the borders of the nervures of the posterior wing, but these were rare ; whilst at Montes Aureos the intermediate forms seem to be as common as the two extreme forms. On the Lower Tocantins, and on the Lower and Upper Amazons, I met with no intermediate varieties.

Heliconius Melpomene, H. Thelxiope, and intermediate varieties.

Mr. Belt's collection adds considerably to our knowledge of the curious local distribution of these allied forms of *Heliconius*. In my paper on the *Heliconiidæ*, already alluded to, I stated that *Heliconius Thelxiope* was confined in its distribution to the alluvial plains of the Amazons, and *H. Melpomene* to the more elevated continental land to the North and South of these plains ; and I argued, that as a series of connecting links between the two distinct types was found at several points on the margin of the low plains, we might fairly infer that one of them was derived from the other by variation and natural selection ; *H. Thelxiope* being probably originally an extreme variety of *H. Melpomene,* strayed into the low humid forests, and, becoming adjusted to the new conditions of life there, spreading, in course of time, as a distinct form, from end to end of the region. Since my paper was published, Mr. W. W. Saunders has exhibited to the Society (see Proc. Ent. Soc. 1866, p. iii.) a fine series of these intermediate varieties which he had received from Cayenne, where the extreme form *H. Thelxiope* does not appear to occur, although there are varieties nearly approaching it. The results of Mr. Belt's investigations confirm what I had observed with regard to the distribution of the forms. He tells me that *H. Thelxiope* did not occur in the Montes Aureos district, but that *H. Melpomene* was abundant between there and Maranham, and was found within three miles of his locality ; whilst at Vizeu, on the coast, nearer the Pará river, he found numerous forms intermediate between the two species, neither of which was there present. This accords with what I observed at Serpa, on the borders of the Guiana highlands, which there form the northern banks of the Amazons, and at one place on the river Tapajos. It also confirms what I have stated, that hybridity has little or nothing to do with the production of these intermediate forms, for in a place where the two supposed parent species are not present, there could be no hybrid productions from them. I think the explanation I have before suggested is greatly supported by these additional facts. None of these intermediate varieties have been found in the humid forests of the alluvial plains where *H. Thelxiope* abounds; nor in New Granada or Venezuela, where *H. Melpomene* is abundant; they are found only in districts which are intermediate in physical character, and their inconstancy shows that the physical conditions do not demand that one of them alone shall prevail over the others, as in the Amazons plain.

The following are descriptions of nine new species in Mr. Belt's collection.

Heliconius novatus.

♀. Expanse 3″ 8‴. Closely allied to *H. Silvana*, Cram. (Pap. 364 C. D.). Differs from all the varieties of that species in having three black spots at the end of the fore-wing cell, with a broad yellow belt lying *beyond* the cell.

Fore-wing broadly truncated at the apex; black, basal half orange, except the costa; a black spot in the middle of the cell, a larger one within the end, and two smaller ones outside the median nervure at the end of the cell; beyond the cell is a broad yellow belt extending from the costa to near the outer margin, where it is crossed by a black lunulated streak; the black apical part of the wing crossed by a belt of four widely separated spots, and having, near the outer margin, a row of five more or less indistinct smaller yellow spots. Beneath, the same, except that the pale spots near the outer margin are larger and white.

Hind wing above, orange; a subcostal stripe, broad outer border and discal macular stripe (sometimes uniting with the outer border) black; two yellow spots near the apex. Beneath, the same, except that the subcostal black stripe is reduced to two large spots, and that the outer margin has a row of thirteen white spots, all in pairs, except the three nearest the apex.

Body and antennæ as in *H. Silvana*.

This species is found also at Pará.

Heliconius paraplesius.

♂. Expanse 3″. Resembling *H. Aœde*, Hübn.; differs in having a yellow spot near the apex of the fore-wing, besides the broad belt behind the cell, and in the abdomen above being ringed with yellow, with the lateral spots elongated instead of round.

Fore-wing black, with the basal third orange; a large subquadrate spot at the end of the cell, a broad curved belt beyond it, consisting of seven elongate spots separated only by the black nervures, a triangular spot between the first and second median branches, and a spot near the apex, divided by four black nervures, all bright yellow. Beneath, the same.

Hind-wing black, a stripe within the cell and seven lines between the radiating nervures orange; a series of whitish marginal specks between the ends of the nervures. Costal portion of the wing deep black. Beneath, the same, except that the white marginal specks are more distinct, two between the nervures respectively.

Body black; head spotted with yellow, disk of the thorax with larger spots; abdomen finely ringed with yellow, and having a row of elongate spots on each side. Antennæ, brown, beneath and the club tawny rufous.

Although closely resembling the common and well-known *H. Aœde*, this species is most nearly allied to *H. Xanthocles*, Bates (Trans. Linn. Soc. xxiii. 561), the two agreeing in the length but not in the colour of the antennæ, and in the hind wing beneath presenting a marginal row of whitish specks. *H. Xanthocles* has not a continuous row of yellow spots on the side of the abdomen.

Olina Stalachtoides.

♀. Expanse 2″ 10‴. Similar in shape to *O. Emilia*, Cramer, but the wings are rather broader.

Fore-wing above, black, with a slight bluish gloss, three triangular spots in the cell, an elongate spot between the first and second median branches, a smaller one between the second and third, a belt of four spots across the apical portion of the wing, and a small spot near the apex, all grayish-white, semi-transparent. Beneath, the pale spots in the same position, but the apical spot elongated into a short belt; the black ground colour is varied with tawny-orange, and there is a short greenish-gray streak near the hind angle.

Hind-wing black, with the whole disk, including the abdominal margin, grayish-white, semi-transparent, the nervures bordered with black; parallel to the outer border is a broadish orange belt, not reaching the apex, and separated from the semi-transparent disk by a broadish band of black; there is a submarginal row of slender grayish-white lines, and within them a row of four white lunules margined with black. Beneath, the same, except that there is a broadish band of orange, extending parallel to and near the margins, from the base round to the anal angle of the wing.

Body black; head and collar spotted with white, thorax with two gray belts, and abdomen striped with gray. Antennæ black; palpi in front white, the terminal joint black.

This handsome and distinct species was once found also on the river Capim, in the interior of the Province of Pará, by Mr. Wallace, and the specimen is now in Mr. Salvin's collection.

Cremna Beltiana.

♀. Expanse 1″ 4‴. Allied to *C. Ceneus*, Cram. (Pap. 156 F.), but very distinct.

Fore-wing with the costa not arched, but straight from near the base to near the apex, the latter slightly produced, the outer margin bowed outwards and strongly waved. Blackish-gray, and ornamented with white spots similar to those of *C. Ceneus* ♀, but larger, and most of them edged with black; the row of spots nearest the outer margin consists only of three, equidistant from each other; the next row is formed of seven spots, the four nearest the costa being in pairs, the fifth lunate, the sixth and seventh oblong and close together near the hind margin. Beneath, the same, but ground colour paler, and spots larger and more distinctly margined with black, especially those on the basal half of the wing.

Hind-wing with the outer margin bowed outwards and waved, colours the same as the fore-wing, and spots edged with black; the row nearest the outer margin consists of five oblong spots, the next row forms a connected string of seven circumflexes, extending from the apex to the abdominal edge. Beneath, the same, but the white spots are so much larger that the basal half of the wing might be described as white, with a number of quadrate black spots. All the wings with a very narrow white fringe in the sinuses.

Body above, dark brown, with a few white spots; beneath white. Antennæ ringed black and white, club black.

One example, Montes Aureos, Maranham.

[The following is a list of the species of *Cremna*, so far as at present known; the genus is a very distinct one, and is separated from *Charis* and allies by having four branches to the subcostal nervure of the fore-wing.

1. *Cremna Ceneus*, Cramer, Pap. 156 F.

Surinam, Amazons, Maranham.

2. *Cremna heteræa*, n. sp.

♂. Expanse 1″ 4‴. Very similar to *C. Ceneus*; costa of fore-wing arched, apex much less produced, and more obtuse. Fore-wing dark brown, crossed by six broadish interrupted belts of a glossy light blue, the one nearest the outer margin lunulated; along the apical half of the costa are a number of small white spots, besides a row along the outer margin; beneath, paler, the belts much more broken up, and consisting of irregular rows of white spots, some of them oblong. Hind-wing above, crossed by five belts, broader and less interrupted than those of the anterior wing, except the middle one, which is divided into squarish spots, forming almost a double belt; the submarginal belt is lunulated, and very broad; near the outer margin is a row of white specks; beneath, the same, but the belts white, and broken up into spots, as in *C. Ceneus*.

Ega and Tunantins, Upper Amazons.

This seems to be an incipient species, scarcely segregated from *C. Ceneus*, the type form of which is also found at Ega.

3. *Cremna Beltiana*, Bates, *ante*, p. 541.

Montes Aureos, Maranham.

4. *Cremna Phryxe*, Felder, Reise d. Novara, Zool. II. 2. p. 299, t. xxxvii. f. 23, 24, ♀.
Bahia.

5. *Cremna Actoris*, Cramer, Pap. 93 D, ♂.
Surinam.

6. *Cremna Eucharila*, Bates.

Napæa Actoris, Hübn. Exot. Schm. i. pl. 34 (*nec* Cramer).

Cramer's figure of *C. Actoris* evidently represents a species more nearly resembling in its markings our *C. Beltiana* than the handsome insect existing in collections under the name *Actoris*, and figured by Hübner. I have not seen a specimen with the numerous large white spots towards the outer margin of the hind-wing, and without a trace of a red submarginal line, as represented by Cramer.

Found throughout the Amazons, but rare.

7. *Cremna Melampia*, n. sp.

♂. Expanse 1″ 10‴. A large robust species. Fore-wing with the costa very slightly arched, apex produced, but the outer margin very little bowed outwards; hind-wing with the anal angle acute, prominent. Above, dark brown, with white marks in the fore-wing only, namely, four lines (two interrupted) across the cell, two between the cell and hind margin, and two rows of spots across the apical portion, those nearest the costa alone being clear white. Beneath, clear light-brown, with numerous short slender lines, forming irregular belts across both wings: all except the submarginal row have, each on its inner side, a large black patch. Body dark-brown above and beneath; antennæ black, the stem ringed with white.

Bahia. In my own collection.

Westwood, in Doubleday and Hewitson's Genera of Diurnal Lepidoptera, enumerates two other species under the genus *Cremna*; of these one, *C. Orpheus*, is a *Lemonias* or *Anatole*, being totally different in neuration from the group to which *Cremna* belongs; the other, *C. Thasus*, Cramer (Pap. 333 I.), I know only from Cramer's figure; it may be a *Cremna*, or a species allied to *Charis Trochilia* and *Hisbon*.]

Pseudopheles, nov. gen.

Differs from *Pheles* in the neuration of the fore-wings, the upper radial (or discoidal) nervure being emitted at the end of the cell, in conjunction with the discocellular nervule, and the lower radial lying about midway between the subcostal and median nervures. The genus differs from *Esthemopsis* of Felder, which it much resembles in form of wings and in coloration, alone by the conjunction of the upper radial and discocellular nervures at their origin. If this difference in the neuration should prove not to be constant when other species are discovered, the genus may very well be united with *Esthemopsis*. The antennæ are concolorous black, with a gradually-formed club. The palpi do not pass the forehead.

Pseudopheles sericina.

♂, ♀. Expanse 2″. Fore-wing strongly arched before the apex, the latter slightly produced, outer margin bowed outwards; hind-wing short, very little longer than the abdomen, anal angle produced. Wings black, glossed with rich blue; fore-wing with a bent basal stripe traversed by the median nervure and its first branch, and a short belt crossed by three nervures before the apex; hind-wing with a broad discal vitta traversed by the median and its two branches, white, semitransparent; fore-wing with a glossy blue streak extending from the base along the postmedian nervure. Beneath, the same, except that the costa and abdominal edge of the hind-wing have a glossy light-blue streak. Body black, striped with bluish-white. Head (except the crown) and palpi clear rosy red. Antennæ black.

Found also at Pará. Occurs, too, on the Upper Amazons as a local variety, wanting the red colour on the head behind the insertion of the antennæ.

Emesis Aurelia.

♀. Expanse 1″ 10‴. Allied to *E. Fatimella*, Westw., but of a tawny duller hue; much less robust than *E. Mandana*, Cramer, and differing in the markings of the underside. Fore-wing with a moderate incurvation in the middle of the costa (as in *E. Fatimella*), apex markedly produced; hind-wing forming an obtuse angle in the middle of the outer border, anal angle rounded off.

Fore-wing above, crossed by five dusky flexuous lines, and having a row of black specks near the outer margin. Beneath, yellow, uniform in tint, except near the apex, where it is ruddy-brown: the flexuous lines reddish.

Hind-wing above, crossed by lines and having a row of submarginal spots, as in the fore-wing. Beneath, the same as the fore-wing, except that the submarginal black specks are enlarged near the apex and anal angle into large quadrate spots.

Body, above tawny, beneath whitish. Antennæ brown, stem ringed with white.

One example; Montes Aureos, Maranham.

Nymphidium sylvarum.

Expanse, ♂ 2″, ♀ 2″ 3‴. A very distinct species, allied to *N. Regulus*, F., and destitute of the usual submarginal pale arcuated lines.

Fore-wing with the costa arched just before the apex, the latter pointed in both sexes; hind-wing moderately long, and outer margin regularly rounded. Wings dark rufous-brown, fore-wing with a triangular spot in the middle of the hind margin, extending only to the median nervure, and two submarginal short thickish lines, parallel to the outer border, ochreous. Hind-wing also rufous-brown, with a very broad ochreous belt across the disk, leaving a small basal spot, and a broad outer border; in the middle of the latter a continuous ochreous submarginal streak. Beneath, the same, but paler. Body brown, apical half of abdomen ochreous. The female is much paler than the male.

Taken at Vizeu, on the coast. I have both sexes also from Pará.

Nymphidium Chione.

♂, ♀. Expanse 1″ 6‴. Fore-wing in shape resembling that of *N. Ascolia*, with the costa rather strongly arched before the apex, and the latter, in the male, slightly produced; hind-wing much longer than in *N. Ascolia*. Wings dark-brown, the central part of all pure white; the white on the fore-wing forming a triangular spot, bisinuate on the outer side, on the hind-wing leaving a brown border of moderate and uniform width. The costal edge of the white patch of the fore-wing is besides indented by the transverse dark streaks of the cell. The outer border of all the wings has a submarginal row of fine gray lines, joined together, and of arcuated or semicircular shape, not at all triangular. Fringe dark-brown, in the fore-wings varied with white. Body dark-brown, abdomen white.

A very distinct species, closely allied to *N. Cachrys*, Fab., (*Damon*, Stoll) and *N. Ascolia*, Hewitson; agreeing with them in shape, and in the form of the fine submarginal gray lines, but differing in the pure white hue of the disk of the wings.

Found also at Pará; not uncommon.

Theope Janus.

♂. Expanse 1″. A small and very distinct species. Fore-wing triangular, with pointed apex, and outer margin slightly bowed outwards; hind-wing scarcely longer than the abdomen, outer margin rounded. Wings above blackish-brown, fore-wing with a triangular silky-blue patch near the base and hind margin. Beneath, pale lilacine-brown, with the basal fourth of all pale yellow; this colour limited in a straight line from the rest of the wing.

Montes Aureos, Maranham.

XXIV. *Observations on Dzierzon's Theory of Reproduction in the Honey Bee.* *By* John Lowe. (*Communicated by the* President.)

[Read 1st July, 1867.]

The mysteries of the bee-hive have in all ages engaged the attention and attracted the study of the naturalist. The many interesting and peculiar phenomena which present themselves to the diligent student of bee-life have given rise to the most varied and conflicting theories in the physiology of reproduction. It is unnecessary for my purpose to do more than simply allude to these; nor shall I particularize the advances which have from time to time been made in apiarian science by many distinguished naturalists and observers. Swammerdam, Réaumur, Mademoiselle Jurine, Schirach, Huber, and others, have contributed much to dispel the mists of ignorance and prejudice which so long encompassed the natural history of the bee. To Francis Huber, of Geneva, especially are we indebted for much valuable and important information, and yet the "Prince of Apiarians" himself, notwithstanding the flood of light which, by his patient and persevering studies, he has thrown upon the subject, has failed to place before us, in all its clearness and entirety, the true history of the bee. Many phenomena still remained unexplained, or misunderstood; and unsolved riddles still hung around the physiology of reproduction.

In 1845, a new theory was promulgated in Germany by an apiarian of great eminence and distinction. The continental naturalists have always shown themselves foremost in explaining the hidden mysteries of bee-life; and now, in the person of Dzierzon, Pastor of Carlsmarkt, near Brieg, in Silesia, a new and startling theory of reproduction in the bee was promulgated, which, in the words of its distinguished author, is said to have "explained all the phenomena of the bee-hive as perfectly as the Copernican hypothesis the phenomena of the heavens."

Dzierzon first expressed his views upon the reproduction of bees in the year 1845, in the *Bienenzeitung* of Eichstadt, and afterwards published them as a regular theory, in a separate bee-book, in 1852.

The principal points of this theory may be shortly expressed thus:—1st. That the queen (female bee), to become good for anything, must be fertilized by a drone (the male), and that the copulation takes place only in the air; that drone-eggs do not require fecundation, but that the co-operation of the drone is absolutely necessary when worker-bees are to be produced. That "in copulation the ovaries are not fecundated, but the seminal receptacle, that little vesicle or knot which, in the young queen, is filled with a watery moisture, is saturated with semen, after which it is more clearly distinguishable from its white colour." That the supply of semen received during copulation is sufficient for her whole lifetime. The copulation takes place once for all, and (as already stated) only in the open air; therefore, no queen which has been lame in her wings from birth, can ever be perfectly fertile—that is, capable of producing both sexes—as copulation never takes place in the interior of the hive. This (Dzierzon says) "is exactly the new and peculiar point in my theory, which I at first only ventured to put forward as a hypothesis, but which has since been completely confirmed."

"The power of the fertile queen, accordingly, to lay worker or drone eggs at pleasure (he goes on to say), is rendered very easy of explanation, by the fact that the drone-eggs require no impregnation, but bring the germ of life with them out of the ovary; whilst, otherwise, it would be inexplicable and incredible. Thus the queen has it in her power to deposit an egg just as it comes from the ovary, and as the unfecundated mothers lay it; or by the action of the seminal receptacle, past which it must glide, to invest it with a higher degree—a higher potency—of fertility, and awaken in it the germ of a more perfect being, namely, a queen or a worker-bee."

2nd. The second and most important point in Dzierzon's theory is, that "all eggs which come to maturity in the two ovaries of a queen-bee are only of one and the same kind, which, when they are laid without coming in contact with the male semen, become developed into male bees, but, on the contrary, when they are fertilized by male semen, produce female bees."

This important proposition, it will be seen, strikes at the root of, and completely abolishes, as Von Siebold expresses it, a "time-honoured physiological law," namely, "that an egg which is to be developed into a male or female individual must always be fertilized by the male semen."

In favour of Dzierzon's proposition, that drones alone are always produced from unfertilized eggs, reference is made to the discovery of the French naturalist Riem, namely, that of "fertile workers," which are known, under certain circumstances, to be capable of laying eggs, but which only develop into drones. It was ascertained anatomically by Mademoiselle Jurine, that the "worker-bees are nothing but female bees whose seminal organs are aborted." Huber has shown that, by virtue of the peculiar treatment, and the administration of royal food to any worker-larva which the bees may select for this purpose, the female sexual organs of such larva acquire development, and the mature royal bee, or queen, becomes thus fitted, after fecundation, for all the functions of a mother bee. Hence such worker-larvæ as receive a partial treatment of this kind, by being reared contiguous to royal cells, obtaining by accident probably a portion of royal food, acquire a certain development of their female seminal organs, in virtue of which the bees so reared sometimes oviposit, but experience shows that their eggs develop only into drones, or males.

Dzierzon's theory also includes the assertion, that every normally organized and fertilized queen must, at the same time, possess the power of laying male or female eggs at will; that is to say, of leaving an egg unfertilized, or depositing it fecundated, according to her will, when engaged in laying her eggs.

Such, then, is a summary statement of the principal points of Dzierzon's new theory of reproduction in bees. Now, it will be at once evident, that, if this theory be correct, as Von Siebold remarks, "we might beforehand expect, that by the copulation of a unicolorous blackish-brown German, and a reddish-brown Italian bee, the mixture of the two races would only be expressed in the hybrid females or workers, but not in the drones, which, as proceeding from unfecundated eggs, must remain purely German, or purely Italian, according as the queen selected for the production of hybrids belonged to the German or Italian race."

In 1854, Dzierzon himself further writes (and I beg to draw particular attention to his remarks, as it is with reference to this important point, which pervades his whole theory, that my following observations are directed):

"Continued observations," he writes, "of the hybrid hives also must be no less adapted to raise the veil more and more, to penetrate into the obscurity, and finally bring the mysterious truth to light. If the drone egg does not require fertilization, Italian mothers must always produce Italian drones, and German mothers German drones, even when they have been fertilized by drones of the other race."

This, of course, is *à priori* the natural and logical inference to be drawn from the whole of Dzierzon's theory as promulgated by its distinguished author; and nothing can better show the great importance he himself attached to this point than the fact that one solitary and isolated instance of a deviation from this rule occurring in his experience, in the case of a German hybrid-mother, caused him to falter in the advocacy, and even to doubt the perfect tenability of his own theory, and this at the time when it was making rapid progress amongst his apiarian friends and brethren; so that, becoming bewildered and confounded, seemingly, amidst the conflicting deductions of his own experiments, he had recourse for an explanation to the antiquated and untenable theory of a bygone age, the exploded hypothesis of Swammerdam, namely, the vivifying action of an *aura seminalis*. Whether the interesting experiments made by Von Berlepsch reconverted Dzierzon, as Professor Siebold predicted, or whether this took place after the scientific experiments and investigations of Von Siebold himself, it does not appear; but in 1861 Dzierzon again reiterates and asserts his firm faith in the doctrine of parthenogenesis in the honey bee, and all the essential points of his own theory of reproduction.

Apologizing for the length of these remarks, I have now to direct the attention of the Society to the results of my own experiments in this very interesting subject.

Shortly after the introduction of the Italian bee (*Apis ligustica*) into England, I had become conversant with Dzierzon's theory, and I hastened to get possession of a colony of that beautiful race. By the aid of the Italian bee, I thought I should be enabled to test some of the points asserted by Dzierzon, and which had been confirmed, apparently, by so many eminent continental apiarians. From Mr. Woodbury, of Exeter, a well-known and indefatigable apiarian—to whom all scientific bee-keepers owe a debt of gratitude for his successful efforts in importing into this country two of the most interesting varieties of the genus *Apis, Apis ligustica* having been imported into England from Switzerland in the autumn of 1859, and *Apis fasciata* from Germany in July, 1865—from that gentleman I received two or three pure Ligurian colonies; and in propagating this new race, and in my numerous and various experiments, I soon sound myself surrounded with the most conflicting and puzzling anomalies.

It is, perhaps, necessary here to state, that Mr. Woodbury is a thorough believer in Dzierzon's theory, though I am not certain whether in practice he eliminates from his apiary all hybridized queens or not. Mr. Woodbury assured me, however, that the colonies I received from him were perfectly pure, and that the offspring of the queens were equally as well marked as the progeny of those he had first imported. Of course, it is essential to the accuracy of our experiments in this question and the trustworthiness of their results, that the race of bee in our posession be pure and uncontaminated, and free of all foreign admixture or taint. With this remark, I proceed to say that the queens I got from Mr. Woodbury produced beautiful workers but indifferent drones; while, on the other hand, some of the subsequent queens, reared from the original ones, bred inferior workers but yet produced more beautiful drones. In short, the results of all my experiments with the Italian bee were very perplexing, and especially in the case when the pure queens reared were hybridized by English drones the phenomena presented were full of mystery and inexplicable. All this created a strong suspicion in my mind that there was a taint or flaw somewhere, and that probably Dzierzon was in error in supposing that the drones of such pure hybridized queens always partook and followed the race of the mother; otherwise, I could not account for the many anomalies brought out in my experiments.

Indeed, I confess that I do not well see that perfect accuracy of results, in this question, could be obtained by aid of the Italian bee, inasmuch as the pure Ligurian drone *sometimes* so nearly resembles the English drone, that purity is often difficult to determine. I only judge from my own experience in the matter, but I believe it is also the experience of several apiarians both in England and Germany. If *colour* be the expression of purity as regards the queen and drone, I confess my inability, according to my experience, to determine on all occasions the *perfect* purity of either.

I failed, therefore, with the aid of the Italian bee, to expiscate the truth of Dzierzon's assertion, that, in the case of hybridized queens, the drone offspring always follow the race of the mother.

In July, 1865, Mr. Woodbury imported from Germany a queen and a few bees of the Egyptian race, *Apis fasciata.* In the following spring he wrote to me to say, that as *Apis fasciata* was decidedly more irascible than *Apis ligustica,* and as he could not well propagate both races, he had made up his mind to "stick to his first love," and therefore offered the original colony of *A. fasciata* to me. I gladly availed myself of this offer, and upon the 7th of June, 1866, the colony reached me in comparative safety. I immediately set to work to propagate the Egyptian race. I succeeded in raising twelve queens during the summer and autumn. Seven of these were fertilized, and became the heads of so many colonies. Three disappeared, and one was encased and killed. Two which I raised towards the end of August, in consequence of the very untoward weather which followed, failed, apparently, to get impregnated, and they became drone-breeders. The drones produced by these, being bred in worker-cells, formed no true test of purity, as in such circumstances they are generally darker in colour; but they appeared pretty well marked. I never witnessed either of these queens come out, or take what is termed the "wedding flight," (the weather being very unfavourable,) although they might have done so without my knowledge. There were Egyptian drones at the time in the apiary, and also in the hives in which the young queens were reared. One of these produced drones towards the close of the season, the other early during the spring of 1867.

It is proper that I should here state, that I reared all the Egyptian queens in proximity to my Italians. I had no English bees in my apiary, but I am not sufficiently removed from other apiaries to be beyond English drone-influence.

Of the respective progenies of the young Egyptian queens, those of two only were similar to the parent colony, though these, too, differed a shade. The bees produced by the others were of a varied and motley character, some Egypto-Italians, and some of a light leaden character, forming a variety *sui generis*. No drones were produced by any of the fecundated queens till towards the close of October, when I was astonished to find some few appearing; but as they were all as badly coloured as the workers, I concluded that a change of queen might have occurred without my knowledge, and that the *supposed* successor had been a drone-breeder, as no young workers appeared. I examined the interior of the hive, and found the queen to be no new princess, but, apparently, the same queen which was reared in summer, but with tattered wings, as though she had suffered much by an encasement—that injurious and often mysterious phenomenon to which I have frequently and fully directed the attention of apiarians in the "Journal of Horticulture."

This was the first serious awakening of my suspicions as to the truth of Dzierzon's theory, though, from the nature of the case, the evidence was by no means satisfactory.

In the middle of May, 1867, others of my hybridized Egyptian queens produced drones of the same varied character; some tolerably well marked, and others very badly marked. Of three hives containing pure Egyptian queens, and now exhibiting drones, not one produced male or worker brood equal to the original stock. The drones, in the marking or colour, correspond in some measure with the marking or colour of the workers; that is, the queen which produces the worst workers shows the worst marked drones, and the queen which produces the best workers produces also the best marked drones. One of the queens, which had evidently been hybridized by a Ligurian drone, as the workers were very beautiful hybrids, produced some drones almost equal to those of the original queen, some very poorly marked, and some, apparently, partaking more of the Ligurian character. There seems to be, thus, a general correspondence of the purity of the drones to the purity of the workers, though I shall be better able to decide as to this when the drones get more numerous.* The important fact, however, is, that these pure Egyptian queens,

* Subsequent observations confirmed these remarks, in the case of all my hybridized Egyptian stocks, four in number.—J. L., Dec. 1867.

being hybridized, produce hybrid males as well as hybrid workers.

I have the pleasure of submitting specimens of the drones and workers of the hybridized queens along with those of the original pure queen, and it will be at once manifest to the members of the Society, that there is a very marked and decided difference.

I deem it necessary here, for the same reason which induced me to refer to the purity of the Italian colonies received from Mr. Woodbury, to refer also to the Egyptian queen now in my possession, which was the first sent to England by Herr Vogel, to whom the Berlin Acclimatisation Society had deputed the task of multiplying and disseminating the race; for it is of the utmost importance, in an experimental point of view, to be assured that any variety of bee which we propagate is really pure and free from all taint. The following is Herr Vogel's description of the queen to Mr. Woodbury:—"The Egyptian queen which you received from me was reared in June last; she is, therefore, about four months old. This queen has received a true impregnation, because the mothers that were reared from her brood here produced true Egyptians. I sent you this queen, because the queens that were thus reared became all beautiful and true Egyptians."

From these observations and proofs, which, by the kindness of your distinguished President, I am permitted the pleasure of submitting to the members of the Entomological Society, I think I am warranted in coming to the conclusion, that the eggs of a hybridized queen, whether they develop into drones or workers, are in some way influenced and affected by the act of fecundation, and that both sexes of the progeny partake of the paternal and maternal character or race. If this is assented to, it follows that Dzierzon's theory of reproduction in the bee—based as it avowedly is upon the principle that eggs which develop into drones bring the germ of life *alone* from the ovary of the queen, are not affected by the male semen, and, consequently, that the males produced by all queens, whether fecundated or not, must necessarily follow the race of the mother—cannot be the true theory of reproduction in the honey bee.

It may appear presumptuous in the writer of these observations to call in question the accuracy of some of those points upon which so eminent an apiarian as

Dzierzon has built his theory; a theory, too, which has been supported by other distinguished observers, such as Baron Von Berlepsch, and which has passed, as the author himself expresses it, "the fiery ordeal of Science under the microscope and dissecting needle of the great physiologist, Professor Theodor Von Siebold, formerly of Breslau, now of Munich." It is not without considerable diffidence that I have ventured to put forward these results in opposition to the opinions of such eminent men; but I cannot shut my eyes to the light of truth. I cannot ignore my own experiences, I must yield to the "inexorable logic of facts." I confess my inability to test the accuracy of that distinguished physiologsst in the highly difficult and delicate scientific manipulations and experiments by which he has endeavoured to confirm the truth of Dzierzon's theory, and establish parthenogenesis in the honey-bee; yet there are points in this theory which, as a practical apiarian, I am competent to examine, and it was to these chiefly that my attention was early directed, and with the results which I have in these observations submitted to the Entomological Society.

How far the discovery, which I think I have made, may affect the doctrine of true parthenogenesis in the bee I will not venture to say. The power of a virgin queen to lay eggs which will develop into drones, independently of fecundation, may still remain unaffected by it. This may be so. Let Science be directed to a solution of the enigma. Scientific research must abide by scientific methods, scientific convictions by scientific investigations. There is no subject, perhaps, more difficult, or more open to false observations and wrong deductions than that of reproduction; but if the views I have here stated be correct, it is plain that parthenogenesis in the bee can receive no aid from the theory promulgated by Dzierzon.

I confess I have been slow in believing in the power thus ascribed to the virgin queen, and yet I could not otherwise account for the conduct of certain young queens, and workers also, in producing drones, notwithstanding that, apparently, they were not impregnated. Of course, in thus believing, we must take for granted certain things; among others, that queens cannot be impregnated in the interior of the hive; that retarded impregnation has no injurious effect; and that a queen which is lame in the wings does not seek to take a "wedding flight." I am inclined to believe the former, but not the latter statement. A maimed or defective bee, worker or queen, will not be deterred, by reason of such defects, from going abroad. I have had more than one instance where such a defective queen came out only to fall over the board and perish. I witnessed a queen on two successive days come thus out to go through the same course; on the first occasion I picked her up, and restored her to the hive, but the following day she repeated the attempt, and I failed to induce her again to enter. I have little faith, therefore, in Von Berlepsch's statements as to lame-winged queens, unless, indeed, they are reared during the cold spring, or at the end of autumn, when they are prevented from going abroad by the state of the weather.

Swammerdam, Réaumur, Debraw, and Hattorf, had all different theories regarding fecundation. Huber, with Réaumur, believed that the queen's fecundation followed actual union, and that no ova were deposited till this was accomplished. They differed only as to whether a union could take place in the interior of the hive. The former believed it could only occur in the air.

I do not see that we have any evidence that the *coitus* takes place "high in the air," as many suppose; indeed, judging from analogy, from the *Bombus* and wasp, we might infer the contrary. But the fact is, we have no well authenticated evidence in the matter. The queen, it is true, rises aloft on her setting out, just as any young bee or drone does, but I doubt if she continues to fly far at such an altitude. Like Huber, I never have been so fortunate as to witness the act of coition, though I once surprised a couple of wasps *in flagranti*, and had the opportunity of showing them to the venerable Sir William Jardine, who confessed to me he had never seen it before. I have always felt surprised at the lack of ocular proof on this head, in the case of the bee, and can only account for it by the supposition that the *coitus* must be of very short duration.

The fact of certain queens and workers also being drone-breeders was known long ago to apiarians. Hattorf believed that in such cases the queen is self-fecundated. Huber ascribed the fact of the queen producing only drones to retarded impregnation, that is, to impregnation beyond the twentieth day of her age. I cannot account for the results of some of Huber's experiments with regard to such queens, unless it be that the confinement to which they were subjected had, in some way, affected their instinct, and produced a change in the character of their fertility; for according to my experience, when queens are allowed full liberty of action, they never become drone-breeders so early as he states. On the contrary, I have had queens which only began to lay worker-eggs six weeks after their birth. Of course, I had no proof as to when they were impregnated, but presumed that they oviposited shortly after fecundation, the same as other queens do. In a few instances drone eggs were laid first, and workers afterwards. Three such abnormal cases of laying have occurred in my experience, but I can offer no explanation of the cause of these anomalies. A curious case is narrated by Huber, which also shows that fecundation does not always secure a normal state of laying. He reared a queen on the 4th October, and on the 31st of the same month she brought back from her "wedding flight" undoubted proofs of her *amours*, and yet that queen, when she began to lay in March following, only produced drones. Of course Huber ascribed this to retarded impregnation.

There is one peculiarity in the conduct of young abnormal queens, according to my experience, which I think worth noticing. It is this, that they do not oviposit so early as perfectly fecundated queens. Indeed, I have had them for months in the hive before they oviposited, and some perished without laying at all, remaining to the last perfectly sterile; whereas, in the case of true fecundated queens, weather being favourable, they generally begin to lay when they are about eight or ten days old. This seems to me rather perplexing, if I dissociate the act of fecundation from oviposition. I have in my apiary at the present time a young queen upwards of four weeks old, and she has been abroad too, but in consequence of the prevailing cold weather, I judge she has not yet been fecundated, for she has not yet laid an egg.* Why is this, if fecundation is not necessary to her becoming even a drone-producer?

* This queen I observed abroad on the twenty-seventh day of her age. She had not laid on the thirtieth, but a more recent examination shows

There is only one other point in Dzierzon's theory to which I shall briefly advert. It is to the change of character which the egg undergoes by its coming into contact with the orifice of the seminal receptacle. If the egg, as asserted, brings the germ of male life with it from the ovary, and is spontaneously developed into a perfect being, independently of fecundation—for I suppose a drone, notwithstanding Dzierzon's assertion to the contrary, is as perfect a being as a worker or female—then the action of the spermatozoids upon the egg must not only incite in it a new development, and awaken therein the germ of what is described as "a more perfect being," namely, a queen or worker, but it must also *destroy* the germ of male life which it orginally contained, and put in its stead a new being completely different in size, sex, and character. This, indeed, is a wonderful metamorphosis, but it is one which scientific investigations profess to reveal!

"In the hive-bee (says Sir John Lubbock, in his admirable paper on the Ova and Pseudova* of Insects), the ovarian development of the ova and pseudova must apparently be identical, since it would appear that, in normal instances, it is not decided until after the ovarian product has entered the oviduct, whether it is to be an ovum or a pseudovum; in other words, whether it be impregnated or not."

"At the same time, the sex of the future animal is determined, since, according to MM. Leuckart and Siebold, eggs always in this species produce females, pseudova give birth to males."

"We are, then, justified in asserting, that in the present state of our knowledge no difference can be pointed out between the ovarian development of the pseudovum in insects and that of the ovum."†

It was admitted by Leuckart, and confirmed by Siebold, that it is impossible, from the external condition of the bee's egg, to arrive at any conclusion as to the sex of the bee which is to be developed in it. Leuckart also admitted that he failed, by the assistance of the

that she is now fertile, having begun to lay on the thirty-first day of her age.

* Sir John has recently suggested that "Euova" would be a more appropriate term than Prof. Huxley's "Pseudova," as they are not "false eggs," but, on the contrary, "are true eggs, and something more."—[Proc. Ent. Soc. 1866, p. lx.].

† Sir John Lubbock "On the Ova and Pseudova of Insects." 1858.

microscope, to ascertain the presence or absence of the seminal filaments upon the micropylar apparatus of freshly-deposited drone-eggs, and from this to draw a conclusion as to their fecundation or non-fecundation. "Until" says Leuckart, "either by experiment, or by direct observation, the strict proof is obtained, that it is only the eggs of the female bees that are impregnated, the question as to the causality of sex in the bees remains an open one."

This strict proof, according to Von Siebold, has been obtained by him. By a rigid course of experiments and observations he has discovered what Leuckart failed to accomplish. Though acknowledging with Leuckart, "that the investigations of the egg of the bee are amongst the most difficult of all investigations of the kind," yet he has been "able to furnish, by direct observations, that evidence which must have been required by science as alone sufficient for the establishment of Dzierzon's theory." He says: "Amongst the fifty-two female eggs examined by me with the greatest care and conscientiousness, thirty-four furnished a positive result, that is to say, in thirty I could prove the existence of seminal filaments, in which movements could even be detected in three eggs." Also: "Amongst twenty-seven drone eggs examined with the same care, and by the same method," he says, "I did not find one seminal filament in any single egg either externally or internally."

Such are the results of scientific investigation. It is perhaps impertinent in me, therefore, to attempt to resuscitate a question which has been, as it were, thus fore-closed by science. But if my observations be correct, that the drones do partake of the paternal influence, how, I ask, are we to account for the contents of the spermatotheca affecting the male eggs in the ovaries, excluded as they are without being invested with the fecundating seminal filaments? How are these apparently opposing facts to be reconciled?

To me it humbly appears the whole subject is full of difficulties. Repeated observations and experiments are no doubt still needed to elucidate the mysteries of reproduction in the bee. The anomalies found in Baron Von Berlepsch's experience, and which he leaves unexplained, would, according to my discovery, receive an easy and simple solution; for, in all his proceedings, I fear he was trusting implicitly to the purity of his drones, whether they had been produced by purely fecundated or by hybridized mothers.

It is not without much diffidence that I have ventured to submit these views, opposed as they are to the opinions of men of high scientific attainments and apiarian experience, but when I am asked to believe in a theory which is professedly based upon certain evidence, the examination and testing of which I find to be wanting, I shall be excused for a little scepticism. The whole of Dzierzon's theory seems to me to be bound up in one chain. The all-important link in that chain—that drone-eggs are not affected by fecundation—is, according to my observations, broken.

XXV. *Descriptions of some New Species of Diurnal* Lepidoptera. By W. C. Hewitson, F.L.S.

[Read 4th November, 1867.]

1. *Papilio Xeniades.*

Male.—Upperside black. Anterior wing with a white bipartite spot near the middle of the inner margin. Posterior wing rounded at the outer margin, dentate, crossed beyond the middle by a band of five detached carmine spots, the three nearest the inner margin larger than the other two, which are minute; lunules on the fringe, and three or four minute spots near the margin, white.

Underside brown, with the nervures black; the base of the anterior wing and three spots at the base of the posterior wing carmine, the spots of the transverse band white.

Female.—Like the male, except that the white spot on the anterior wing is larger and tripartite, with (outside of it) some irrorations of white; that the outer margin is nearly straight; and that the white spots near the outer margin of the posterior wing are much larger.

Exp. 3-7/10 inches.

Hab. Ecuador.

In the collection of W. C. Hewitson.

A beautiful species, nearly related to *P. Euryleon* of Hewitson, from which it differs chiefly in having the carmine spots of the posterior wing lower down and forming a macular band instead of a palmate spot, and in wanting the two white apical spots.

2. *Papilio Dares.*

Female.—Upperside black, the outer margin with white lunules. Anterior wing with a small white spot beyond the middle. Posterior wing dentated, the dentations long; crossed beyond the middle by two macular bands of crowded carmine spots; the first band of six oval spots, the first of which, near the costal margin, is smaller than the rest, and the last, at the anal angle, is larger; the second band of five spots, three of which, nearest the anal angle, are lunular.

Underside as above, except that the carmine spots of the first band of the posterior wing are smaller.

Exp. 3-7/10 inches.

Hab. Nicaragua.

In the collection of W. C. Hewitson.

Before I had got that sex, I believed this to be the female of *P. Photinus* of Doubleday; I now see, however, that it is very different. The carmine spots of the first band cross the wing in a double curve, and those near the margin, instead of being triangularly lunate, are very slightly so.

3. *Leptalis Othoe.*

Female.—Upperside dark-brown. Anterior wing with two large white spots, one beyond the middle touching the costal margin, the other at the middle of the inner margin; two very minute indistinct white subapical spots. Posterior wing pale yellow, broadly bordered with brown, except on the costal margin.

Underside pale yellow. Anterior wing as above, except that the costal and outer margins and apex are broadly yellow, slightly irrorated with brown. Posterior wing yellow, with the exception of the centre which is white, and irrorated with pale brown.

Exp. 1-11/20 inch.

Hab. New Granada.

In the collection of W. C. Hewitson.

Nearly allied to *L. Zathoe* of Hewitson, but differs from it in not having one of the spots, and in the form of the other.

4. *Leptalis Ithomia.*

Male.—Upperside brown, both wings with a submarginal row of white spots, large on the posterior wing. Anterior wing with a large triangular spot from the base to the middle of the wing; crossed a little beyond the middle by a broad oblique band, and by a subapical bifid spot, all of pale yellow; the inner margin also yellow. Posterior wing pale yellow, with the outer margin broadly brown.

Exp. 1-15/20 inch.

Hab. Ecuador.

In the collection of W. C. Hewitson.

Most nearly allied to *L. Eumelia*, the spots and bands being in the same position; the submarginal spots give it, however, a very different aspect, and a still greater resemblance to the *Ithomiæ*.

5. *Leptalis Avonia.*

Male.—Upperside dark-brown. Anterior wing with a longitudinal spot within the cell, a large spot on the costal margin beyond the middle, a small round spot below this, and a lunular subapical spot, all pale yellow. Posterior wing pale yellow, polished where the wings meet; the outer margin broadly dark-brown.

Underside as above, except that the lower half of the anterior wing is white and polished; that the posterior wing has the costal margin and apex broadly brown; that the costal margin is marked by two large oval pale yellow spots; and that both wings have a submarginal band of white spots, large and distinct on the posterior wing.

Exp. 1-17/20 inch.

Hab. Quito.

In the collection of W. C. Hewitson.

In form and in the position of the spots, this species greatly resembles *L. Theucharila* of Doubleday; in colour it is altogether different.

6. *Pieris cinerea.*

Upperside. Anterior wing with the basal half white, the costal margin and apical half black, marked with a subapical bipartite white spot. Posterior wing gray-blue, the outer margin, from the apex to the middle, broadly brown.

Underside. Anterior wing as above, but paler. Posterior wing dark-brown, the costal margin, from the base to beyond the middle, white.

Exp. 1-8/10 inch.

Hab. Ecuador.

In the collection of W. C. Hewitson.

Very closely allied to *P. cæsia* of Lucas, but differs from it on the underside in wanting the yellow at the apex, and in having the posterior wing black instead of yellow.

7. *Heliconia Timareta.*

Upperside black. Anterior wing with one large central angular white spot, divided by the nervures, which are black, into seven unequal parts, five of which are above the median nervure; one, much larger than the rest (its outer border broken by two small black spots) within the cell, one above the subcostal nervure, and three (one of which is very minute) below this; the other two portions, which are below the median nervure, are large and separated by the second median nervule.

Underside dark-brown. Wings as above, except that the anterior wing has a scarlet spot at the base of the costal margin, and that the posterior wing has a line of pale yellow on the costal margin, and four scarlet spots at the base.

Exp. 3-4/10 inches.

Hab. Ecuador.

In the collection of W. C. Hewitson.

Not unlike *H. Heurippa* of Hewitson, if that species were deprived of its red spots.

8. *Colœnis Telesiphe.*

Upperside dark-brown. Anterior wing with a longitudinal carmine spot, irrorated with black, within the cell; below this a carmine spot, traversed by the second median nervule; crossed beyond the middle by a quinquepartite band, also carmine. Posterior wing crossed near the base by a sex-partite band of lilac-white.

Underside dark-brown, variegated with gray. Anterior wing with the first and second carmine spots as above; a large triangular spot on the costal margin beyond its middle, an irregular spot near the apex, gray. Posterior wing with the base, a broad irregular band before the middle, and several short transverse bands near the apex, gray; a triangular silver spot near the middle of the outer margin.

Exp. 2-8/10 inches.

Hab. Ecuador.

In the collection of W. C. Hewitson.

A beautiful species, in form like *C. Euchroia*, from which it does not differ on the underside. In colour it resembles *Heliconia Telesiphe*.

9. *Heterochroa Saundersii.*

Female.—Upperside rufous-brown. Anterior wing with five indistinct bands across and outside the cell; crossed a little beyond the middle by a broad band of orange, divided by the nervures into seven parts, the middle part projecting beyond the rest towards the outer margin; beyond this band to the apex, much darker than the rest of the wing. Posterior wing with four bands (the third of which is broken into spots) and the outer margin dark-brown.

Underside rufous, adorned with numerous silver spots. Anterior wing with ten silver spots, four (bordered with black) near the base, three of them in the cell, the middle one of which is in the form of a V, and six near the apex in parallel bands of three spots each. Posterior wing with six large silver spots near the base; crossed at the middle by a rufous-brown band, followed by two brown spots and two transverse bands of white spots, some of which are touched with silver.

Exp. 2-2/10 inches.

Hab. Ecuador.

In the collection of W. C. Hewitson.

This species, though very distinct, has a good deal of resemblance on the underside to *H. leucophthalma*. I have named it after the most generous of Entomologists.

10. *Cyclogramma bimaculata.*

Male.—Upperside. Anterior wing dark-brown, with a central trifid spot of white, and a subapical spot of the same colour. Posterior wing rufous-brown. Both wings glossed with blue.

Underside. Anterior wing as above, except that the base is carmine, that the central white spot is prolonged upwards to the costal margin, near which it is tinted with carmine, and that the apex is gray (inclosing the white spot) crossed by a submarginal black line. Posterior wing rufous gray; two spots at the base, a spot at the middle of the costal margin, and a submarginal zig-zag band, all carmine; a linear band of black near the base, a submarginal band of lunular lilac spots, bordered above with black, and four central round spots in pairs, bordered with black.

Exp. 1-7/10 inch.

Hab. Mexico.

In the collection of W. C. Hewitson.

This species does not differ from *C. Pandama* on the underside of the posterior wing.

11. *Clerome Amathusia.*

Female.—Upperside rufous-brown. Anterior wing with the apex acute; crossed beyond the middle by a broad curved band of rufous yellow, commencing on the costal margin where it is broadest and of the brightest yellow, and ending at the anal angle where it is rufous and indistinct. Posterior wing crossed beyond the middle by a zig-zag rufous-brown band.

Underside rufous, tinted with lilac near the base, paler beyond the band; crossed from the apex of the anterior to the anal angle of the posterior wing by a continuous common linear dark-rufous band; both wings with a submarginal band of minute rufous ocelli, some of which are pupilled with white, and both with a submarginal rufous line; anterior wing with a pale rufous band near the base (curving outwards), and a spot of the same colour at the end of the cell; posterior wing with a dark rufous band near the base (curved inwards).

Exp. 3-1/10 inches.

Hab. India.

In the collections of Mr. Atkinson, of Calcutta, and of Mr. G. Semper, of Altona.

In form this species resembles the genus *Amathusia*, and is very different in that respect from the other species of the genus in which I have placed it, with which it agrees, however, in every other way.

JOURNAL OF PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY OF LONDON.

1866.

February 5, 1866.

Sir JOHN LUBBOCK, Bart., F.R.S , &c., President, in the chair.

The President thanked the Society for having elected him to occupy the Chair, and nominated as his Vice-Presidents, Messrs. W. W. Saunders, Westwood and Pascoe.

Prize Essays.

The Prize awarded by the Council for an Essay "On Ailanthiculture" was presented by the President to the author, Dr. Alexander Wallace; and it was announced that the Council renewed the offer of last year, and would give Two Prizes of the value of Five Guineas each to the authors of Essays or Memoirs, of sufficient merit and drawn up from personal observation, on the anatomy, economy, or habits of any insect or group of insects which is in any way especially serviceable or obnoxious to mankind. The Essays should be illustrated by figures of the insects in their different states, and (if the species be noxious) must show the results of actual experiments made for the prevention of their attacks or the destruction of the insects themselves. On some former occasions the Council has selected a definite subject, as *e.g.*, the Coccus of the Pine Apple, the larva of Agrotis Segetum (the large caterpillar of the turnip), &c., but on the present occasion the selection is left to the candidates themselves, provided only that the subject be one fairly belonging to the Economic branch of Entomology. The Essays must be sent to the Secretary at No. 12, Bedford Row, indorsed with mottoes, on or before the 30th November, 1866, when they will be referred to a Committee to decide upon their merits; each must be accompanied by a sealed letter indorsed with the motto adopted by its author, and inclosing his name and address. The Prize Essays shall be the property of, and will be published by, the Society.

Donations to the Library.

The following donations were announced, and thanks voted to the donors:—'The Transactions of the Entomological Society of New South Wales,' Vol. i., Part 4; presented by the Society. 'The Entomologist,' vol. ii.; by the Editor, E. Newman, Esq. 'On the Fossil Insects from Illinois, the Miamia and Hemeristia,' by Samuel H. Scudder; by the Author. 'Exotic Butterflies,' Part 57, by W. C. Hewitson; by W. W. Saunders, Esq. 'A Catalogue of the Lepidoptera of Devon and Cornwall,' by J. J. Reading, Part III.; by the Author. 'Proceedings of the Royal Society,' Nos. 79 and 80; by the Society. 'The Entomologist's Annual,' for 1866; by H. T. Stainton, Esq. 'Stettiner Entomologische Zeitung,' 1866, Nos. 1—3; by the Entomological Society of Stettin. 'The Zoologist,' for February; by the Editor. 'The Entomologist's Monthly Magazine' for February; by the Editors.

Election of Honorary Members.

MM. Guérin-Méneville, of Paris, and Boheman, of Stockholm, were severally ballotted for and elected Honorary Members.

Exhibitions, &c.

Mr. Dorville sent for exhibition a male specimen of Sterrha sacraria, captured by him at Alphington, near Exeter, at sugar, in August last (see Ent. Mo. Mag. ii. 115); a gigantic Vanessa Cardui, measuring 2 inches and 10 lines in expanse, and having a black spot in the pale band at the anal angle of the anterior wings; a variety of Argynnis Selene, wanting many of the ordinary black markings of the upper side, and with the under side of the hind wings very abnormal; a female Satyrus Tithonus having an additional ocellated spot on the anterior wings; a female Agrotis segetum, with the anterior wings nearly black; and a variety of Triphæna orbona with mottled anterior wings, and with the posterior wings very pale yellow.

Mr. S. Stevens exhibited a male of Papilio Semperi, from the Philippines, with black wings and a bright scarlet body; the body of the female being grey.

Prof. Westwood exhibited a pair of the dog-tick, Ixodes plumbeus, which he had kept without food in a glass tube for twelve months, having taken them away with him from the Meeting of this Society held on the 6th February, 1865, (see 'Proceedings,' 1865, p. 82). Shortly afterwards numbers of young ones were observed in the tube, but they soon died; the tube however was now again thronged with young in the hexapod state. The female parent was no longer living.

Prof. Westwood also exhibited a larva with long filaments at the sides of the body, which he at first thought to be Neuropterous (Sialis), and afterwards Lepidopterous (Hydrocampa), but which from examination of De Geer's figures he believed to be Dipterous, and probably the larva of Tipula replicata. It was found in damp moss in Derbyshire, and there was no doubt that the filaments were branchial and connected with respiration.

The President remarked upon the apparent absence or scarcity of tracheæ in these branchial apparatus.

The President exhibited magnified coloured drawings of two larvæ, and requested information to what insects they belonged. Except that one was Lepidopterous, and the other probably Coleopterous, no light was thrown upon the subject.

Mr. W. W. Saunders exhibited a box full of Heliconiæ, "all taken together in the same locality" at Cayenne, including forms which have been described under seven or eight specific names; the examination of these specimens had convinced him that all of them were referable to a single species, H. Melpomene, or at most to two species; the structure and general form were constant, whilst the colour varied enormously, so that if his conclusion were correct colour must henceforth be considered as of small specific value amongst butterflies.

Mr. Bates said that he had found nearly the whole of the same forms on the Amazons, and had come to the conclusion that there were three species, Heliconia Melpomene, H. Thelxiope, and H. Vesta, but that the majority were merely intermediate varieties. In their typical states those three were perfectly distinct, did not interbreed, and no connecting links were found. For a distance of 1800 miles up the Amazons, Heliconiæ occurred everywhere, but the intermediate varieties were found in only one locality, on the hilly mainland of or adjoining Guyana, at the other extremity of which was Cayenne. The three species occurred in the forests, but the varieties did not. He had endeavoured to investigate the question whether the species interbred, and whether the varities were the result, and had satisfied himself that the varieties were not hybrids. He thought that the insects were unstable vacillating species; H. Melpomene, Thelxiope, and Vesta had become segregated in the alluvial plains, and might now be considered as species, though in his opinion they themselves were the descendants of some one prior unstable form which was their common ancestor. He conceived that the whole phenomena, both of the formation or development of the different species and the existence of the intermediate varieties, were explicable on the broad principle that an insect, in disseminating itself over a wide area, adjusts or accommodates itself to local conditions.

Mr. Saunders remarked that the Heliconiæ exhibited were all from the same locality, and therefore presumably had been subjected to like conditions.

Mr. Bates admitted that many different varieties were found in one spot; but as local variation was not the only form of variation, such collocated varieties might be produced by causes similar to those which produced the remarkable diversity between the offspring of some of our domestic animals.

Dr. Alex. Wallace said that the course which the discussion had taken led him to enquire whether Bombyx Ricini and Bombyx Cynthia were distinct species; the two insects interbred, and the hybrids were fertile and bred on for generations, not only amongst themselves, but with either of the parent forms. And yet B. Ricini was from Bengal and fed on Ricinus communis; B. Cynthia from China and fed on Ailanthus glandulosa; they differed in the egg, in the colour of the larvæ, in the shape of the cocoon, in the quality of the silk, in the imago, and in their habits. B. Ricini produced six or seven generations in the year, and was too fertile for this country, since it could not be prevented from hatching in winter when no food for the larvæ was obtainable; whilst B. Cynthia, though last year it had produced four generations in France, in an ordinary season produced only two, and perhaps a single generation would be the rule in this climate.

Mr. J. J. Weir enquired on which plant the hybrids fed? Dr. Wallace replied, on both or either indifferently.

Mr. F. Smith said that the remarks he had made at a previous Meeting, (see 'Proceedings,' 1865, p. 130), as to the tapping noise alleged to be made by "deathwatches," had induced Mr. Henry Doubleday to send him an account which shewed that his (Mr. Smith's) doubt was, as to Anobium at all events, unfounded. Mr. Doubleday, under date of Epping, 31st Dec. 1865, wrote as follows:—

"I cannot speak positively about the Atropos, but I am strongly inclined to believe that it is the insect which produces the continuous faint ticking sound so frequently heard in the spring. It seems almost impossible that such a delicate little creature should be able to produce any sound whatever, but I have always found it in places from which the ticking sound appeared to proceed. I have often thought it very wonderful that the pied woodpecker can, by striking the branch of a tree with its beak, produce a sound which may be heard for half a mile; we could not produce a similar sound by striking the tree with a stick or anything else. I can speak positively with regard to the Anobium, and I assure you that this little beetle produces the loud ticking sound, by raising itself upon its legs as high as it can, and then striking the head and under part of the thorax against the substance upon which it is standing, generally about five or six times in rapid succession; and it always chooses a substance which produces the most sound. It is evidently a call-note from one individual to another, as you very rarely hear one rap without its being immediately answered by another. I have repeatedly kept one in a card pill-box, and if I imitated the sound, by tapping anything with a pointed pencil or something of that kind, the Anobium would instantly answer me. This insect is common in our house, but it is not very easy to obtain them, as, when you have found out by their rapping where they are, they drop the instant you move anything near them. If all is well I will endeavour to obtain you some bye-and-bye, and send them to you alive."

Dr. Alex. Wallace mentioned, that on recently repairing the roof of an old church at Colchester, which had been attacked by Anobium, it was found that the damage was chiefly confined to the south side, the other sides being but slightly affected; this was the case both with the nave and aisles. Could it be that the beetles selected the south side from its greater warmth?

Mr. McLachlan enquired if the same description of wood was used throughout? Dr. Wallace believed so; all that he saw was oak.

Prof. Westwood said, if it were oak the depredator was doubtless Anobium tessellatum; there might be other reasons than the warmth which took the beetles to the south side; the prevalence of particular winds, or greater exposure to rain, might make the wood more liable to decay, or more attractive and palatable to the insects.

Mr. Stainton announced with regret the recent death of Senator von Heyden, of Frankfort, from an accidental fall, in the 73rd year of his age.

Mr. Stainton also announced the arrival of Mr. Wollaston at the Cape de Verdes: the examination of two small islands had already yielded 150 species of Coleoptera.

Prof. Westwood mentioned that in the Stett. Ent. Zeit. just published was a figure of a gynandromorphous Dytiscus (male on the right side, female on the left), very much resembling that described and figured by him in the third vol. of the 'Transactions,' p. 203, pl. xi. Mr. McLachlan added that, in the same publication, a gynandromorphous Argynnis Paphia was mentioned, the right side of which was female and the left side male, and which had this additional peculiarity that the female portion was of the form known as var. Valesina. Prof. Westwood said that a similar gynandromorphous variety had been recorded in the publications of one of the Belgian societies.

Papers read.

Mr. Baly communicated the concluding portion of his paper entitled "New Genera and Species of Gallerucidæ"; containing descriptions of four new species of the genus Cerotoma.

Mr. Hewitson communicated the concluding portion of his paper entitled "Descriptions of New Species of Hesperidæ"; comprising seventeen additional species of the genus Hesperia.

March 5, 1866.

W. W. Saunders, Esq., V.-P., in the chair.

Donations to the Library.

The following donations were announced, and thanks voted to the donors:— 'Schriften der Königlichen Physikalisch-ökonomischen Gesellschaft zu Königsberg,' 1864, Parts 1 & 2; presented by the Society. 'Synopsis des Nevroptères d'Espagne,' par A.-Edouard Pictet; by the Author. 'Una Rectificacion mas acerca del Animal-Planta, y descripcion de un nuevo Insecto?' par Antonio del Castillo; by Dr. Gray. 'The Zoologist' for March; by the Editor. 'The Entomologist's Monthly Magazine' for March; by the Editors.

Exhibitions, &c.

Mr. W. H. Groser said that when at the Meeting in December, 1865, a doubt was expressed whether the noise made by Anobium was caused by percussion, he had a strong conviction that the fact thus disputed rested on the authority of competent observers, and he had since met with the following passage respecting Anobium tessellatum in the Rev. L. Jenyns' 'Observations on Natural History:'—

"It is curious to observe one of them labouring, as it were, to make itself heard; raising itself on its hinder legs it beats forcibly on the wall on which it stands with the fore part of the head, giving seven or eight strokes at a time in pretty quick succession."

Mr. Groser had written to Mr. Jenyns, asking if this statement was made from his own actual observation, and Mr. Jenyns replied, "I am quite sure of the correctness of what I have stated in my 'Observations &c.,' respecting the tapping of Anobium tessellatum, having witnessed it repeatedly. With regard to A. striatum, I do not recollect now (it is so many years since) whether what I have added in reference to that species was stated on the ground of having *seen* it make the noise in question or only having heard it."

Mr. S. Stevens exhibited a Japanese collection of butterflies and beetles from Hakodadi, and remarked upon the close resemblance of many of the species, to those indigenous to this country.

Mr. Tegetmeier exhibited a general collection of Japanese insects from Nagasaki, the greater part being Lepidoptera and Coleoptera.

Mr. W. W. Saunders, Mr. F. Smith, Mr. Pascoe and Mr. M'Lachlan made observations upon the number of Japanese forms, of Lepidoptera, Coleoptera and Neuroptera, which were of an European type.

Mr. F. Smith, on behalf of Mr. S. Stone, exhibited a singularly compact and symmetrical nest of Vespa sylvestris; also nests of Vespa rufa, V. germanica and V. sylvestris, which were constructed in 1864 by workers only. The original nests to which the wasps belonged, together with the queens and the principal part of each colony, had been removed by Mr. Stone; a few workers which remained had recommenced building, but, deprived of the guidance and control of the queen, had produced in each case a monstrosity, an irregular and shapeless piece of clumsy workmanship. There were young larvæ in sealed cells constructed by the workers, which larvæ were the produce of eggs laid by the workers.

Mr. Tegetmeier had known workers of the hive-bees to lay fertile eggs, but these had always produced drones; two or three eggs were laid in one cell, but not more than one ever hatched.

Mr. F. Smith pointed out that the sealed cells in the wasps' nests exhibited were the cells, not of drones, but of workers, of females,—which was an extension of the observation and theory of Von Sieboldt.

Mr. M'Lachlan exhibited a twig of mulberry tree sent from Saugor, Central India, by Captain Alexander, on which were deposited in rows numerous eggs, which were probably those of a species of Ascalaphus or Myrmeleon; the arrangement of the eggs was precisely similar to that of the European Ascalaphus macaronius, as described by Dr. Brauer; the young larvæ that had emerged from the eggs were also exhibited. With reference to Geoffroy's observation, that Myrmeleon formicarius immediately after emergence deposits one or two eggs, which, however, are unproductive, Mr. M'Lachlan said that his own observations had convinced him that these so-called eggs were not eggs at all, but were in reality the meconium, which, instead of being voided in a liquid state, was in this instance solid, and took the form of egg-like lumps.

The Rev. O. Pickard-Cambridge (who was present as a visitor) exhibited a general collection of insects made by himself in Palestine, Syria, Lesser Asia, Greece, &c. All the specimens were admirably preserved and set, notwithstanding that the collection was made under the difficulties of being almost always on horseback, and seldom staying more than a day in one place; moreover his principal object of pursuit had been spiders, of which he had captured a great number and of very peculiar forms.

Prof. Westwood called attention to the "Schriften der Königl. phys.-ökon. Gesellschaft zu Königsberg" for 1864, in which was described and figured a new Amphipod —a marine animal—in gum copal or gum animé.

Paper Read.

Mr. Edward Saunders read a paper intituled "Catalogue of Buprestidæ collected by the late M. Mouhot in Siam, &c.; with Descriptions of new Species." Forty-four species were enumerated, of which thirty-three were described as new; three new genera were characterized—Cardiaspis, allied to Dicercomorpha of Henri Deyrolle; Engycera, allied to Melobasis; and Oncomœa, between Brachys and Pachyscelus.

New Part of 'Transactions.'

Trans. Ent. Soc. third series, vol. ii. Part 6 (being the concluding part of that volume) was announced as ready for distribution.

April 2, 1866.

Sir JOHN LUBBOCK, Bart., President, in the chair.

Donations to the Library.

The following donations were announced, and thanks voted to the donors:—'Exotic Butterflies,' by W. C. Hewitson, part 58; presented by W. W. Saunders, Esq. 'Monographie des Platypides,' par F. Chapuis; by the Author. 'Proceedings of the Royal Society,' Vol. xv. No. 81; by the Society. 'The Zoologist' for April; by the Editor. 'The Entomologist's Monthly Magazine' for April; by the Editors.

Election of Member.

John Watson, Esq., of Rose Hill, Bowdon, Cheshire, was ballotted for and elected a Member.

Exhibitions.

Mr. William Rogers sent for exhibition specimens of the ichneumon Pimpla oculatoria, which he had bred from the egg-bag of a spider found under the loose bark of an oak-fence.

Mr. F. Smith and Mr. Desvignes both said that they had bred the species, but always from bramble-sticks.

Mr. W. W. Saunders exhibited three interesting objects from New South Wales. First, a number of (empty) eggs, probably of a Chrysopa, disposed in a line or chain on, or rather over, the bark of a tree; they were elongate in shape, about twice as long as broad, formed a continuous and connected chain, and each was supported by a hair-like pedicel about a quarter of an inch above the level of the bark; but the peculiarity of the arrangement was that the first, third, fifth, and so on, were disposed with their longer axes all in the same direction, and rested on pedicels which were perpendicular to the plane of the bark, whilst the alternate eggs were transversely placed, with their shorter axes in the same line with the longer axes of the odd numbers, and were supported by longer pedicels which were inclined at about half a right angle to the plane of the bark: the object of such an arrangement was difficult to imagine, whilst it must necessarily render the process of egg-laying a very complex operation. Secondly, a larva, probably of a Lamellicorn beetle, with two fungoid excrescences, Sphæriæ, springing from the back of the head, one on each side, like ram's horns. [See Proc. Ent. Soc. 1834, p. xviii.; 1836, pp. vi., xxiii.; 1838, p. iv.; 1839, p. xxxiv.; 1841, p. xxii.; 1842, p. lxvii.; 1852, p. xxi.; 1854, p. xvi.; 1857, p. xcvii.; 1863, p. clxxii.; 1864, p. xliv.; 1865, p. lxxxix.; for other instances of fungoid growths on insects]. And thirdly, four Locustideous larvæ, about half an inch long, attached to a small branch of a tree; one of them was tightly held head downwards by the other three, which were themselves so locked in a close embrace and had their legs so intricately entangled, that it seemed they had been unable to release themselves, and thus had died.

Mr. F. Smith said that, in Stephens' 'Catalogue of British Insects,' the genus Bembex was included on the authority of Donovan, who had figured B. octopunctata as British, but without assigning any precise locality. In the 'Entomologist's Annual' for 1866, p. 122, he (Mr. Smith) had expressed a hope that this, amongst other genera now expunged from our list, might be re-discovered: he had the pleasure of exhibiting a specimen of Bembex olivacea (which name was a synonym of, but had priority over, B. octopunctata) placed in his hands by a gentleman at Bristol, to whom it was given many years ago by a Dr. Hicks, who said that he had himself captured the insect near Gloucester.

Mr. J. J. Weir exhibited some larvæ which he believed to be only the common meal-worm (*Tenebrio*), but which were found in a wine-cellar, and had done considerable damage by eating through the corks of port wine, so that the wine escaped: sealing-wax on the head of the cork did not operate as a preventive. Oddly enough, though they had attacked the corks of sherry also, they had not completely perforated them, but stopped short of the wine. It was suggested as a probable cause for the incursion into the cellar that perhaps bran had been used in packing the wine, in lieu of saw-dust.

Mr. W. W. Saunders said that numerous instances of injury done to corks by various insects had been brought before the Society. [See Proc. Ent. Soc. 1835, p. lv.; 1837, p. lx.; 1848, pp. xxxv., xli.; 1849, p. lxi.; 1851, p. cxiv.; 1852, pp. viii., xvii., xxiii.] He remembered a case in which a number of larvæ of Dermestes lardarius, which had been brought into the docks with a cargo of skins, made an incursion into a neighbouring warehouse in which were stored some manufactured corks; these they perforated and rendered useless: large damages were claimed against the Dock Company, and a law-suit seemed imminent, but the matter was finally compromised.

May 7, 1866.

W. W. Saunders, Esq., V.-P., in the chair.

Donations to the Library.

The following donations were announced, and thanks voted to the donors:—'Proceedings of the Royal Society,' No. 82; presented by the Society. 'Journal of the Linnean Society,' Vol. ix. Zool. No. 33; by the Society. 'Journal of the Royal Agricultural Society,' 2nd Series, Vol. ii. Part 1; by the Society. 'Tijdschrift voor Entomologie,' Vol. viii. Parts 5, 6; 2nd Series, Vol. i. Parts 1, 2; by the Entomological Society of the Netherlands. 'Stettiner Entomologische Zeitung,' 1866, Nos. 4—6; by the Entomological Society of Stettin. 'Die Neuroptera des Lithographischen Schiefers in Bayern,' Part 1; by the Author, Dr. Hagen. 'Synopsis des Agrionines, 5e légion: Agrion;' by the Author, M. E. de Selys-Longchamps. 'The Zoologist' for May; by the Editor. 'The Entomologist's Monthly Magazine' for May; by the Editors. Wood's 'Illustrations of the Linnæan Genera of Insects,' 2 vols.; Rennie's 'Conspectus of the Butterflies and Moths found in Britain;' Yeats' 'Institutions of Entomology;' Martyn's 'English Entomologist;' Marsham's 'Entomologia Britannica;' Hüber, 'Recherches sur les Mœurs des Fourmis indigènes;' Schrank, 'Enumeratio Insectorum Austriæ indigenorum;' Duméril, 'Considérations générales sur la Classe des Insectes;' Sulzer, 'Die Kennzeichen der Insekten;' Klug, 'Monographia Siricum Germaniæ;' Barbut, 'The Genera Insectorum of Linnæus;' Schæffer, 'Elementa Entomologica;' by J. W. Dunning.

Election of Members.

Philip Green, Esq., of 11, Finsbury Circus, and W. Stavenhagen Jones, Esq., of 79½, Gracechurch Street, were severally ballotted for and elected Members.

Exhibitions, &c.

Mr. M'Lachlan exhibited some galls found on ground-ivy at Lewisham, supposed to be those produced by Aylax Glechomæ; these are, however, described as occurring singly, while those exhibited were in a cluster of four.

Mr. Bond exhibited a finely-marked variety of the female of Cabera exanthemaria, bred by the Rev. Mr. Horton, of Powick, near Worcester.

Mr. Newman sent for exhibition some larvæ of Hepialus lupulinus found in a heap of wet clay amongst the under-ground rhizomes of the common coltsfoot (*Tussilago farfara*), at Henlow, near Biggleswade, in April last: these larvæ were all dead, and remarkable as forming the pabulum of a fungus, probably a Sphæria, occupying the whole interior, and sending out its mycelia in all directions through the skin, while in some specimens a stout capitate column rose from the neck of the larva immediately behind the head, evidently the fructification of the fungus. This singular formation is figured in 'The Entomologist,' vol. iii. p. 75.

Mr. Stainton exhibited some Dipterous larvæ he had that morning received from Mr. Borthwick, Treasurer of the Natural History Society of Alloa: these larvæ were reported to be very injurious to the young wheat, destroying the main stem just above the root.

Mr. W. W. Saunders observed that some similar larvæ had been brought under his notice by one of his neighbours in Surrey, but that if the larvæ attacked the wheat when very young the result was simply the destruction of the main stem, and the plant put out an additional quantity of other stems, and no more injury was done to the crop than by pasturing sheep upon wheat when getting too luxuriant early in the season.

Mr. Stainton exhibited a number of drawings, made by Miss Wing, of the Micro-Lepidopterous larvæ he had collected during March in the South of France, at Cannes and Mentone, including Acrolepia Smilaxella of Millière, of which the larva fed on the leaves of the Smilax aspera; Hyponomeuta egregiellus, *Duponchel*, which fed on the Erica scoparia; a Gelechia (probably G. biguttella), bred from Dorycnium suffruticosum and D. hirtum; Coleophora congeriella, *Staudinger*, on D. suffruticosum; a green Depressaria larva on Genista spinosa, which, instead of producing a novelty, had yielded only D. atomella; Gelechia Psoralella of Millière on Psoralea bituminosa; an Elachista larva mining down a leaf of Carex, just as it might have been doing in England at the same period of the year; larvæ of the insect so injurious to the olives, and which Herr Kaltenbach, of Aix-la-Chapelle, had last year first correctly referred to the genus Prays, Prays oleellus being evidently, both in form, structure and even in marking, closely allied to Prays Curtisellus, whilst there was a great similarity in the habits of the larvæ, that of P. Curtisellus being as destructive to the shoots of the ash as that of P. oleellus to the shoots of the olive; also a drawing of a true gall formed on the shoots of Gypsophila saxifraga by a small Lepidopterous larva (probably of the genus Gelechia, but which had not yet been bred). Mr. Stainton observed that the only other instance of a true gall formed by a Lepidopterous larva was that formed by Asychna æratella on Polygonum aviculare.

Mr. Stainton also exhibited a drawing of a larva found on spindle in his own garden at Lewisham, the habits of which were very peculiar, inasmuch as these larvæ were found only where there was a bundle of the "frass" of last year's larvæ of Hyponomeuta Evonymellus resting on the twigs of the spindle; but wherever there was such a mixture of web and excrement left on the plant one of these larvæ was to be found underneath, feeding on the bark and even eating the wood of the spindle. The appearance and agility of the larva reminded him much of the genus Gelechia; and already were there three instances known in that genus ('Intelligencer,' Vol. vii. p. 157) of larvæ which were only found as companions of other larvæ. The beauty and neatness of the drawing of Miss Wing elicited very general admiration.

Mr. E. W. Janson exhibited specimens of Throscus elateroides, *Heer*, a species not hitherto recognized as an inhabitant of Britain, captured, during the past month, by Messrs. J. A. Brewer and E. Smith, near Rochester, Kent, at the roots of herbage: he remarked that this species may be readily distinguished from its ascertained indigenous congeners by its bi-carinate forehead, grooved eyes and the thickly punctate interstices of the elytra, and submitted magnified drawings and the following concise diagnoses of the three species now known to inhabit Britain: he likewise stated that Dr. J. A. Power had recently taken this species in the same locality and under similar circumstances:—

"Genus Throscus.

I. Eyes with an oblique central groove in front only.

Sp. 1. *T. dermestoides*, L., Latr., Steph., Heer, Redtb., v. Kiesenw., de Bonv. (Elater dermestoides, *L.*)

Forehead with two distinct parallel longitudinal ridges in front between the eyes, and a very short indistinct one between them.

Thorax scarcely perceptibly dilated at the sides in front of the posterior angles, finely and somewhat thickly punctate.

Elytra punctate-striate, all the striæ distinct; the interstices with two irregular series of sparsely disposed punctures anteriorly, which gradually assume the position of a simple row posteriorly.

II. Eyes with an oblique central groove running completely across them.

Sp. 2. *T. elateroides*, Heer, de Bonv.

Forehead with two fine parallel longitudinal ridges in front between the eyes.

Thorax conspicuously dilated at the sides in front of the posterior angles, finely and rather thickly punctate.

Elytra finely punctate-striate, the striæ next the suture obsolete; the interstices thickly and finely punctate.

The frontal ridges are, in some individuals, so faintly raised as to be distinguishable only in a good light and in thoroughly clean specimens.

Sp. 3. *T. obtusus*, Curt., Steph., v. Kiesenw., de Bonv.

Forehead convex, scarcely perceptibly punctate, and without the faintest trace of longitudinal ridges.

Thorax very short, and very much dilated at the sides in front of the posterior angles, sparsely punctate.

Elytra finely punctate-striate, the striæ next the suture usually very faint; the interstices somewhat thickly and minutely punctate."

Mr. W. W. Saunders exhibited a singular conical nidus, which he considered to be that of a spider, from New South Wales, formed out of a single leaf, by a series of folds, so artfully contrived that the whole of the leaf was used up in its construction, producing a tent-like structure quite impervious to wet; the nidus was about half an inch in length and nearly the same in diameter at the base.

Mr. Saunders also exhibited two cases formed by the larvæ of some species of Œceticus (Oiketicus)?, about two inches in length, constructed of four series of small pieces of the culm of some kind of grass; these four series were of different lengths, increasing as the larvæ appear to have grown larger and required a more roomy habitation: in each series the pieces of culm were very nearly equal in size and length, and so arranged as to form a cylinder. These cases had somewhat the shape of a pocket-telescope drawn out to its full length: they were from New South Wales.

Mr. E. L. Layard said that he had obtained several species of these insects at the Cape, in Australia, and also in Ceylon; he had observed that the young larvæ when first hatched constructed their cases from the body of their parent: in one species the case of the larva when full grown was composed externally of sticks, much larger than the case itself, placed lengthwise, and this ornamentation was not added until the insect was full grown.

Mr. M'Lachlan observed that the fact of young larvæ of case-bearing species employing the body and case of the female parent as materials for their own cases, had been noticed by Réaumur; and he had himself seen it done by our British species of Fumea.

Mr. Haward exhibited some Coleoptera and other insects of various orders from Natal.

Mr. E. L. Layard called the attention of the Society to the fearful ravages of a species of white ant at St. Helena: it is a small slender species, having very long jaws, and he believed specifically distinct from any which he had seen in Ceylon or at the Cape of Good Hope; it was introduced into the island about twenty years ago, in timber from the West Coast of Africa, but its ravages had only become serious within the last ten years; at the present time James Town might be said to be devastated by it, the whole of the cathedral was destroyed, and indeed everything in the town made of wood was more or less injured; the library was also destroyed by them, and it was noticed that the theological works were eaten first, which he (Mr. L.) attributed less to the fact that the insects studied divinity, than to those books not being so often consulted by the reading public as novels and lighter works, and the insects therefore less disturbed in their work of destruction. Teak seemed to be the only wood they did not eat, but they would freely bore holes through it in order to get at other kinds more suited to their tastes: this fact had been proved, by placing a deal plank between two pieces of teak, when the latter were perforated and the deal devoured. They might even be said to make their way through tin cases, for in the Government stores it was found that their moist frass on the outside of such cases caused rapid oxidization of the metal, which enabled the insects to make their way in and devour the contents. He believed that unless some effectual remedy could be provided it would ere long be impossible to use timber on the island for any purpose; any one who could suggest a remedy would confer a vast benefit on the inhabitants. The ravages of the insect were at present confined to James Town, but might spread all over the island at any moment, and even reach vessels in the roadstead in firewood, or by other means, and be carried to the Cape, Ascension, or elsewhere: it was a subject for serious consideration; the injuries already done to the Government buildings, &c., would necessitate an outlay from the public purse of many thousand pounds.

The Secretary mentioned that in December, 1863, a communication had been addressed to him by the Secretary of the Admiralty, with reference to the depredations committed at James Town by the white ants. See 'Proceedings' 1863, p. clxxxv. Mr. Bates, Mr. Wallace, and the late General Hearsey had subsequently addressed to him various practical suggestions, the whole of which were incorporated in a letter which on the 2nd of February, 1864, he had forwarded for the information of the Lords Commissioners of the Admiralty.

Mr. Layard also remarked that at the Cape of Good Hope wild bees were exceedingly abundant, and as the natives appeared to be quite indifferent to the stings of these insects, they dug up the nests and consumed the honey with perfect impunity: in the plains the nests were usually found in those of the white ants, which had previously been ravaged by the anteater; in the hills, in holes and caverns. He had always understood that the cause of the swarming of bees was want of room in the hive or nest; he had, however, noticed that in the caverns above mentioned the nests threw off swarms, and want of room could not be the cause in those cases.

Mr. Tegetmeier observed that the Scotch plan of providing additional room, by placing a box hive containing a strong stock between two empty hives, usually prevented swarming in this country, the bees availing themselves of the increased accommodation instead.

Mr. Layard said that both this and Nutt's system had been tried by himself and Mr. Corless, the most experienced bee-master at the Cape, and had failed. Mr. Corless had lately constructed a hive in sections, so that each comb could be removed and examined with the bees *in situ;* they hoped on his return to be able to settle some vexed questions by the aid of this observatory, and their observations should be communicated to the Society.

Papers read.

The Rev. Douglas C. Timins communicated a paper entitled "Notes of collecting at Hyères (Var)."

Mr. Desvignes sent a paper entitled "New British Ichneumonidæ," containing descriptions of 39 species of Gravenhorst's genus Tryphon.

New Part of 'Transactions.'

Tr. Ent. Soc., third series, vol. v. part 2, containing the Prize Essay "On Ailanthiculture" by Dr. Wallace, and being the second Part for 1866, was on the table.

June 4, 1866.

Sir John Lubbock, Bart., President, in the chair.

Additions to the Library.

The following donations were announced, and thanks voted to the donors:—'Proceedings of the Royal Society,' No. 83; presented by the Society. 'A Catalogue of Phytophaga,' Part 1, by the Rev. Hamlet Clark; by the Author. 'On the Structure of the Egg in Scatophaga,' and 'Description of the Skin cast by an Ephemeron, in its "Pseud-imago" condition,' by Tuffen West, F.L.S., &c.; by the Author. 'Notes upon some Odonata from the Isle of Pines,' by Samuel H. Scudder; by the Author. 'New Species of North American Coleoptera,' Part 1; 'List of the Coleoptera of 'North America,' Part 1; 'On the Species of Galeruca and allied Genera inhabiting North America;' 'Note on the Species of Myodites, *Latr.*, inhabiting North America;' and 'Remarks on Stylopidæ,' by John L. Leconte, M.D.; by the Author. 'The Zoologist' for June; by the Editor. 'The Entomologist's Monthly Magazine' for June; by the Editors.

The addition by purchase of the 131st livr. of the 'Genera des Coléoptères d'Europe' was also announced.

Election of Members.

Count George Mniszech, of Paris, was elected a Foreign Member. Osbert Salvin, Esq., M.A., F.L.S., of 16, Bolton's Grove, West Brompton, and Thomas Turner, Esq., of 5, Dix's Fields, Exeter, were elected Ordinary Members.

Exhibitions, &c.

The Secretary read a letter from Dr. Wallace, in which the writer expressed his regret that the drawing of the full-grown larva of Bombyx Cynthia given in his Essay on Ailanthiculture (Tr. Ent. Soc. 3rd Ser. vol. v. pl. xvi.) was not quite truthful, the reason being that the larvæ were not sent to the artist until the fourth week in October, when the weather had become wet and chilly and the food deficient, and the larvæ were in consequence half-starved and torpid; moreover, on their journey the gray-blue bloom was knocked off, and was not subsequently secreted; it had, therefore, been impossible for the artist to do full justice to the larva. Dr. Wallace added that he had had sent him some eggs of the Japanese oak-feeding silkworm, Bombyx Yamamai, the young larvæ of which had hatched out, and required his constant attention during the previous month.

Mr. Wilkinson read from the Report of Mr. Consul Zohrab on the trade of Berdiansk for the year 1865 (Commercial Reports received at the Foreign Office from Her Majesty's Consuls, presented to Parliament, February, 1866), the following extract, communicated by Prof. E. W. Brayley, of the London Institution:—

"The appearance of a poisonous black spider amongst the wheat at harvest time created for a few days a panic among the labouring classes. Wages rose to double their ordinary rate, and it was with difficulty the labourers could be induced to work. More than 300 persons were bitten by this venomous insect, but only three cases were reported to have proved fatal, and these deaths, it is supposed, are not to be attributed solely to the bite of the spider. Fortunately this visitation was restricted to one part of the town lands, otherwise the consequences might have been very serious. From some villages in this district news was received that the spider had also visited them. The bite of this insect was indicated by a hard white spot. The first symptoms experienced were alternate violent heat and cold, shortness of breath bordering on suffocation, an increased pulsation of the heart, and pains in the chest and back, then weakness in the legs and dizziness in the head. After a few hours these symptoms diminished, and in two days the patient was able to resume his work. The general remedy employed was to cup the poisoned part and liberally wash it with cold water. Some cauterized the place, but this remedy was not so efficacious, and it created, besides, a fresh wound. The first time this spider was seen at Berdiansk was in 1864, but very few persons were bitten by it. Last year, however, it increased to a most alarming extent. It was remarked that the spider was very active in killing locusts, on which it seemed principally to feed, and it was only when disturbed that it stung persons. The majority of the persons bitten did not know the cause of their illness, and it was only the same symptoms in each case that proved it to be the sting of the spider."

Mr. M'Lachlan exhibited the case of a caddis-worm which was found attached to a rush about two feet above the level of the adjacent water; it was of the genus Limnephilus, and he conceived that when, in accordance with the usual habit, the larva had fixed its case prior to the assumption of the pupa-form, the instinct of the creature had been at fault, and the larva had omitted to make allowance for the growth of the plant, by means of which the case had been raised above the water, and the pupa had consequently perished.

Mr. Stainton mentioned that from the galls on Gypsophila saxifraga, found at Mentone, of which he had exhibited a drawing at the previous Meeting (*ante*, p. x.), there had emerged two moths of the genus Gelechia, belonging to what he supposed he must call a new species allied to G. leucomelanella. The group of Gelechiæ, however, which fed on the Caryophyllaceæ were most difficult to deal with; new forms were continually discovered, intermediate between what have hitherto been considered distinct though closely-allied species; it was not improbable that other intermediate links would be supplied until the whole series, thus made continuous, would require to be united—should he say, into one *species?*

Mr. M'Lachlan thought the group in question was a good illustration of the "phytophagic species" of Mr. Walsh.

Mr. C. A. Wilson communicated a further instalment of his "Notes on the Buprestidæ of South Australia."

Prof. Westwood exhibited drawings of several species of Goliath beetles, which he proposed to describe, and for some to create new subgenera.

Mr. Pascoe exhibited two new species of Articerus, and read the following note respecting them:—

"Of the eight known species of Articerus, five are from Australia; three of these, described by Prof. Westwood, have short thick antennæ; another, described by the same author, has them remarkably curved; the species recently described by Mr. Waterhouse has longer antennæ, but they are terminated by a compressed truncate club curved inwards at the apex. The two species before the Society have also long antennæ, but gradually enlarging from the base to the apex, in one of them, however, expanding rather more rapidly when approaching the tip; one is from Mr. Odewahn, of Gawler, South Australia; the other from the Rev. George Bostock, of Fremantle, West Australia; they may be thus differentiated:—

Articerus Odewahnii, n. sp.

A. pallide ferrugineus; capite prothoraceque subtiliter punctulatis; antennis basin versus abrupte angustioribus.

Long. lin. $\frac{3}{4}$.

Hab.—Gawler.

Articerus Bostockii, n. sp.

A. rufo-testaceus, elytris dilutioribus; capite prothoraceque subcrebre punctatis; antennis basi sensim angustioribus.

Long. lin. 1.

Hab.—Fremantle.

"The former has compressed antennæ, as may be seen by the section presented at the apex, whilst in the latter it is nearly or quite round. A. Odewahnii also has the head considerably smaller in proportion, and if examined sideways it will be found to be of nearly equal depth throughout; but the larger head of A. Bostockii begins to diminish under the eyes, and is drawn rapidly up so as to be scarcely more than half the depth at the apex. The elytra of A. Odewahnii are much smaller than those of the other species. In neither do the tibiæ present any appearance of angularity or toothing, but this may be because they are both females. Mr. Du Boulay thinks the antennæ are *flexible*, but in this Mr. Bostock does not agree. Referring to the species which I have named after him, Mr. Bostock writes as follows:—'The first caught was found (when disturbed?) on his back, and two ants at once seized him to carry him to a place of safety. . . . . I saw another on a stick protruding from an under-ground nest, and as I approached nearer to capture it I plainly saw two ants, one on either side, seize it and hurry it down the hole. . . . . The latter specimen caught was resting with his body inclined at an angle of about 30°, and was bowing his head vertically and his antennæ laterally in a most amusing manner.' Mr. Bostock thinks there is a 'bag of ant-liquid beneath the fovea' (cavity on the abdomen?)."

Mr. Pascoe also exhibited a small collection of Coleoptera from Fremantle, placed in his hands by the Rev. Hamlet Clark, to whom it had been sent by the Rev. George Bostock. In addition to the species of Articerus above described, the collection included Anthicus strictus, *Er.*, and two probably new species, found in ants' nests, being, as Mr. Pascoe believed, the first instance of an Anthicus occurring in such a situation; a beautiful new species of Ptinus, Mezium sulcatum, two new species of Hyocis, Scopodes boops, *Er.*; two species of Platynotus, one certainly and the other probably new; a Cryptophagus, two species of Brachypeplus, a Scymnus, Uloma?, Platysoma, &c.; an insect of unknown genus of the size and outline of Corticaria serraticollis, *Duval*, but with very peculiar tarsi; and a new Mecynotarsus, of which the following diagnosis was read:—

"*Mecynotarsus albellus*, n. sp.

"M. testaceus, pube densa alba tectus; parte prothoracis protensa breviuscula, ovata, dentibus quadratis rubris undecim instructa; elytris humeris producto-rotundatis; pedibus antennisque testaceis.

Long. lin. $1\frac{1}{4}$.

Hab.—Fremantle."

But the most remarkable insect in the collection was an entirely new form, also found in ants' nests, for which the name of Ectrephes formicarum was proposed, and of which the following description was read:—

"Ectrephes, n. g.

"Caput insertum, subtus inclinatum, fronte pro receptione antennarum profunde excavata. Oculi parvi, rotundati. Mandibulæ rostriformes. Antennæ tri-articulatæ; articulo basali breviter obconico; secundo minuto; tertio elongato, compresso, apice oblique truncato. Prothorax transversus, utrinque pone apicem emarginatus, lateribus carinato-alatis. Elytra breviter ovata, convexa. Femora et tibiæ compressæ; tarsi 5-articulati, elongati, filiformes.

"*Ectrephes formicarum*, n. sp.

"E. ommino fusco-castaneus; elytris nitidis, pilis minutis erectis valde dispersis.

Long. lin. 1.

Hab.—Fremantle.

"The position of Ectrephes is uncertain; the fact of the elytra closely embracing and covering the abdomen cuts it off from the Paussidæ; in its 3-jointed antennæ it approaches Gnostus, *Westw.*, another isolated genus. The antennæ arise from a cavity in front of the head, and the latter is so bent down that the mandibles almost touch the anterior coxæ. The metasternum is very short, and the intermediate and posterior coxæ are therefore closely approximate on each side, but widely apart as regards their fellows. The anterior coxæ are exserted, cylindrical and divergent. The abdominal segments appear to be only four in number, owing probably to the union of the second and third; counting it as one only, that segment is of large size, whilst the third is reduced to a mere line. I regret that I have not successfully extracted the mouth, but so far as I could judge the mentum was very small, with two large fusiform palpi; I could not distinguish the maxillary lobes, of which Gnostus has one only, and that very minute. I hope to give a figure of the insect, and to enter into further details on a future occasion."

Prof. Westwood considered Ectrephes to belong to the Paussidæ, notwithstanding that the abdomen was entirely covered by the elytra.

July 2, 1866.

Sir John Lubbock, Bart., President, in the chair.

Additions to the Library.

The following donations were announced, and thanks voted to the donors:— Hewitson's 'Exotic Butterflies,' Part 59; presented by W. W. Saunders, Esq. 'The Zoologist' for July; by the Editor. 'The Entomologist's Monthly Magazine' for July; by the Editors.

The following additions by purchase were also announced:—Aubé, 'Pselaphiorum Monographia'; Chevrolat, 'Coléoptères du Mexique'; A. de Norguet, 'Catalogue des Coléoptères du Département du Nord'; J. Thomson, 'Arcana Naturæ'; Westwood, 'Arcana Entomologica.'

Election of Members.

The Hon. Thomas De Grey, M.P., of 23, Arlington Street, and Christopher Ward, Esq., of Halifax, were elected Members.

Exhibitions, &c.

Mr. Stainton exhibited larvæ of Laverna phragmitella in a head of Typha latifolia; and specimens of the Gelechia, very like G. leucomelanella, bred from Gypsophila saxifraga, to which reference was made at previous Meetings (*ante*, pp. x. xv).

Mr. Bond exhibited a specimen of Dianthœcia cæsia taken by Mr. Hopley in the Isle of Man, where the species had recently been discovered by Mr. Gregson (see 'The Entomologist,' vol. iii. p. 103).

Mr. Edwin Shepherd exhibited an old specimen of the same species, from Bentley's collection, labelled "cæsia," in the hand-writing of the late Mr. Bentley. This specimen was reputed to have been captured in Yorkshire; and the fact that it resembled the specimens from the Isle of Man (which differed from the typical Continental form of the insect, and seemed to be a permanent variety) was in favour of the British origin of Mr. Bentley's specimen.

Mr. Bond also exhibited a Phycita captured in the Isle of Man by Mr. Hopley, and which he believed would prove to be a new species; specimens of Sesia philanthiformis bred from pupæ sent to him by Mr. Greening from the Isle of Man; and a series of bred specimens of Papilio Machaon from Wicken Fen, Cambridgeshire, remarkable for their large size, as were most of the specimens of that butterfly which he had bred during the present season.

Mr. Edward Saunders exhibited a collection of Mexican butterflies, amongst which were Papilio Asclepias and others of that genus, and a gynandromorphous Euterpe (sp.?), of which the right side was male, the left female.

Mr. S. Stevens exhibited Dicranocephala Wallichii from North India, and D. Bowringii from South China.

The Secretary read the following extracts from the 'Journal of the Society of Arts' of 29th June, 1866:—

"*Insect Wax.*—The trade in this article in China is large. In 1864, from the single port of Hankow alone, 5100 cwt. were exported. It is taken by the Chinese as medicine, but is principally used as stearine in the manufacture of candles. It is one of the most valuable of the many products of Sze-Chuen, being worth sixty and seventy taels per picul (133 ℔s). The wax is deposited, for the protection of its eggs, by an insect which inhabits the trees on which the wax is secreted. The formation of the wax was a subject which occupied the especial attention of M. Simon, a French savant, who, a year or two ago, passed a considerable time in the interior, during which he is said to have traversed the greater portion of Sze-Chuen, and to have reached the eastern confines of Thibet." (See Proc. Ent. Soc. 1853, pp. 93-95, as to this Coccus-product).

"*Protection of Trees from Insects.*—The following simple method of preserving fruit from the ravages of insects is recommended by the Imperial Society of Practical Horticulture of the Rhone, and by the director of the School of Arboriculture of the Parc de la Fête d'Or at Lyons. The quantity of fruit destroyed by insects that deposit their eggs in the blossoms is enormous. These creatures are said to have a great antipathy to vinegar, the mere odour of which is enough to drive them away, and, in some cases, to destroy them, and nothing more is required than to sprinkle the branches with a mixture of vinegar and water at the moment the blossoms begin to appear. The mixture recommended consists of one part of vinegar to nine parts of water, but as French vinegar is very strong, perhaps the amount of water should be less when English vinegar is used. When the liquids are well mixed, the solution is to be sprinkled over the flower-buds by means of a garden engine or syringe, or even with a watering-pot with a fine rose. M. Denis, the director of the school referred to, tried the experiment last year, and reports that fruit trees so treated were covered with fruit, while those to which the acidulated water was not applied bore scarcely any. The other remedy proposed is against ants and other insects which mount the stems of trees. Take common lamp-oil, and expose it in the sun for three or four days, or until it acquires a gummy consistency and very disagreeable smell, then with a small paint-brush paint around the tree, at about two feet from the ground, a band of the oil two inches wide, repeating the operation for three or four successive days. It is said that this method will protect the tree for four years at least. Perhaps coal tar might be found to answer the same purpose."

Mr. Stainton said that he had recently received a communication from M. Milliére respecting the injury done to crops of rye in the neighbourhood of St. Etienne; Dr. Maurice, of that place, had directed his attention to the subject, but being unable to detect the author of the so-called "epidemic in the rye," had applied to M. Milliére. Mr. Stainton believed that the injury was caused by the larva of the Micro-Lepidopterous Ochsenheimeria taurella, which by burrowing in the stem caused the ear to wither away.

Mr. Pascoe said that last year (see 'Proceedings,' 1865, p. 90) he had read a note respecting insects alighting on the snow in high mountain regions, and sinking into it from the melting of the snow by the radiation of heat from the insect; in 'The Zoologist' for the present month, Mr. Albert Müller, in commenting on the above communication, quotes from F. von Tschudi s 'Thierleben der Alpenwelt' the following passage:—"Winged insects, which are often carried by the wind to the upper snow-fields, will sink into these sometimes two feet deep, and it has been observed that these creatures settle voluntarily on the 'firn' [a particular state of the snow, when its surface is held together by thin plates or crystals of ice, is so designated], extending their wings and limbs, and that they rest in this position at their ease without moving, it being probable that they enjoy the absorption of the oxygen of the 'firn.' If they are taken up and removed to a stone or a piece of wood, they will at once proceed to the 'firn,' where they extend themselves as if inebriated, and gradually sink in, (seemingly) in full enjoyment. Dug out of a depth of two feet, they sometimes get lively again very quickly; otherwise, if left to themselves, they soon perish and at once get decomposed, and then the sinking in will cease. It has been tried to place dead insects on the 'firn,' when the body was found to swell up to a soft mass, then to shrink very much and afterwards to decay; after this the 'firn' closes itself over it, which does not easily happen with living insects." Mr. Müller suggests that the lumps of peat found in several of the holes were the sediment of the decayed bodies of the insects, perhaps increased in size by dust or fine sand so often carried by heavy gales; and adopts the theory that the holes were formed by the radiation of heat from the insects. Mr. Pascoe did not, however, believe that radiation alone would account for insects sinking to the depth of two feet; he thought that long before they reached such a depth they would have exhausted the heat already absorbed, and would be concealed from the sun's rays by the imminent snow, and thus be prevented from absorbing more heat. On the Monte Moro the holes were about an inch in depth.

Prof. Westwood had observed bees which had been tempted out of the hive by early sunshine to fall on the snow; becoming benumbed by the cold, they lay without action, and gradually descended, so far at all events as that the whole of the body was below the level of the snow.

Prof. Brayley (who was present as a visitor) criticized von Tschudi's explanation of the reason for the insects settling on the 'firn,' and wished to know whence the oxygen was supposed to be derived; he suspected that von Tschudi had in his mind the old and exploded notion that pure oxygen was given off during the melting of snow, or that the water of melted snow contained an extraordinary quantity of oxygen. Insects, however small, would from the texture of their wings absorb heat very readily, and when placed on the snow they would by radiation give it off again, probably with equal rapidity; the melting of the snow, the formation of a cavity, and the descent of the insect, would be the natural result; but he was not able to account for an insect sinking to the considerable depth of two feet, as mentioned by von Tschudi. He should like to ask Mr. Pascoe whether the diameter of the hole in the snow greatly exceeded the expanse of the out-stretched insect? He imagined it would not.

Mr. Pascoe replied that the insects, when taken out of the cavities, were wet and limp, and their wings became clogged together, so that he could not speak with accuracy as to their admeasurement; he thought, however, that the breadth of the expanded wings would be nearly equal to the diameter of the hole.

The President said that he also had noticed similar holes in the snow when crossing some of the Alpine passes, though at the time he had not bestowed upon them the attention which it now appeared they deserved.

The President called attention to a paper by M. Balbiani, published in the 'Comptes Rendus,' June 4, 1866, in which the writer propounded a theory that the Aphides are true hermaphrodites. According to M. Balbiani's observations, each ovarian tube possesses an enlarged end which contains a group of cells; one of these, which occupies the centre and is surrounded by the others, is the most important, "car elle représente l'élément générateur ou la cellule mère de tous les ovules qui, dans chaque gaine, sont destinés à se transformer en embryons;" the peripheral cells nourish the central one; when the ovule enters the ovarian tube, it possesses a germinative vesicle and spot; the latter soon disappears, and after it the vesicle also; during this time many nuclei become apparent in the surface of the vitellus, and condense round themselves the homogeneous substance of which it consists; these are the blastodermic cells, which at this period are not surrounded by any membrane; the cells increase in number so as to cover the whole egg; after awhile an opening commences at the posterior end, and from it some of the contents protrude like a hernia; a delicate membrane is then visible inside the blastodermic cells; the hernial portion forms a connexion with the epithelial cells, and, when this is done, the vitelline vesicle contracts inside the blastoderm and divides into two secondary vesicles, of which the posterior one adheres to the epithelium, while the other remains free; these vesicles or cellules are the embryos of the sexual elements; the surface of each becomes covered with a generation of small cellules which grow and continue to develope others; the posterior group is male, the anterior (the free one) is female; the latter remain colourless and are smaller than the male cellules, which become green or yellow (this is the pseudo-vitellus of Huxley); the mother vesicle soon disappears, while the male one increases and constitutes a reservoir of fecundating corpuscles; up to this time the embryonal development has not commenced, but from this point it proceeds regularly until the birth of the young Aphis.

Prof. Westwood was reminded, by the mention of Aphides, of a circumstance which had recently puzzled him. He had at Oxford some rose-trees which did not grow in the spring, but had only lately thrown out shoots; no sooner did a shoot appear, no matter how minute, than a fine fat Aphis was found upon it, and though the trees were carefully cleaned daily, yet morning after morning a fresh Aphis was on each new bud. The Aphides were all apterous; they could scarcely have been blown upon the plants by the wind, since they occurred so constantly, and always on the youngest buds; the roses were planted away from any overhanging trees or shrubs; and he did not think the insects were hatched on the buds, since this would under the circumstances have required a retardation of the development of the eggs in order to keep time with the retarded development of the buds; he could only conclude that each night they had crawled up from the ground, but it was curious that they should be found exclusively on the smallest last-developed shoots.

Mr. Edward Sheppard had noticed the same thing on the young buds of jasmine, as if the Aphides had been born on and with the buds.

The Rev. Douglas C. Timins communicated the following notes on the larvæ of Charaxes Jasius and Melitæa Provencialis:—

"It may interest some entomologists to know that I have succeeded in rearing the larvæ of the splendid Charaxes Jasius in England. In January of this year I obtained some young larvæ at Hyères. They grew very slowly, and in April were not nearly full-fed. I brought them to England, and carefully fed them with Arbutus Unedo, placing their cage in the sun (they only feed in sun-light, as far as I have observed), and about the 15th of May some of them assumed the pupa state. On the 5th of June two specimens emerged; one, however, had the wings crippled. I have also bred Hesperia Althææ and Melitæa Provencialis. The larva of the latter has not been described; its length when full-fed is about an inch and a half; head black; body black, velvety, the back powdered with white dots; a stripe of white dots along each side; numerous jet-black spines on each segment; fore legs reddish brown, hind legs red; in societies, on Lonicera Balearica. The pupa is remarkably handsome, being white, with golden-yellow rings chequered with black on each abdominal segment, and having the wing-cases marked with golden-yellow and black; it is of course suspended by the tail. The larvæ were obtained at Hyères on the 21st of March, changed to pupæ at Hyères between the 2nd and 7th of April, and the first imago emerged at Winchelsea on the 6th of June. M. Provencialis appears to be merely a local variety of M. Desfontainesii, or perhaps Provencialis is the type, and Desfontainesii the variety."

With reference to the last remark, Mr. M'Lachlan observed that Melitæa Desfontainesii was commonly considered to be only a variety of M. Artemis; an opinion in which Mr. Bates said that he concurred.

New Part of 'Transactions.'

A new part of the 'Transactions' (Trans. Ent. Soc., third series, vol. v. part 3), being the third Part published during the present year, was on the table.

August 6, 1866.

Professor Westwood, V.-P., in the chair.

A special vote of thanks to Mr. W. Wilson Saunders was passed, in acknowledgment of the hospitable reception given to the Members of the Society at Reigate, on the 6th ultimo.

Donations to the Library.

The following donations were announced, and thanks voted to the donors:— 'Transactions of the Linnean Society,' vol. xxv. part 2; presented by the Society. 'Verhandlungen der K.-K. zool.-botan. Gesellschaft in Wien,' vol. xv.; by the Society. 'On the Metamorphoses of Insects,' by Sir John Lubbock, Bart.; by the Author. 'The Zoologist' for August; by the Editor. 'The Entomologist's Monthly Magazine' for August; by the Editors.

Exhibitions, &c.

Mr. S. Stevens exhibited a collection of insects sent by Mr. Reed from Bahia, chiefly Coleoptera, and amongst which were some fine Cicindelidæ and Carabidæ, Odontochile, Dercyllus, Scarites, &c.; also a new Cetonia from Sierra Leone; and three species of Pogonostoma sent by Mr. Gerrard from Madagascar.

Prof. Westwood said that since the July Meeting he had had an opportunity of examining the remarkable beetle then exhibited and described by Mr. Pascoe, under the name of Ectrephes formicarum (*ante*, p. xvi.); it did not belong to the Paussidæ, nor was it allied to Gnostus; the mouth was different from anything with which he was acquainted, possessing enormous mandibles, with an elongated triangular or conical moveable lobe; this was another instance of the extreme modification of form found amongst insects frequenting the nests of ants.

Mr. Janson exhibited a box of Coleoptera collected by Mr. Charles Turner in the New Forest, amongst which was Quedius dilatatus found in the larva-burrows of Cossus ligniperda.

Mr. M'Lachlan exhibited a remarkably dark variety of Cabera pusaria, captured by Mr. Dorville at Alphington, near Exeter; the specimen was a male, and, whilst the body retained the ordinary milky hue, the wings were quite sericeous and fuscous.

Mr. Bond exhibited Scoparia basistrigalis, a new species, recently characterized by Dr. Knaggs (Ent. Mo. Mag. iii. 1), and for comparison therewith specimens of S. ambigualis, the most nearly-allied British species.

Mr. Bond also exhibited two specimens of Catoptria microgrammana, a rare coast insect, and two specimens of Sericoris euphorbiana (*Zeller*), a species which had for some years been unique as British in the cabinet of Mr. Shepherd: both species were taken at Folkestone by Mr. Meek during the present season.

Prof. Westwood mentioned that it was only within the last few days that he had bred any of the perfect insect of Bombyx Cynthia at Oxford; so that his prospect of a second crop of Ailanthus silk was this year hopeless. Others, however, had succeeded in rearing the moth at an earlier period.

Prof. Westwood directed attention to a paper by Mr. Packard, just published in the 'Annals and Magazine of Natural History,' in which it was asserted that the pupæ of Hymenoptera go through a series of mutations of form, analogous to those of Chloeon, as detailed by Sir John Lubbock. He suggested that the hive-bee afforded a good subject for observations in corroboration of this theory.

Mr. M'Lachlan mentioned the capture, on the banks of the Mole, near Reigate, of Sisyra Dalii (Hemerobiidæ), on the occasion of the Society's excursion thither, on the 6th ultimo; and exhibited a collection of cases of caddis-worms, part of which were from Bavaria, and the rest had been collected by Mr. Albert Müller in the neighbourhood of Basle. Amongst them were some remarkable forms of the case of Halesus digitatus, the case (formed of sand) of Enoicyla pusilla, of which the larva is non-aquatic, and a singular case, of uncertain genus, formed of vegetable matter arranged transversely so as to form a partially angular tube closed by a solid operculum, in the centre of which were four small holes to admit the water.

The Secretary read a communication respecting the recent plague of locusts in Algeria, the serious character of which was confirmed by an official circular issued by Marshal Canrobert. The creatures first appeared during the month of April; coming from the gorges of the mountains and the fertile valleys of the littoral, they descended first on the plain of the Mitidja and the Sahel of Algiers. Their mass, at certain points, intercepted the light of the sun, and produced an effect similar to that of the snow storms which, in the winter season, fall in Europe, and blot out even the nearest objects from the sight. The vegetation of the country offered an attractive bait to the destructive insects. A large portion of the colza, oat, late barley and vegetable crops were immediately destroyed, and in some parts even the interiors of houses were invaded. The Marshal used all his endeavours in encouraging the population in their efforts against the invaders; by his orders the troops were called out to help the colonists to combat the plague, and the Arabs, whose interests were also at stake, joined their efforts against the common enemy. In a few days enormous quantities of the insects were destroyed; but human efforts had little effect against those winged multitudes, which fled over the country, and only abandoned one field to fall upon another. It was impossible to prevent fecundation and the deposit of eggs, which quickly gave life to larvæ innumerable, so that the first swarms were soon replaced and centupled by new generations. The appearance of these young locusts is especially to be dreaded, on account of their voracity; the hungry myriads fell upon everything which had escaped the depredations of their predecessors. They filled up the water-courses, the canals, and the rivulets, and the troops had the greatest difficulty in preserving the water from infection. Almost at the same time the provinces of Oran and Constantine were invaded. At Tlemcen, where no locusts had appeared within the memory of the oldest inhabitants, the soil was covered with them. At Sidi-bel-Abbès, at Sidi-Brahim, and at Mostaganem, they attacked not only the tobacco plantations, the vines, and the fig trees, but also the olive trees, notwithstanding the bitterness of the leaves of the latter. At Relizabe and at Harba they invaded the cotton grounds. The road between Mostaganem and Mascara was literally covered with them along its entire course of fifty miles. In the province of Constantine the locusts appeared simultaneously from the Sahara to the sea, and from Bougie to Calle. At Batna, at Setif, at Constantine, at Gelma, at Bone, at Philippeville, and at Djidjelly, the people acted energetically against the invasion, but neither fire nor other obstacles offered to the progress of the insects were sufficient to prevent the destruction, which fell principally upon the European settlements. The damage done is immense, though it is impossible at present to ascertain the whole extent of the mischief, for the work of devastation is going on daily; such a terrible visitation has not been known in modern times.

September 3, 1866.

Sir JOHN LUBBOCK, Bart., President, in the chair.

A special vote of thanks to the President was passed by acclamation, in acknowledgment of the hospitable reception given to the Members of the Society at High Elms, on the 11th ult.

Additions to the Library.

The following donations were announced, and thanks voted to the donors:—'Transactions of the Zoological Society of London,' Vol. v. Part 5; 'Proceedings of the Zoological Society of London,' 1865; presented by the Society. 'Bulletins de l'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Bruxelles,' 2nd series, Vols. xx., xxi.; by the Academy. 'Annals of the Lyceum of Natural History of New York,' Vol. viii. Nos. 4—10; by the Lyceum. 'Proceedings of the Boston Society of Natural History,' vol. x.; by the Society. 'The Journal of Entomology,' Vol. ii. No. 14; by the Proprietors. 'The Zoologist' for September; by the Editor. 'The Entomologist's Monthly Magazine' for September; by the Editors.

The following additions by purchase were also announced:—'Revue Zoologique,' 11 vols.; Laporte & Gory, 'Histoire Naturelle et Iconographie des Insectes Coléoptères,' 4 vols.; J. Thomson, 'Essai d'une Classification de la Famille des Cérambycides;' J. Thomson, 'Systema Cerambycidarum;' Trimen, 'Rhopalocera Africæ Australis,' Part 2.

Election of Member.

M. A. Depuiset, of No. 17, Rue des Saints Pères, Paris, was ballotted for and elected a Foreign Member.

Exhibitions, &c.

Mr. Bond exhibited a male specimen of Bombyx Cynthia which measured 6¼ inches in expanse of wings: those reared by Dr. Wallace at Colchester during the present year varied from 3—6½ inches; they also showed some variations in the quantity of white hair or down upon their bodies, some having small tufts only of that colour, others having bands, whilst in a few specimens almost the entire surface was white.

The Secretary had been requested by Dr. Wallace to say that during September his Ailanthery would be worth looking at, and he would be very glad to show it if a day's previous notice were given him. The season had been very unfavourable; long continued rain and wind made great havoc, and a severe hail-storm which happened early in August riddled the Ailanthus leaves, and knocked down the worms, of which many were killed. Nevertheless there would be a crop; his first cocoons were begun on the 18th of August, and he had a second smaller supply of younger larvæ to supply the vacancies caused by the previous inclemency of the weather.

Mr. S. Stevens had recently visited Lady Dorothy Nevill's Ailanthery, where also many larvæ had been blown off the trees by the wind, and it was necessary to employ a man or boy to replace them on the leaves. Birds, however, were seldom found to attack the larvæ.

Prof. Westwood said that wasps carried off the newly-hatched larvæ. He might mention that a correspondent of his had had a few of the larvæ in-doors, but two of them escaped; after a time two specimens of the perfect moth were found upon the single Ailanthus tree which was growing in the garden.

Mr. Pascoe directed attention to an account given by Mr. Consul Meadows, and published in a recent number of 'The Times,' of a Chinese silk-worm, the pupa of which was used as an article of food.

Prof. Brayley communicated the following extract from the Report of Mr. Vice-Consul Lay on the Trade of the Port of Che-foo in Northern China, recently presented to Parliament:—

"Amongst the articles that can be exported from Che-foo, there is brown silk produced from the wild silk-worms that swarm in the mountain forests, and the quantity of this article that could be brought into the market, if prices suited, may be computed at not less than 12,000 bales a-year. This silk is of different qualities, according to the process and care adopted in reeling it from the cocoons, and some of it is well adapted for manufactures. The natives weave plain silk goods from it called 'pongees,' and about 100,000 pieces of these stuffs could be bought annually."

Mr. A. F. Sheppard exhibited a box of Lepidoptera, all bred or captured in the Isle of Man by Mr. Gregson, and including Dianthœcia cæsia, D. capsophila (a *var.* of D. carpophaga in Mr. Gregson's opinion), Sesia philanthiformis, Sericoris littorana, Eupœcilia albicapitana, Sciaphila Colquhounana, Gelechia vicinella and G. leucomelanella (which Mr. Gregson believed to be but one species), a new species of Gelechia, and the new Phycis, allied to P. dilutella, of which Mr. Bond exhibited a specimen at the July Meeting (*ante*, p. xviii).

Mr. Stainton exhibited Gelechia vicinella, which had been bred by Mr. Gregson from larvæ collected in the Isle of Man, feeding on Silene maritima; and Gelechia atrella, which had been bred by Mr. Jeffrey from larvæ collected near Saffron Walden, feeding in the stems of Hypericum. The first-named species belonged to the group of which the larvæ are all attached to plants of the natural order Caryophyllaceæ, but Gelechia atrella had always been supposed to belong to the group of species attached to plants of the natural order Leguminosæ, and its occurrence on Hypericum was so startling that Mr. Stainton had at first suspected some error of observation; however, Mr. Jeffrey's statements were positive and conclusive, that he had bred fourteen specimens in three different receptacles, one of which had not been previously used for larvæ, and that he had not collected any larvæ feeding on Leguminosæ before the first imago of G. atrella had appeared. The habit of the larva was, moreover, very peculiar; it burrowed in the stems of the Hypericum early in May, and thereby caused the upper shoots of the plant to droop, which had led to its discovery.

Mr. Stainton also exhibited a series of Micro-Lepidoptera received from M. Millière, of Lyon; amongst which were specimens of the Depressaria Rutana of Fabricius (a species which had been lost sight of for many years), bred from Ruta angustifolia, at Cannes, and of a new species of Gelechia nearly allied to G. costella, which had been bred from Hyoscyamus albus, at Cannes. Mr. Stainton remarked that our common G. costella was hardly known on the Continent; he had never seen a specimen in Germany, indeed the only Continental example he had seen was from Holland; yet the food-plant, Solanum dulcamara, was extensively distributed. The occurrence, therefore, of an allied species feeding on a nearly allied plant in the South of France was very interesting.

Mr. S. Stevens exhibited some coloured drawings of butterflies of extreme beauty and most minute accuracy, executed without the aid of a lens by Mr. Mitchell, who was present as a visitor.

The Secretary exhibited a curious variety of Melanippe fluctuata, found by Mr. E. S. Haines at rest on a wall at Brierley Hill, Staffordshire, in 1864; it bore considerable resemblance to the form described by Haworth under the name of costovata.

The Secretary exhibited drawings of the larva, pupa and both sexes of the imago of a new Geometrideous moth belonging to the genus Agathia, *Guén.*; these were communicated by Mr. H. L. Schrader, of Shanghai, who found the larvæ on Salix pentandra, but they for some time escaped detection by reason of their resemblance to the remains of a leaf of which the softer parts had been eaten away. Four of the larvæ were found in the neighbourhood of Shanghai on the 1st of August, 1865; they were then about an inch long; between the 8th and the 14th they changed to pupæ; a cocoon was formed (but so slight that the pupa was visible through it) and attached to the stem of a twig, the head of the pupa resting in the angle between the stem and a leaf-stalk; two males emerged on the 20th and 24th of August respectively, and one female on the 21st.

The Secretary read a communication respecting the injury done to the cotton crop in Louisiana by the "army worm," the larva of Heliothis armigera. It stated that the crop was in danger of being entirely eaten up. Two years ago the planters of Louisiana, tempted by the high price of cotton, which was then selling at fifteenpence a pound, began to cultivate cotton, which had been almost abandoned. The sugar cane became of secondary importance; but the caterpillar arrived, and swept away the hopes of the planters in a few days. The noise made by the multitudes of voracious insects was described as audible at the distance of a mile, and to resemble the crackling of a house on fire. It was thought for a long time that the army worm only visited Lower Louisiana, but this was an error; in 1788, these insects destroyed 280 tons of cotton in the Bahamas; they caused the cultivation of cotton to be given up in many of the West Indian Islands, and the case was almost the same in Egypt; in 1793 this insect visited Georgia, and in 1800 it ravaged South Carolina; four years later they descended on the whole of Louisiana; and in 1825 they ravaged the whole of the Southern States, and it was very difficult even to get seed for the following year. The last general visitation was in 1845. The army worm appears often in Guiana and other parts of South America. The mischief done by these creatures is, fortunately, not always of the same serious extent; sometimes even the insects, when they come late, as they did last year, thin the seed pods, and produce a positive benefit. If it were not so, considering that they have appeared twenty-three times in the United States since 1793, the growing of cotton would be hazardous to be continued. The most favourable circumstances for the production of the army worm are heat, moisture and clouded skies, up to the end of the month of June; when such is the case the visitation is looked upon as certain; it was so this year. The caterpillars cannot support great heat and continued drought; in Louisiana and the other States of the South, as well as in the Bahamas, a torrid summer kills them, especially where the soil is sandy. In 1826 the creatures appeared on the 1st of August in Louisiana and North Carolina, but hot weather set in, and by the 23rd of the same month they had all disappeared.

Mr. S. Stevens exhibited a house-fly to which were attached six Chelifers; and had observed another upon which were no less than eight of those parasites.

Mr. F. Moore read the following extract from the 'Journal of the Asiatic Society of Bengal,' 1866, p. 73, respecting the synchronous emission of light by fireflies (see 'Proceedings' 1865, pp. 94, 101):—

"Camp, near Myanoung, Nov. 22, 1865.

"During a visit to Calcutta, a few months ago, Mr. Grote drew my attention to a sort of controversy which had been started at home, touching the habit which fireflies were stated to exhibit occasionally, of a concurrent exhibition of their light, by vast multitudes acting in unison; a statement which appeared to have been somewhat sceptically received. Mr. Grote does not appear to have ever witnessed this phenomenon in Bengal, and questioned me if I had ever observed any confirmatory instance. Fireflies are tolerably well known, of course, to the resident in Bengal, but I had never there observed any such habit among the countless fireflies which form such fiery-like ornaments to the shrubberies about Calcutta. In Pegu, however, I have witnessed the exhibition in question; myriads of fireflies emitting their light, and again relapsing into darkness, in the most perfect rhythmic unison. I much regret that I did not secure specimens, but the circumstances were as follows:—I had halted my boat for the night alongside a small clearing in the low-lying tract of country forming a part of the Irawadi Estuary (Delta), east of the Bassein River, where the water was salt, and the entire country not more than a foot, if so much, above the flood-level. Night had closed in, and my servant, who brought in the tea, asked me to step out of my tent and see the fireflies, which, he said, he had never seen the like of before. On stepping out of the tent, a truly beautiful sight presented itself. In front was the broad and deep river sweeping on, with its indistinctly seen back-ground of primæval forest on its opposite bank. Around me was the recently-formed clearing, with its two or three huts and my own camp as the sole proof of man's occupancy, for miles and miles, but, for all the wildness and almost desolation of the scene, the bank on which I stood was a glorious spectacle, and those acquainted with the class of native servants will well understand that it must have been at once unusual and beautiful indeed to rivet the attention of a listless khitmutgar! The bushes overhanging the water were one mass of fireflies, though, from the confined space available for them on low shrubs, the numbers may not have been actually more than are often congregated in Bengal. The light of this great body of insects was given out, as I have said, in rhythmic flashes, and, for a second or two, lighted up the bushes in a beautiful manner; heightened, no doubt, by the sudden relapse into darkness which followed each flash. These are the facts of the case (and, I may add, it was towards the end of the year), and the only suggestion I would throw out, to account for the unusual method of luminous emanation, is that the close congregation of large numbers of insects, from the small space afforded by the bushes in question, may have given rise to the synchronous emission of the flash, by the force of imitation or *sympathy*. Mr. Montgomery, of the Survey Department here, also fully corroborates the habit of our Pegu fireflies simultaneously emitting their light, but adds he has only remarked it under conditions similar to those described above, in low swampy ground. It still remains, therefore, to be decided if the insect is different from the ordinary one, or if, as I am inclined to think, the simultaneity is produced by sympathy and great crowding of individuals.—W. Theobald, jun."

Mr. M'Lachlan mentioned that the genus of Hydropsychidæ (Trichoptera) described by him in the 'Transactions' (third series, v. 270), under the name of Sciops, was identical with the Hydromanicus of Brauer (Verh. K. K. zool-botan. Gesellschaft in Wien, xv. 420), which had priority over Sciops, so that the latter name must sink. The two species described by Mr. M'Lachlan were, however, both distinct from the Hydromanicus irroratus of Dr. Brauer.

Mr. Janson exhibited a small collection of Jamaican insects, the produce of the first three weeks of Mr. C. P. Gloyne's residence near George Town; amongst a few Hemiptera, an Emesa was the most interesting; and amongst the Coleoptera, an Epitragus, a Charactus, Hebestola, Desmophora, Notoxus, Helops, &c.

The Secretary read a further instalment of "Notes on the Buprestidæ of South Australia," communicated by Mr. C. A. Wilson, of Adelaide.

Mr. Pascoe read the following description of a new genus of Tmesisterninæ :—

"The Queensland insect described below is closely allied to Spintheria, from the opposite land of New Caledonia. It is exceedingly interesting as being a second form of a group which, almost excluded from Australia, abounds in New Guinea and the Celebes (Mr. Wallace's collection alone contains nearly a hundred species), and is represented as far as Timor to the West, Manilla to the North, and New Zealand to the South. It is also interesting from the remarkable structure of its mesosternum, which is produced anteriorly into a sharp spine, overlapping the prosternum. The following characters separate the genus from Spintheria and from all other known forms of Tmesisterninæ. :—

Anastetha, n. g.

Antennæ setaceæ, corpore longiores. Prothorax basi latus et bisinuatus, lobo scutellari producto. Scutellum elongatum, angustatum. Femora postica haud incrassata. Mesosternum antice in spinam acutam projectum.

Anastetha raripila, n. sp.

A. nigra, nitida, fere glabra, pilis argenteis perpaucis solum induta; elytris obscure rubris, plaga subtransversa prope medium sita tertiaque parte apicali nigris, apicibus ad suturam dentatis.

Long. 5 lin.

Hab.—Rockhampton."

Papers read.

Mr. Frederick Smith read a paper entitled "Notes on some Hymenopterous Insects collected by Mr. Peckolt, at Catagallo, South Brazil." Amongst them was the

Dielocerus Ellisii of Curtis, a sawfly which is social in all its stages, as described by Curtis, whose account of its economy was corroborated by Mr. Peckolt; but the most interesting object in the collection was the female of the stingless honey-bee Trigona, which has been hitherto a desideratum with Hymenopterists. Amongst some hundreds of specimens of Trigona Mosquito were a few workers and females, and of the latter half a dozen examples; there was no difficulty in discovering the queen, which, when her abdomen was distended with eggs, was more than double the length of a worker, and had very much the appearance of a gravid female Termes. The collection also included Cryptocerus elongatus, which was said to be destructive to nests of the mosquito bee (Mr. Bates has described another species of Cryptocerus as feeding on the dung of birds); and a white ant, very destructive to coffee beans, closely resembling, if not identical with, the Termes cumulans of Hagen.

Mr. Roland Trimen, of Cape Town, communicated a paper entitled "Notes on the Butterflies of Mauritius." Of the twenty species of Rhopalocera (exclusive of the doubtful native, Thymele Ramanatek) enumerated by Boisduval in his "Faune Entomologique de Madagascar, Bourbon et Maurice" as inhabiting the last-mentioned island, the author himself, during a visit of three weeks in July, 1865, captured sixteen, and was presented by other collectors with the remaining four; in addition to which he captured four species, and was presented with another not known to Boisduval as Mauritian. The five additional species were Callidryas Florella, *Fabr.*, C. Rhadia, *Boisd.*, Terias Rahel, *Fabr.*, Junonia Rhadama, *Boisd*, and Libythea Cinyras, *n. sp.?*

Future Meetings of the Society.

The President announced that there would not be any Meeting of the Society in October, and that the future Meetings would, by permission, be held in the Rooms of the Linnean Society, in Burlington House, Piccadilly.

November 5, 1866.

Sir John Lubbock, Bart., President, in the chair.

The Meeting was this day for the first time held in Burlington House. A resolution in the following terms was proposed by the President, seconded by Mr. Alfred R. Wallace, and carried by general consent:—

"That the Society desires to record its sense of the liberality and kindly feeling of the Linnean Society evinced by the permission given to assemble in these Rooms, and that the thanks of the Society be offered to the Linnean Society accordingly."

Notice of Subjects for Discussion.

The President referred to the suggestions made by the Council twelve months previously (see 'Proceedings,' 1865, p. 128), as to giving notice beforehand of papers intended to be read or subjects to be introduced for discussion. In no single instance had notice been given; but the Council was so convinced that the interest and scientific value of the Meetings would be increased by the adoption of such a course, that he had been requested again to mention this matter from the Chair. If the

Secretary were forewarned in time to announce the subject for consideration in the 'Athenæum' of the Saturday preceding the Meeting, Members specially interested in and conversant with that subject would probably make a point of being present, and moreover invitations might be issued to men of science who were known to be well acquainted with the matter, and thus the discussions, otherwise desultory, might lead to definite practical results.

Donations to the Library.

The following donations were announced, and thanks voted to the donors:—'The Journal of the Linnean Society,' Zoology, Vol. ix. No. 34; presented by the Society. 'The Journal of the Royal Agricultural Society of England,' 2nd series, Vol. ii. Part 2; by the Society. Hewitson's 'Exotic Butterflies,' Part 60; by W. W. Saunders, Esq. Lacordaire, 'Genera des Coléoptères,' Vol. vii., and Parts 7 & 8 of the Plates; by the Author. 'Observations on the Development and Position of the Hymenoptera, with Notes on the Morphology of Insects,' by A. S. Packard, jun.; by the Author. 'Eugereon Boeckingii, eine neue Insectenforme aus dem Todtliegenden,' by Dr. Anton Dohrn; by the Author. 'Stettiner Entomologische Zeitung,' 1866, Parts 7—12; by the Entomological Society of Stettin. 'The Zoologist,' for October and November; by the Editor. 'The Entomologist's Monthly Magazine,' for October and November; by the Editors.

Election of Member.

Colonel Henry Scott, R E., Sec. R.H.S., of Ealing, was ballotted for, and elected a Member.

Exhibitions, &c.

Mr. W. W. Saunders exhibited two larvæ of Cicadæ from Mexico, each of which had a Clavaria growing from between the eyes; the fungi were probably of the same species, though dissimilar in their development. He remarked that these fungoid excrescences were most frequently found on Lepidopterous larvæ, and usually arose from the joint immediately behind the head; in the present case, however, the Clavariæ sprang from the front, giving to each larva the appearance of the conventional unicorn. It was a question whether the growth of the fungus commenced during the life of the insect; he was not aware of any observation which supported that notion, and thought that the growth did not begin till after death. Acting upon the suggestion of the President, Mr. Saunders promised to bring forward for discussion the subject of "Fungoid growths on Insects" at a future Meeting, of which due notice should be given.

Mr. Bates mentioned that some capital articles on insect-fungi by Mr. Cooke had recently appeared in Hardwicke's 'Science Gossip.'

Mr. W. W. Saunders exhibited two larva-cases sent from Brazil by Mr. Reed, one of which was zoned or ribbed in different directions so as to form quite a regular sculpture on the outside; the two were somewhat similar, and probably belonged to two species of the same group of Coleoptera.

Mr. Janson exhibited various new or rare Coleoptera recently received by Mr. Bakewell, from Dr. G. Howitt, of Melbourne, *viz.*, Hemiphasis Bakewellii, *White*, from Melbourne; Passalus teres, *Perch.*, New South Wales; Lissotes obliteratus, *Westw.*, Hobarton; Lissotes cancroides, *Fabr.*, Hobarton; Lissotes subtuberculatus, *Westw.*, Hobarton; an apparently nondescript species of Lissotes from Victoria, to which Dr. Howitt applied the trivial name "furcicornis"; a new species of Ceratognathus, from Hobarton, for which Dr. Howitt proposed the specific title "setiger"; and Dorcadida bilocularis, *White*, from Hobarton.

Mr. Stainton exhibited the specimen of Stathmopoda? Guerinii, which he had received from M. Guérin-Méneville in 1857, with the intimation that it was "éclose d'une grande galle sur le pistacier," and which till last month had remained unique. Towards the end of September Dr. Staudinger, who had gone on a collecting expedition to Celles-les-Bains (Department of Ardèche) sent over some Nepticulized leaves of Pistacia terebinthus, and on the 28th of September Mr. Stainton wrote suggesting a search for the gall-feeding Stathmopoda. On the 2nd October Dr. Staudinger wrote in reply:—"Many thanks for the notice respecting Stathmopoda? Guerinii, of which I herewith send you five larvæ. I had long noticed the galls on the Pistacia (often very large), and had opened some, but there were thousands of Aphides within and a quantity of white dust, so that it seemed an unprofitable occupation. To-day, however, I have renewed my search with fresh energy, though it is very dirty work, as there is besides a resinous secretion. I found, however, two sorts of larvæ in them, generally living amongst hundreds of Aphides, on which they probably feed, since I did not find the inner parts of the galls eaten; the larger larva belongs to the Phycideæ, and the smaller white larva is that of Stathmopoda? Guerinii; of this latter I also found pupæ, and in one firmly closed gall a fresh specimen of the perfect insect. There are three kinds of galls on the Pistacia; the largest is at the ends of the shoots, elongate and curved, but they vary much in form and size; one which I found was nearly a foot in length. It was only in this kind of gall that I found the larvæ of the S. Guerinii, generally in the smaller specimens. The larva makes a firm case of grains of excrement, which is attached to the inside of the gall; generally there is an opening made, through which the perfect insect may escape, yet I found some galls in which this was not the case, and in which the moth would only come out in the interior of the gall. I imagine that the Aphides are the originators of the galls, in which subsequently the moths lay their eggs; but on what do the larvæ feed?" Ten days later Dr. Staudinger had been able to add some further details:—"The Aphides originate the galls, then the moths deposit their eggs on them: the larvæ feed on the inner walls of the galls: the larvæ of Stathmopoda Guerinii sometimes leave the open galls and creep to some distance to undergo their change to the pupa state; but more frequently they remain in the galls. The pupæ stick sometimes half out of the galls, and then retreat back again; they do this especially when there has been heavy rain, and the water has penetratad the galls." A beautifully coloured drawing, by Miss Wing, of the gall and larva was also exhibited.

Mr. Stainton also stated that he had lately received from Herr Hofmann, of Ratisbon, a larva in the berries of the alder, which was presumed to be that of Stathmopoda pedella; of this he exhibited a figure, and remarked that it was with the greatest difficulty that this larva could be got out of the alder-berries alive, for it was often in a burrow close to the central core, and owing to the hardness of the berry it was almost impossible to avoid the destruction of the larva.

Mr. Stainton exhibited a collection of Tineina from Syria and Asia Minor, which Herr Lederer, of Vienna, had liberally sent over to enable him to work out the collection of insects made by Mr. Pickard-Cambridge in Palestine. Several of these were of extreme beauty, and some belonged to genera not known to occur in Europe. Mr. Stainton remarked that in addition to a specimen of the species which Zeller had described in 1847 as Dasycera imitatrix, from its extreme similarity to Dasycera Oliviella, there were two specimens from Amasia which seemed intermediate between D. imitatrix and D. Oliviella; and that when species came so extremely close together it was important to examine a long series, in order to ascertain the extent and limits of variation in each.

Mr. F. Smith exhibited some galls found in July, at Deal, on the shoots of the elm, and which when fresh were of an apple-green colour, with the side exposed to the sun of a rosy hue, so that they had a perfectly fruit-like appearance: they were of considerable size, hollow, and contained numbers of Aphides, probably a couple of hundred in a single gall. He had sent specimens to Mr. Armistead, who believed the gall to be undescribed.

Mr. M'Lachlan found the same gall in the summer near Kingston-on-Thames, not on the Ulmus campestris, but on what he believed was known as the Dutch cork elm; they contained Aphides, and were full of water.

The President remembered to have seen very similar galls near Naples, he believed on elm.

Mr. Pascoe exhibited two females of a Coccus, the case or covering of which resembled a small shell, and might well be mistaken for a Patella; they were from Port Lincoln, South Australia, and were said to have been found "on the under side of Eucalyptus leaves."

The President exhibited specimens and magnified drawings of a new Myriapod, about one twenty-fifth of an inch in length, and remarkable not only for its small size but for the small number of legs, having only nine pairs: he found it not unfrequently in his kitchen-garden, among decaying leaves and in other similar situations. It might at first sight be taken for a larva, but he had watched many specimens for nearly two months, and during that time they had not undergone any further change or exhibited signs of further development; moreover, some of the males contained spermatozoa, which showed that *they* were mature. The first pair of legs was attached to the segment immediately succeeding the head, the other eight pairs to the four following segments; the youngest specimens were provided with only three pairs of legs, there was no eight-legged stage, but at a single moult they changed from three pairs to five pairs, and afterwards to six, seven, eight and nine, acquiring a new pair at each successive moult. The animal was white in colour, active in habit, intelligent in appearance, and frequently occupied itself in cleaning its feet with its mouth, after the manner of a fly or cat. In many other points it differed from all centipedes, of which the President believed it to constitute a new type; the Myriapods were separated from other Arthropods by so broad a division that any form which even tended to bridge over the gap was of very great interest: he proposed to give a history of the transformations of this novelty, and to describe it under the generic name of Pauropus, in allusion to the paucity of feet.

Prof. Westwood remarked that a certain identity of size appeared to run through particular groups, and this had hitherto seemed to be the case with the Myriapoda as with other Orders; the general run of Centipedes ranged (say) from ten inches down to an inch or an inch and a half; it was therefore very remarkable to meet with one of the almost microscopic dimensions of that exhibited (though the genus Pollyxinus made some approximation to it in size), and he should have been inclined to resort to the theory that it was an immature larval form, but for the observations of the President, which seemed to be conclusive on that head.

The Secretary exhibited, on behalf of Mr. W. Rogers, a singularly pale variety of the female of Hipparchia Janira, captured at Tooting on the 6th of September; and a specimen of Rumia cratægata, bred from a pupa found in an old fence at Tooting during the present year, in which the left fore wing and the right hind wing (with the exception of a slight tinge at their outer margins) were pure white, whilst the body and the other two wings were of the ordinary yellow, and of not less than the usual brightness and depth of colour. The specimen could be regarded only as a monstrosity, or *lusus naturæ;* it was as if Nature had fallen short of colouring matter, and had determined that such matter as she had should be employed as far as it would go in the perfect colouring of certain parts, and should not be equably diffused over the whole surface so as to produce an insect faint and pale throughout; the transverse or cruciform fashion, however, in which the colouring of the parts had been completed was curious.

The Secretary exhibited some Egyptian beans, sent "from a Greek firm," which on the outside appeared perfectly sound, whilst in the inside of many there was "a peculiar worm," some of which were found alive and were forwarded "for the use of the Society." The "peculiar worm" proved to be the perfect form of a species of Bruchus.

The Secretary read a letter from Mr. Henry Reeks, dated "Cow Head, Newfoundland, 13th Sept. 1866'; though but recently landed, the writer had already found that the Diptera, in the shape of mosquitoes, black flies and sand flies, predominated far beyond his requirements for obtaining specimens; Lepidoptera seemed scarce on that portion of the island; of Hymenoptera he had seen only one species of Vespa, and that not V. Germanica, which he saw in Canada.

The Rev. Douglas Timins communicated the following "Note on the appearance of Argynnis Lathonia":—

"I observe that at p. 115 of the 'Proceedings' for 1865, the appearance of Argynnis Lathonia late in September is mentioned as 'unusual.' As I have been for many years in the habit of taking that species in fine condition regularly from about September 25th to October 5th, and as information respecting its other periods of flight may be acceptable to English entomologists, I subjoin a note on this subject. Early in March hybernated specimens appear. The first fresh individuals emerge from the pupa late in May or early in June; they remain on the wing for some time, but are soon wasted. The second brood appears early in August, and lasts until September. Then, lastly, after this brood is almost over, and represented only by a few very tattered specimens, a small number of fine fresh specimens appear, a sort of third brood, in fact, late in September or early in October. These are generally smaller, and nearly always darker than the preceding broods; and they occasionally hybernate. These remarks apply only to the North of France, where the climate is similar to our own. In the South fresh Lathonias may always be seen, at least in October, November, December, February, April and May. I have even known this species emerge from the pupa in January (*not* being forced by heat). The third brood is so regular in its appearance that I used always, when residing in the North of France, to make one or two excursions in October or late in September in search of it. During these excursions I often met with the autumn brood of Melitæa Dia, and once I captured Limenitis Sybilla on the 1st of October, in very fine condition. I exhibited the specimen at the Oxford University Entomological Society: it differed in no respect from the type of the species."

Papers read.

Mr. M'Lachlan read a paper entitled "New Genera and Species of Psocidæ."

Mr. Edward Saunders read "Descriptions of six new Species of Buprestidæ belonging to the Tribe Chalcophorides, *Lacordaire*." Four of the species were referred to the genus Chrysochroa, one to Steraspis, and the other to Cyphogastra; the whole were exhibited, together with their nearest allies, for comparison.

New Part of 'Transactions.'

The publication (in September) of Trans. Ent. Soc., third series, vol. iii. part 3, being another instalment of Mr. Pascoe's 'Longicornia Malayana,' and the fourth part issued during the present year, was announced.

November 19, 1866.

Sir JOHN LUBBOCK, Bart., President, in the chair.

Donations to the Library.

The following donations were announced, and thanks voted to the donors:—'Bulletin de la Société Impériale des Naturalistes de Moscou,' 1865, No. 4; 1866, No. 1; presented by the Society. 'On the Origin of Species by means of Natural Selection, or the Preservation of favoured Races in the Struggle for Life,' by Charles Darwin, M.A., F.R.S., &c.; by the Author. 'Catalogue of Longicorn Coleoptera, collected in the Island of Penang by James Lamb, Esq,' by Francis P. Pascoe, F.L.S., F.Z.S., &c., late Pres. Ent. Soc.; by the Author.

Election of Members.

Percy Bicknell, Esq., of Beckenham, was elected a Member; and G. H. Verrall, Esq., of Lewes, an Annual Subscriber.

Exhibitions, &c.

Prof. Westwood exhibited pupæ of Thecla Betulæ, and remarked that the larva does not spin any silken band or girth, but simply fixes itself lengthwise on the leaf.

Mr. A. F. Sheppard sent for exhibition, on behalf of Mr. Gregson, remarkable varieties of Pieris Rapæ, P. Napi, Leucophasia Sinapis and Anthocharis Cardamines; also Gelechia ——?, taken by Mr. Hodgkinson in North Lancashire and by Mr. Gregson in South Lancashire; Phycita subornatella of Zeller, taken in the Isle of

Man and in Ireland; and an Acidalia, respecting which the following extract was read from a letter from Mr. Gregson:—

"I send you Acidalia veterata; it may be the same as one named mancuniata by Dr. Knaggs from some aberrant stunted second-brood females, but as the rule is to name from normal males (not females) as types, of course his name falls, especially as his diagnosis may mean anything or nothing. I do not know Dr. Knaggs, and of course have not any wish to offend him, but could not accept his new name for my old insect when based upon an abnormal type."

Mr. Stainton exhibited a living specimen of Stathmopoda Guerinii (*ante*, p. xxxi.), and called attention to the peculiar position of the hind legs, which were elevated and stretched out sideways as in S. pedella (which received the name of pedella from Linné from the peculiar posture of its hind legs) and as in the curious Indian insect Atkinsonia Clerodendronella, of which a drawing by a native artist at Calcutta was also exhibited. With reference to the galls in which the larvæ of S. Guerinii reside, Mr. Stainton referred to a passage in Réaumur (vol. iii. p. 305) in which these galls on the 'terebinthe' and their Aphis-inhabitants were mentioned, the plant which bore them having obtained the name of the fly-tree (*l'arbre aux mouches*) from the pod-like excrescences containing these Aphides. Mr. Stainton referred to the possibility of the larva of S. pedella being an inhabitant of galls, and thought that the habitat assigned by Linné for the larva "*in alni foliis, subcutanea*" might after all be correct: he quoted a passage from a paper by T. Bergmann, who had furnished Linné with the notice of the habit of Tinea pedella, to shew that that observer was aware of the existence of Lepidopterous larvæ in galls, and finally he quoted a passage from the Proceedings of the Entomological Society of Philadelphia, vol. 5, pp. 143, 144, to shew that Mr. Benjamin D. Walsh had bred a small moth (a Batrachedra) in plenty from galls formed by one of the Tenthredinidæ on the leaves of willows.—"Each gall containing a single larva, unaccompanied by the larva of the Nematus which makes the gall, which it must consequently have destroyed or starved out, either in the egg or in the larva state."

Mr. E. G. Meek exhibited Dicrorampha flavidorsana (Knaggs, MS.),* a species new to Science, from North Devon and Haslemere; a species of Noctuina, supposed to be new, taken by Mr. Harrington near New Cross; † and Stigmonota leguminana from Epping Forest.

Mr. Hewitson sent for exhibition some eggs "found upon the grass near some heath" and which were unknown to him: no member present hazarded a conjecture as to the insect to which the eggs were referable.

Mr. Hewitson communicated the following note on the plumules on the wings of butterflies:—

"When I was last at Bowdon, Mr. Watson, who has been studying the plumules from the wings of butterflies, pointed out to me a group of the Pieridæ which he considered ought to be set apart from the rest of the genus, having none of those

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* Since described Ent. Mo. Mag. iii. 176, and figured Ent. Ann. 1867, fig. 5.

† Xylina Zinckenii, *Tr.*; see Ent. Ann. 1867, p. 136.

plumules upon them which abound on the other species. This group consists of P. Thestylis of Doubleday, an undescribed species closely allied to it, P. Clemanthe, *Dd.*, and P. Autothisbe of Boisduval. This is confirmed by another distinctive character which these species possess, the costal margin of the anterior wings being strongly serrated. I felt therefore very much interested, when, on paying a visit to Mr. Wallace, who is now studying the Pieridæ, I found that he has also set apart this group. I send this notice to confirm an opinion I have expressed elsewhere, that a study of these plumules will produce evidence which 'will assist in determining the sexes, as well as in testing the worth of nearly allied species.' I may add that these species have for many years been put together in my collection, having noticed the peculiar serration of the wings."

Mr. E. W. Janson exhibited, on behalf of Mr. T. J. Harris, of Burton-on-Trent, a specimen of Macronychus quadrituberculatus, *Müller*, a Coleopterous insect previously unknown to inhabit Britain, captured by that gentleman, early in the autumn of 1864, in the vicinity of that town.

Mr. S. Stevens exhibited a remarkably fine pair of the rare beetle Eucheirus Duponchelii, and a number of small exotic beetles taken for the most part in ants' nests.

Mr. Weir exhibited a paper-like substance used by a Ceylon ant for lining its nest.

Mr. M'Lachlan mentioned that the galls on the elm which were exhibited by Mr. F. Smith at the previous Meeting (*ante*, p. xxxii.) had been described by Claude Joseph Geoffroy in 1724, and by Réaumur in 1737, the latter of whom gave figures of the gall: De Geer and Etienne Louis Geoffroy (1764) also referred to it, and the insect was the Schizoneura gallarum-ulmi of De Geer.

Prof. Westwood exhibited a highly magnified drawing of a monstrous individual of Pieris Pyrrha, a Brazilian butterfly, from the collection of Mr. Hewitson, of which the two wings on the left side of the body and the fore wing and costa of the hind wing on the right side were coloured as in the male (being white on the upper surface with a black tip to the fore wings, thus resembling Pieris Brassicæ), whilst the remainder of the right hind wing was coloured as in the female, thus resembling one of the Heliconiidæ. Prof. Westwood remarked that such a specimen and such a species afforded ground for some comment on the relationship of those mimetic animals which had recently attracted so much attention, and had afforded Mr. Bates materials for a remarkable and elaborate paper in the 'Transactions of the Linnean Society.' Prof. Westwood, in the first place, considered that every species of animal (except in the instances noticed below) was, so far as its habits and economy were concerned, as *independent* of its so-called allied species as if every individual of the latter had ceased to exist; the same might also be affirmed even of the individuals of each species, except,

1st, in the relations of the sexes of each species, and the result of their union;
2nd, in the relation between an individual or species and the animal or vegetable upon which it subsists; and
3rd, in cases of perfect socialism, where many individuals assist in the economy of the society.

This *independence in economy* was the result of similar independence or *isolation in structural relations*, and implied the *genetic distinction* of each species. But naturalists had found it convenient to assume closer or wider degrees of structural affinity as the basis of their classification, derived from the most distinctive character of their various groups, of whatever rank. Thus the Mammalia appropriated to the land, the birds to the air, and the fishes to the water, were characterized at once by the organs which were of the greatest use in enabling them to subsist in their respective elements, and hence a primary importance was attached to the organs of locomotion, and thus groups were formed and characterized, which have been termed classes, orders, families, tribes, genera, &c. It was, however, only upon the greater or less degree of *resemblance*, either of the entire animals or portions of their organs, to those which were associated with them in such groups, that these arrangements were based. Various kinds of resemblance were, however, accepted by naturalists as affording grounds for classification, and while some of these were highly natural, others were very artificial in their nature. Species which agreed together in their most essential characters were regarded as related together by affinity, but others, although bearing a general resemblance, might differ widely in their important organisms: this latter relationship, overlookéd by the earlier naturalists, or confounded by them with relations of affinity,* was first clearly pointed out by Mr. W. S. MacLeay, and in fact formed one of the principal key-stones of his system. Instances of this kind of resemblance were then pointed out:

1. Between members of the different kingdoms of nature: Ex. Byrrhus and a bit of earth; the larva of Geometra and a twig; Orchides and insects.
2. Between different classes of the same kingdom: Ex. Humming-bird and humming-bird moth; eel and snake.
3. Between different orders of the same class: Ex. Vespa and Ceria; Trochilium and Vespa; Eristalis and Apis; Tricondyla and Condylodera.
4. Between different sections of an order: Ex. Papilio and Urapteryx; Carabus and Adelium.
5. Between different families of a section: Ex. Papilio paradoxus and Danais; Leptalis and Heliconia.
6. Between different genera of a family: Ex. Species of various genera of Heliconiidæ.

From the latter instances, the Professor thought it was evident that the relation which had been termed mimetic resemblance was only an exaggerated analogy; and as these analogies (more or less complete) were found to occur throughout nature it might be assumed that they formed an element in creation, and hence that it would be unphilosophical and illogical to refer their occurrence in a more striking degree in any one instance to a special cause, although the analogy did certainly in many cases seem to be given to the creature for purposes of protection. In the MacLeayian and Swainsonian systems these analogies were considered as existing as tests of affinities, and without regarding or employing them in the sense adopted by the authors of those systems, it seemed to Prof. Westwood that it was necessary to take them into consideration in endeavouring to arrive at a correct view of the general "System of

* As where Ascalaphus, with its long-knobbed antenna, was described as a Papilio.

Nature." Applying the preceding observations to the mimicry exhibited by the various Pieridæ (chiefly of the genus Leptalis) of different species of Heliconiidæ described by Mr. Bates, Prof. Westwood contended that Mr. Bates's supposition that the imitation had been assumed by the former in order to enable them to subsist (the Heliconiidæ which possess a strong and disagreeable odour being found to be dominant in South America) was not tenable—

1. Because the mimicking species could barely be said to exist, much less to flourish, in the country where the Heliconiidæ abounded, "not one in a thousand" having been found by Mr. Bates.
2. Because there still occurred numerous species of white Pieridæ in the country of the Heliconiidæ in a flourishing condition.
3. Because there were vast numbers of other groups and species of butterflies in Brazil equally subject to attacks of birds with the Pieridæ, which had never attempted the assumption of forms of the dominant group, Heliconiidæ.
4. Because there were great numbers of instances of mimicry between the different Heliconiidæ themselves, which could not have the inducement to mimicry attributed to the Pieridæ.
5. Because there were species of Pieridæ (such as that to which Mr. Hewitson's monstrous individual belonged) of which only one sex mimicked the Heliconiidæ. It would require a wide stretch of imagination to suppose that natural selection could have led to the assumption of such mimicry by the individuals of only one of the sexes of a species.*
6. Because the theory assumed that the Heliconiidæ existed before the attempt at mimicry commenced on the part of the Pieridæ; whereas Mr. Bates' statement would lead to the inference that the Heliconiidæ were so unstable a group that the manufacture of species is still going on among them.
7. Because, according to the doctrine of chances, it was in the highest degree improbable that a casual variation of any given species of Pieridæ should by constant modification, assisted by hereditary descent, gradually assume the form, colour and markings of another species, especially of so remarkable a type as the Heliconiidæ. But for an entire group to be simultaneously engaged in such a process, each species tending towards distinct and equally peculiar species, would by a logician be pronounced impossible. The admission that the God of Nature created these species in their present mimetic condition for some wise but hidden purpose disposed of all difficulty.

Mr. Alfred R. Wallace followed, with an exposition of the theory of mimicry or adaptive resemblances as explaining anomalies of sexual variation. He began by pointing out what was meant by mimicry; when moths or beetles so closely resembled the bark of the trees they were accustomed to rest on that it was difficult to distinguish them, or when the curious Phasmidæ were undistinguishable from the sticks or leaves among which they lived, no one doubted that the resemblance was serviceable to the creature,—it was a protective adaptation. So with the moths of the genus Trochilium, which resembled stinging Hymenoptera, but were themselves helpless sluggish

* Papilio Cenea exhibts a double system of mimicry, the male resembling Danais Echeria and the female Danais Chrysippus!

creatures, the protection gained was no less clear; and this was termed mimicry, because one insect was, as it were, dressed to imitate another. Mr. Bates first showed how extensively this prevailed in nature, especially among the Lepidoptera, and argued that if the imitated forms had any special immunity from attack, the species of other groups which resembled them would to some extent be free from attack also, and would thus gain an advantage in the struggle for existence. He then shewed that the forms imitated always belonged to dominant groups, or those excessively abundant in species and individuals, and therefore presumptively free from the attacks of those insect-enemies that kept down the numbers and threatened the extinction of other species; and that in the case of the Danaidæ and Heliconiidæ (the groups most frequently imitated all over the world), the protection was probably the powerful odour they emitted. The theory of natural selection, or the preservation of useful variations, was shown to be fully capable of explaining these facts, and it bore the test of a true theory by also explaining other anomalies as they arose. A species of Diadema was then exhibited, in which the female was glossed with blue, while the male was dull brown, thus reversing the usual sexual characters of the genus; and it was observed that the male in insects was usually more active, the female more sluggish; the male gaily coloured, the female dull; and these facts were connected by the consideration that the female, having to carry a heavy load of ova, and to deposit them in places favourable for their development, required protection for a much longer period than the male, whose duty of fecundation was very speedily performed. Thus dull colours were useful to female insects, since it rendered them less conspicuous. It followed that any other kind of protection would be also more necessary for the female than for the male, and, to show that this really was so, a male specimen of the well-known leaf-insect (*Phyllium*, sp.) was exhibited, having none of that wonderful protective resemblance to a leaf which characterises the female. So in the well-known case of Diadema Bolina, the male was a richly-coloured blue, white, and black insect, while the female was orange-brown, quite differently marked, and resembled most minutely Danais Chrysippus, which had a range nearly coincident with it. It was suggested that the explanation of the anomalous insect which was the origin of these remarks was, that the female, by acquiring the metallic-blue gloss, was made closely to resemble the common Euplœa Midamus which inhabited the same localities; it thus gained an advantage in being mistaken for a species which insectivorous birds did not attack.

Mr. Bates was of opinion that the individual of Pieris Pyrrha described by Professor Westwood presented simply an instance of unequal hermaphroditism, three-fourths male and one-fourth female. As such it was a mere monstrosity, and had no bearing whatever on the question of the origin of species; the Darwinian theory dealt only with variations that were propagated, and not with monstrosities, the peculiarities of which were not transmitted to their descendants. With regard to those cases where the female sex of a species alone was found to mimic species of other families, the male remaining true to the normal type of its group, he thought it was absolutely necessary that an entomologist should have had opportunities of observing the habits of the species before drawing conclusions concerning them. In all such cases he had found that the females had a different mode of life from the males. In Pieris Pyrrha and other allied species the females were confined to the shades of the forest, where they flew near the ground, and were slow in their movements; whilst the males spent the hours of sunlight flying about open places, in company with the males of a great number of other butterflies; they resorted to the forest shades only towards evening or on cloudy days. The cause of the female of Pieris Pyrrha having been brought to resemble a Heliconid butterfly was the same as that which had drawn out the wonderful mimetic dress of the Leptalides; namely the protection which such resemblance afforded them against the persecutions of insectivorous animals. A more remarkable case than Pieris Pyrrha was that of Papilio Torquatus, a well-known Brazilian butterfly, of light yellow and black colours (in the male). Like the male of Pieris Pyrrha, Papilio Torquatus (male) spent his days in the open sunshine, whilst the female was confined to the shades of the forest, flying heavily and depositing her eggs one by one underneath the leaves of low trees. The female offered the most striking contrast in colours to the male, being black with white spots and crimson macular belt. It was significant that the dominant forms of Papiliones of the forest shades of tropical America had precisely that style of coloration; but the importance of the present case lay in this, that the female Torquatus presented local varieties in the various regions inhabited by the species, the male remaining unchanged, and the varieties were adapted in dress to the species of the dominant Æneas group peculiar to the localities. Thus on the Lower Amazons the form of the female was that which had been named P. Candius by Hübner, having a white spot on the fore wing, and a crimson belt on the hind wing, precisely as in the females of the common species inhabiting the same region, *e.g.* P. Æneas, P. Parsodes, P. Echelus, P. Ergeteles, &c. On the Upper Amazons, the female was very variable, but the commonest varieties resembled closely the females of the species of the Æneas group most prevalent there, namely, P. Lysander and P. Bolivar: the resemblance to the female Bolivar was most extraordinary, for in that species the crimson macular belt was replaced by yellow. Mr. Bates also made some remarks in answer to the objections which Professor Westwood had urged against the explanation of these imitative analogies on Darwinian principles. He said that the case of the Leptalides published by him could not, in his opinion, be explained in any other way. The species of Leptalis in question was found in several distant localities; in some of them it existed under one constant local form only, in others it was exceedingly variable, the common varieties showing a wonderful tendency towards a likeness to the predominant species of Ithomia of the respective localities. If the dress now worn by the Leptalis was given it at its creation, as Professor Westwood believed, how would he explain all these numerous shades of variety found in one and the same locality? To be consistent he must say that each variation was lineally descended from an originally created variety, which would be absurd, as so many species are known to offer numerous similar varieties in one and the same brood. As some of these varieties of Leptalis resembled species of Ithomia peculiar to the locality more than their sister varieties did, the conclusion was simple and natural, that, the imitation being a rule in all other localities, the process was there at work by which the close imitation was brought about. The less exact imitations were in course of time destroyed without bringing forth progeny, and then the state of things was identical with what was found in other localities, namely, one or more constant forms of Leptalis resembling closely their companion Ithomiæ.

Dr. Sharp remarked that whether the resemblances under discussion were purely accidental or not could be determined by a numerical investigation, by ascertaining what proportion the cases in which species resembling one another occurred in company bore to the cases in which species with a similar amount of resemblance occurred away from one another. He thought, however, that some of the cases of mimicry might be accounted for on other grounds than those supported by Messrs. Wallace and Bates, for if the Darwinian theory of a common descent were true, then the laws and principles of heredity could be applied to different species, as they have heretofore been to individuals. He proposed four classes, under each of which he believed some of these resemblances could be placed:—

1st. Resemblances purely accidental; for the doctrine of chances would show that if there were in the world a sufficient number of species resembling one another, a greater or less number of these would be sure to occur in company.

2nd. Resemblances the result of descent from a common parent; for it being understood that a certain character would be transmitted from parent to offspring through an indefinite number of generations, unless circumstances tending to alter it were brought to bear on that character, it could readily be perceived that some species of Lepidoptera might resemble one another in coloration, by reason of the resemblance of each to a common parent similarly coloured.

3rd. Resemblances the result of exposure to similar circumstances; for undoubtedly, if the Darwinian theory were true, the coloration of species of Lepidoptera must be referred sooner or later to external causes operating on the organism. But the cases where mimicry occurred were cases in which the species, being constantly found together, were necessarily to a very great extent subjected to the same external conditions. Thus in a certain locality a species of Leptalis was found closely resembling a species of Heliconia, and in another locality a second and allied species of Heliconia was found. Mr. Wallace would say that this Heliconia differed from the first Heliconia because of the changed circumstances to which it was exposed: but with this second species of Heliconia was found a second species of Leptalis, differing from the first species of Leptalis in nearly the same manner as the second species of Heliconia differed from the first, and this was easily comprehensible, its companionship with the Heliconia having exposed it to exactly the same disturbing influences.

4th. This class was that to which Messrs. Bates and Wallace referred all these resemblances, and it was the only one that could correctly be spoken of as mimicry; the colour of the Heliconia, without any reference to common descent or to the operation of similar external agencies, being the determining cause of the colour of the Leptalis.

Paper read.

Messrs. Crotch and Sharp read a joint paper entitled 'Additions to the Catalogue of British Coleoptera, with Descriptions of New Species." The additions were no less than seventy-one in number, the whole of which were exhibited; of these sixty had been described by continental authors, and eleven, belonging to the genera Ptilium, Atomaria, Telephorus, Sitones, Anthicus, Gyrophæna, Philonthus, Lathrobium and Stenus, were characterized as new to Science.

December 3, 1866.

Sir John Lubbock, Bart., President, in the chair.

Additions to the Library.

The following donations were announced, and thanks voted to the donors:—'Mémoires de la Société Linnéenne de Normandie,' Vol. xiii. and xiv.; 'Bulletin de la Société Linnéenne de Normandie,' Vol. x.; presented by the Society. 'Etudes Hymenopterologiques,' par J. Sichel; by the Author. 'Memoir of the late Stephen Stone, Esq., F.S.A., &c., of Brighthampton, Oxon;' by Prof. Westwood. 'The Zoologist' for December; by the Editor. 'The Entomologist's Monthly Magazine' for December; by the Editors.

The following additions by purchase were also announced:—'Zoological Record,' Vols. i. and ii. 'British Beetles,' by E. C. Rye. 'British Bees,' by W. E. Shuckard.

Election of Members.

E. T. Higgins, Esq., of 24, Bloomsbury Street, and Andrew Swanzy, Esq., of 122, Cannon Street, were elected Members; H. L. Schrader, Esq., of Shanghai, a Foreign Member; and F. Lovell Keays, Esq., of 4, Harringay Villas, N., and Walter Thornborrow, Esq., of 4, Provost Road, N.W., Annual Subscribers.

Exhibitions, &c.

Mr. Stainton exhibited living specimens of Gracilaria scalariella, bred from larvæ mining in the leaves of Echium vulgare at Cannes, which he had received a fortnight ago from M. Millière.

Mr. Stainton also exhibited a flat pouch-like gall formed on the leaves of Pistacia lentiscus, apparently by Aphides, but which was inhabited by a Phycideous larva. This he had received from Mr. J. T. Moggridge, who met with it at Mentone.

Mr. Janson exhibited a collection of insects, chiefly Coleoptera, made by Mr. W. Hume in the neighbourhood of Rio de Janeiro.

Mr. W. F. Evans sent for exhibition a number of insects found in wool imported from New Zealand, accompanied by the following note:—

"Some time ago I brought under the notice of the Society the circumstance of the large number of Pyronota festiva found in wool imported from New Zealand. Since then I have requested my friend to continue sending me every insect which might be found in the fleeces from that locality, and now beg to exhibit the various insects, larvæ, animals, a seed and a shell, &c., &c., which have been thus found. The Pyronota seems to be in the greatest profusion, and the specimens vary very much in colour."

Mr. Duer (who was present as a visitor) exhibited a pupa of Vanessa, having some extraordinary projections from both wing-cases.

Dr. Sharp exhibited specimens of Stenus major, *Mulsant*, taken at Southend: this insect was new to our Fauna, and was hitherto known only as a native of the South of France.

Prof. Westwood mentioned that the late Mr. Stephen Stone, of Brighthampton, had bequeathed his valuable collection of wasps' nests and other natural objects to the Oxford Museum.

Prof. Westwood read the following letter from Mr. Edward Holdsworth, dated Shanghai, July 20, 1866:—

"I trust you will pardon my taking this liberty, but my excuse is this,—reading your revised edition of Dru Drury's 'Exotic Entomology,' the other day, I noticed you remarked that no authenticated description of Actias Luna had been sent to you: as I have reared several specimens this summer I am able to give you a correct description of this larva. As soon as hatched the worm is reddish brown, with two black bands round its body and several black spots: after the first change it is reddish brown, with fleshy points all over its side and back, each point surmounted with a black spot and one thin white hair. In two or three days the larva changes to a yellowish red colour, a sign that it is about to pass to its second skin: after this change it appears of a light yellowish green colour, the fleshy points (mentioned before) are yellow, and each is surmounted with one brownish hair. On the head are four large fleshy points, which are each surrounded by a black ring, below the extreme tip, which is yellow. After the next change the four major spots on the head and the one at the end of the back are now very large, and have seven short hairs or bristles sticking out at the ends. This is the last change, and the larva is now about two and a half or three inches in length, and fully one inch in diameter. It is fairly common in the neighbourhood of Shanghai, and always found feeding on privet. Those I reared I fed with willow, and they thrived very well on it. It spins a very large cocoon, fully two and a half inches long, but with too much gum about it to allow the silk to be made use of. The caterpillar has down its back two straight lines or ridges of fleshy lumps, which terminate with a single lump placed over the joint of the last leg and in the centre of the back: along each side and just above the legs is a yellowish line, running the length of the body and terminating at the fleshy lump placed on the side of the last leg. The vent and outsides of the two last legs (right and left) are of a very deep plum-colour. In this change the black rings on the four major fleshy lumps on the head almost fade away, and the caterpillar is well covered all over with thin hairs about one-eighth of an inch long: at the base of each leg is a yellow spot, and over the mouth are four spots or fleshy lumps forming a crescent. Now comes the fourth change, and the larva is now about two inches long: the fleshy lumps on the back and sides have changed to reddish yellow, with a black ring on the top of each lump and four black short hairs also: on each side of the light-coloured line on the side of the larva are little reddish yellow spots, and on the line at the base of each leg are diamond-shaped marks, the inside yellow and the outer mark dark red: the legs and under part of the body are of a beautiful dark green, the sides a lighter green, and the back much lighter still and covered with white hairs; the legs are covered with black hair, and all the fleshy lumps with four or five black bristles.

"There can be no mistake about the larva I have described, for those I have reared have now come out of their cocoons, and the moth is a white-green, with one spot on each wing, two under-wings swallow-tailed; a pink or rather reddish pink line borders the top of the upper wings and crosses the head; the body covered with white down."

Prof. Westwood added that Mr. Holdsworth had mistaken the Asiatic Actias Selene for the North American A. Luna: the larva of the Indian species was figured in the fifth volume of the Society's 'Transactions' (pl. v.), from a drawing by Captain Hutton: it was desirable to see the perfect insect, as there appeared to be several local races of it.

Prof. Westwood exhibited a series of specimens of Liparis dispar, reared from the egg-state by Mr. Briggs, of St. John's College, Oxford, illustrating not only a remarkable variation, according to the nature of the food of the larvæ, but also showing a strong tendency to degeneration. The progenitors of these specimens, two or three generations back, had been obtained wild in Yorkshire, and were of moderate size (not so large, however, as the specimens formerly taken in such quantities at Whittlesea Mere). The eggs were received in October, 1865, and the caterpillars hatched during the first half of the following May. The caterpillars were divided into two groups, those composing one of which were fed exclusively on elm, and the others exclusively on whitethorn. The caterpillars spun up between the 5th and 18th of July. No perceptible variation was observed in the larvæ, cocoons, or pupæ of the two divisions. The males in both divisions began to hatch on the 18th of July, but the females did not appear until half the males were already hatched. Almost all the males in both divisions were fully developed, only two cripples appearing out of the thirty-two fed upon elm. The males fed on elm averaged one inch and five-twelfths in the expansion of their fore wings: they were uniformly coloured, much darker and richer than the males fed on the whitethorn, the dark markings on the fore wings were strongly defined, the ground colour of these wings was also darker; the hind wings were reddish brown. The males fed on the hawthorn were considerably smaller, averaging only one inch and two-twelfths in expanse; the ground colour of all their wings was paler and grayer than in the others, but the markings of the fore wings were generally well defined. A few of the males in each division were considerably smaller than the specimens exhibited. In the elm-fed females fourteen out of sixteen were crippled, with their wings not properly developed, and even the other two were slightly crippled: they were not so large as those of the hawthorn-fed larvæ. Having been impregnated by the males, none of these females deposited eggs, although they pulled off the down from their tails and fixed it in tufts in the box, after the manner adopted by ordinary females of this species in the act of oviposition. Of the white-thorn-fed females less than one half were crippled, and these were not generally so much crippled as the elm-fed females. This experiment seemed to prove that had the species depended solely on the existence of the elm-fed individuals it would have become extinct; whilst the smaller size of the males of the hawthorn-fed group showed that even amongst them (the females of which were so much better developed than the elm-fed ones) the principle of degeneration had set in, and that it would have been very improbable that a distinct phytophagic race or sub-species would have been effectually produced.

Mr. M'Lachlan remarked that Liparis dispar was scarcely a fair subject on which to experimentalize and theorize, inasmuch as it now existed in this country only in a semi-domesticated state.

Mr. Bates, referring to the discussion which had taken place at the previous Meeting (*ante*, p. xl.) respecting mimetic resemblances, introduced Mr. T. Belt, the gentleman who had favoured him with many of the facts, as to the aversion of insectivorous birds to the Heliconiidæ, which were referred to on the former occasion, and in Mr. Bates' paper in the Linnean Transactions.

Mr. T. Belt gave a detailed narration of his observations on this subject, and stated that not only were the perfect insects of Heliconia protected by their unpleasant odour, but that the larvæ also were rejected by fowls.

Mr. Stainton remarked that a curious instance of the dislike which birds seemed to have for certain insects had come under his observation some eighteen years previously. When he was attracting moths by light, he had often such numerous attendances that he had frequently captured fifty Noctuæ, or more, in a quarter of an hour; whatever came must be caught, or it was in the way, and, in order to ascertain most readily whether there was anything of value, Mr. Stainton adopted the plan of smothering the whole lot with the fumes of sulphur. When the operation had been performed, more than nine-tenths of the dead insects would probably be Agrotis exclamationis. He thus had a vast store of useless dead moths, which he disposed of by giving them to the poultry, the young turkeys particularly enjoying them in spite of their flavour of sulphur. On one occasion, amongst a number of A. exclamationis, there was one specimen of Spilosoma Menthastri, and though not one of the young turkeys rejected a single A. exclamationis, they each in succession took up the S. Menthastri and put it down again, and it was left, conspicuous as it was, on the ground. This insect, it was well known, had a peculiarly disagreeable odour.

Mr. J. J. Weir had frequently noticed that cage-birds refused the larvæ both of Spilosoma Menthastri and S. lubricipeda.

Prof. Westwood stated that a fluid of very disagreeable odour was emitted by those insects from behind the collar; this was probably similar to that ejected by many of the Chrysomelidæ. He inquired whether anything of the kind had been observed in the Heliconiidæ.

Mr. Bates said that one group of Heliconiidæ was furnished at the apex of the abdomen with a process from which, when the abdomen was pressed, a very disagreeable odour was exhaled; but he had never seen any fluid ejected.

Mr. McLachlan remarked, as bearing upon the theory of Natural Selection, that having recently been engaged in an examination of the British Psocidæ, in which family the generic or sectional characters were principally grounded on the neuration, he had found occasional instances of aberration in the arrangement of the veins: these aberrations consisted in one wing of an insect which belonged to a particular genus or section assuming, entirely or partially, the neural characters of another genus or section; in no case, among several hundred examples, did he find neural variation which was strictly abnormal.

Dr. Sharp offered some criticisms on the theory advanced by Messrs. Bates and Wallace, and argued —

1st. That natural selection was a power of differentiation, and, although it was quite possible that a differentiating power might work so as to produce resemblances, it was at first sight improbable that it should do so; and more evidence was required of the truth of a paradox than of a truism.

2nd. It must be shown that animals possessing the so-called mimetic resemblances occurred far more frequently in company with one another than away from one another. But if this were shown, a single case of such resemblance between animals living in different localities would throw doubt on the theory, by suggesting that there was probably some more comprehensive law which would account for *all* those resemblances.

3rd. It must be shown that the cause of the rarity of the Leptalis was one acting on the insect entirely or chiefly while it was in the perfect state; this had not been done, and it was improbable that it could be; for the most critical periods in the life of Lepidoptera, as regarded their enemies, were the larval and pupal states.

4th. It must be shown that the enemy (whatever it might be) which attacked the Leptalis sought its prey principally by the sense of sight; but this suggested another improbability. If the Heliconia, which the Leptalis resembled, was protected by its nasty odour, surely the bird or other enemy of the Leptalis must be very foolish to let *it* escape when it smelt nice, because it *looked* like the Heliconia. The purpose of protection would have been better accomplished by the Leptalis mimicking the Heliconia in that point by which the Heliconia was protected.

5th. A forcible objection to the mimicry theory (as already pointed out by Prof. Westwood) was the rarity of the mimicking species. The theory involved the hypothesis that there was a time when the Leptalis differed in pattern from the Heliconia; was the Heliconia then commoner than now, or as rare? If commoner, it was curious that, when not protected, it flourished better than now, when protected. If as rare, how could it have survived at all before and during its transmutation? It would, perhaps, be suggested that the Leptalis was formerly commoner than now, and that some enemy arose, rendering it necessary that the Leptalis should find a new means of defence. This, however, was mere supposition, and it was almost impossible to adduce facts to prove it; but supposing it to be the case, why did not the enemy exterminate the Leptalis when it did not resemble the Heliconia, as (according to the theory) it would now, but for this resemblance. The further supposition must be made, that the enemy was not at first very dangerous to the Leptalis, and that in proportion as it grew dangerous, the Leptalis grew more and more to resemble the Heliconia: it was certainly very fortunate for the Leptalis that spontaneous variations, bringing it to resemble the Heliconia, should occur in the exact proportion required for its safety.

6th. Again, taking the time when the Leptalis differed in pattern from the Heliconia, it was said that specimens exhibiting small variations approximating to the Heliconia were selected for the preservation of the species. But a small variation in marking would be of no practical service to the Leptalis, especially as it was by its nasty *odour* that the Heliconia was protected; to which it might be added that on the theory of Natural Selection no reason or fact was brought forward to induce the belief that variations of the required sort should occur at all.

In conclusion, whilst admitting the impossibility that such a theory as that of mimetic resemblances could ever be shown by facts to be correct at all points, Dr. Sharp was of opinion that the evidence as yet adduced was insufficient to convince an unprejudiced observer. The most that could at present be said of the theory was, that it was very ingenious, and might or might not be true.

Mr. Wallace, in replying to Dr. Sharp, remarked that it was very easy to make objections to any theory, and many of those advanced were of such a general nature that it would require the whole subject to be again fully gone into to answer them in detail. The first objection was one of those vague and general statements which was really no objection at all; it was said that natural selection, being a power of *differentiation*, was therefore not likely to produce *similarity!* But natural selection was more than a power of differentiation; it was the preservation and accumulation of *useful variations;* and the moment it became useful to one creature to resemble another, all variations which tended to make it so would be preserved, and would accumulate till an outward similarity was produced. In answer to the second objection, Mr. Wallace admitted that it must be shown that pairs of mimetic insects occurred together more frequently than apart, and maintained that this had been shown: he denied that a single case of mimicry by insects of different countries would discredit the general explanation; since in *one case* the resemblance might easily be accidental, or recent changes of distribution might have parted creatures that once lived together. But, however this might be, even one case of mimicry among insects from distinct countries (as complete and striking as many of those adduced by Mr. Bates and the speaker) had not yet been produced by the opponents of the theory. Dr. Sharp, as a third objection, required proof that the scarcity of Leptalis was owing to persecution in the perfect state, not in the larval or pupal conditions; probably Dr. Sharp could not give such proof in the case of a scarce British insect which he had studied for years, and it was quite immaterial to the question. The Leptalides alone of all Pieridæ were universally scarce in individuals, and almost all the Leptalides, and they alone, mimic Heliconiæ. As to requiring proof that birds seek their prey by the sense of sight, it was so generally admitted that insectivorous birds captured their prey by sight, that if Dr. Sharp denied it he should rather prove that they do not. In the next place, it was asked, "Was the Leptalis, before it resembled the Heliconia, abundant or rare? If abundant, then it was better off without protection than with it. If rare, how did it survive at all before and during transformation?" The reply was, that before the Leptalides began to mimic the Heliconiæ they were more abundant than now, and like nations and individuals, they were better off when they did not require protection, than now when they cannot exist without it. The Leptalides were not now the same insects they were then, and their conditions of existence had also materially changed since that remote epoch. Lastly, it was said that as the Heliconiæ were protected by their disagreeable odour, a superficial resemblance to the Heliconiæ could not be at first a sufficient motive power to change the species of the Leptalides. Mr. Wallace thought, on the contrary, that it would, because it was self-evident that under all circumstances "the fittest must survive," and any variation which caused but a small percentage of individuals to escape destruction would to that extent benefit that variety, and might, when the species was struggling for existence, cause that variety alone to survive. To deny this would be to deny that insectivorous birds could ever be deceived by slight resemblances, although it was well known that very rude resemblances sometimes deceived animals and even men. Mr. Wallace thought, therefore, that the theory of the "survival of the fittest" (or natural selection) did offer an explanation of almost every fact connected with mimicking insects, and that the objections that had been made to it were of a vague nature, and such as could be made against any theory whatever that attempted to explain the phenomena of organic life. Our knowledge of the present life-history of insects was exceedingly imperfect, and how many questions might be asked concerning them that no one could answer. In the long life-history of species how much more must ever remain unknown; yet because our knowledge was thus incomplete we should be the more thankful for such a theory as that of Mr. Darwin, which supplies a real cause of modification of species, and enables us to correlate so many of the most curious phenomena of organic existences, and to comprehend the series of actions and reactions by which they have most probably been brought about.

Prof. Westwood reiterated, with further illustrations, some of the objections to the theory stated by him at the previous Meeting, and the discussion was brought to a close by a few remarks from the President.

Paper read.

Mr. M'Lachlan read a paper entitled "A new Genus of Hemerobidæ, and a new Genus of Perlidæ." The former was described under the name of Rapisma, and the type was the Hemerobius viridipennis of Walker; the latter under the name of Stenoperla, and the type was the Chloroperla prasina of Newman.

January 7, 1867.

Sir John Lubbock, Bart., President, in the chair.

Additions to the Library.

The following donations were announced, and thanks voted to the donors:—'Mémoires de la Société de Physique et d'Histoire Naturelle de Genève,' Vol. xviii. pt. 2; presented by the Society. 'Exotic Butterflies,' Part 61; by W. W. Saunders, Esq. 'Notes on the Zygænidæ of Cuba,' by Augustus Radcliffe Grote; by the Author. 'Lepidopterological Contributions,' by Aug. R. Grote and Coleman T. Robinson; by the Authors. 'Note on the Japan Silkworm,' by Captain Thomas Hutton; by the Author. 'De Tunnelgravende Biller Bledius, Heterocerus, Dyschirius og deres Danske Arter,' 'Danmarks Cerambyces,' 'Danmarks Buprestes og Elateres,' 'Krebsdyrenes Sugemund, I. Cymothoæ,' 'Phthiriasis og Mundens Bygning hos Pediculus,' by J. C. Schiödte; by the Author. 'Danmarks Geophiler,' by Bergsöe and Meinert; by the Authors. 'Om Slaegten Stalita,' by the Editor of 'Naturhistorisk Tidsskrift.' 'The Entomologist's Annual;' by H. T. Stainton, Esq. 'The Zoologist' for January; by the Editor. 'The Entomologist's Monthly Magazine' for January; by the Editors.

The following addition by purchase was also announced:—Bericht über die Wissenschaftlichen Leistungen im Gebiete der Entomologie während der Jahre 1863 und 1864,' von Dr. A. Gerstaecker; Erste Hälfte.

Election of Subscriber.

Samuel Alfred Davis, Esq., of 4, Durham-place West, Holloway, was ballotted for, and elected an Annual Subscriber.

Exhibitions, &c.

Prof. Westwood exhibited a number of butterflies, chiefly Heliconiidæ, collected by Dr. Burchell in Central South America, and observed that the Burchell collection was peculiarly interesting, from the fact that each specimen bore a ticket giving the date (sometimes even the hour of the day) and the precise locality of capture, so that the range of particular forms could be traced, and the limits thereof fixed with accuracy.

Mr. M'Lachlan asked the reason why humming-bird hawk-moths (*Macroglossa stellatarum*) chased up and down stone walls, banks, or cliffs, but particularly stone walls near the sea; dozens of specimens might frequently be seen so doing, and in positions far removed from any flowers. Mr. A. E. Eaton suggested that the habit might result from the extra heat afforded by the walls. And Mr. F. Smith mentioned that he had had sent to him from the Isle of Wight some clay nests extracted from a wall, which eventually produced hymenopterous insects, but which were said by the sender to be formed by the humming-bird-hawk; it seemed probable that his correspondent had noticed the moths performing in the manner described by Mr. M'Lachlan in the neighbourhood of the nests, and had thence erroneously inferred that the nests were the workmanship of the moths.

Mr. A. E. Eaton mentioned that he had, during the past season, found near Lyndhurst a hornet's nest in a very unusual situation, namely, in a bank composed of sandy soil where no wood was near. The colony was a strong one, and the nest so deeply imbedded in the bank that he had been unable to take it.

Mr. M'Lachlan said that, since the previous Meeting, at which he had stated that Liparis dispar existed in this country only in a semi-domesticated state (*ante*, p. xliv.), he had written to Mr. Doubleday on the subject, and that gentleman replied as follows:—"I do not know of any locality in Britain where it occurs in a state of nature, and I am strongly of opinion that it has only been found in the fens round Yaxley; when I was there in 1839 the larvæ swarmed on the gale and dwarf sallows. English was there in 1846, and he found the larvæ pretty common, but not so abundant as they were in 1839. Haworth simply says, 'In salicetis, rarissime.' I believe all the specimens which were placed in the old collections were continental, or reared from eggs brought from the Continent, as they were very different from the fen specimens, and just like those found in France; and I think most of those now bred in this country are of continental origin. I once collected a great quantity of the pupæ in Paris, and brought them home to Epping. The following spring I turned out thousands of larvæ, but they did not establish themselves, although I saw plenty of the moths in one field in August. In 1846 I obtained an immense quantity of eggs from moths bred from larvæ brought from Yaxley. Next spring great numbers of larvæ were turned out on the dwarf sallows growing among the gravel-pits in the Forest. A few larvæ were seen the following year, but not afterwards. It is very strange that a moth which frequents towns and suburban gardens on the Continent should be found in such a very different locality here. In France the larvæ appeared to feed principally on the elm."

Prof. Westwood repeated that Mr. Briggs' specimens (*ante*, p. xliv.) were the descendants, only three or four generations removed, of ancestors which were captured in a state of freedom.

Captain T. Hutton, of Mussooree, communicated a "Note on the Japan Silkworm," in which he expressed his opinion that the Japanese mulberry-feeding form yielding green cocoons is nothing more than a hybrid between a sickly and degenerate race of Bombyx Mori and the little monthly-worm, B. Sinensis, and repeated his conviction that, for the purpose of renewing the European stock, experienced entomologists should be deputed to visit different parts of China, with a view to the re-discovery of the silkworm in its natural state of freedom.

Papers read.

The following papers were read: " Choreutidæ and Crambina collected in Egypt in 1864, and Crambina, Pterophorina, and Alucitina collected in Palestine in 1865, by the Rev. O. Pickard-Cambridge; determined and the new species described, by Professor Zeller; the German descriptions translated into English by H. T. Stainton;" and " A Monograph of the genus Hestia, and descriptions of forms not hitherto noticed; with a tabular view of the Danaidæ and remarks on their natural affinities. By A. G. Butler, F.Z.S., Assistant in the Zoological Department of the British Museum."

New Part of 'Transactions.'

Part 4 of Vol. v. of the "Transactions" (third series), published in December, 1866, and being the fifth Part issued during that year, was on the table.

ANNUAL GENERAL MEETING,

January 28, 1867.

Sir John Lubbock, Bart., President, in the chair.

The President announced that one of the Prizes offered by the Council for Essays on Economic Entomology had been awarded to Dr. Wallace, of Colchester, for an Essay on the Oak-feeding Silkworm from Japan.

An Abstract of the Treasurer's Accounts for 1866 was read by Dr. Sharp, one of the Auditors, and showed a balance in favour of the Society of £79 15*s.* 1*d.*

The Secretary read the following:—

Report of the Council for 1866.

In accordance with the Bye-Laws the Council begs to present the following Report:—

Perhaps the most important event in the history of the Society during the past year has been the removal of our Meetings to Burlington House. Other scientific bodies were desirous of obtaining like privileges to those granted to us by the Linnean Society, but the Council was fortunately able to make arrangements compatible with the retention of our usual day of meeting, the first Monday of the month. It is hoped that the inconvenience necessarily caused by any change of locality to some of our Members will be compensated by greater convenience to others; the unquestionable superiority of the present over our late gathering place, and the diminution of our rental in Bedford Row, are material advantages gained; the Society has returned to the locality in which it flourished during the first eighteen or nineteen years of its existence; and additional *prestige* will attach to us as a body from assembling within these walls, the scientific centre of London.

France and Sweden have filled the places in our Honorary List vacated by France and Germany: Guérin-Méneville and Boheman are the chosen successors of Dufour and Schaum. During the year 1866 one Member died, another resigned; of Ordinary Members and Subscribers twenty-four have been elected; and the muster-roll of the Society contains the hitherto unequalled number of 207 contributors.

The Library grows apace; the stream of donations flows continuously, and considerable additions have been made by purchase.

The publications of the year extend to 450 octavo pages, illustrated by thirteen plates; and the sum derived from the sale of the 'Transactions' exceeds that of any recent year. The Council regrets the non-appearance of a second instalment of Mr. Baly's "Phytophaga Malayana;" further delay on the part of the author must necessarily lead to the abandonment of the scheme by which a separate volume of the 'Transactions' was devoted exclusively to that subject.

The financial operations of the year may be exhibited in the following classified form:—

Receipts.	£	Payments.	£
From Members	232	Publications	196
Sale of 'Transactions'	87	Library	37
Interest on Consols	3	Prize Essay	5
Donations	16	General Management	100
	£338		£338

The actual income has exceeded the actual outgoing by 3*s*. 3*d*.; and a comparison of the pecuniary position of the Society now and last year gives the following result:—

	Jan. 1, 1866.			Jan. 1, 1867.		
Cash in hand	£11	14	10	£11	18	1
£109 14*s*. 9*d*. Consols (say)	100	0	0	100	0	0
	111	14	10	111	18	1
Liabilities	56	5	0	50	0	0
Balance	£55	9	10	£61	18	1

In conclusion, the Council ventures to submit that the increased number of Members, the sustained interest of the Meetings, the growth of the Library, the scientific value of the publications, the undiminished funds, and the lessened liabilities, are indicative of an administration characterized alike by activity and prudence.

January 28, 1867.

The following gentlemen were elected to form the Council for 1867, namely:—Messrs. Bates, Dunning, Sir John Lubbock, M'Lachlan, Moore, G. S. Saunders, Dr. Sharp, A. F. Sheppard, Frederick Smith, Stainton, S. Stevens, Weir, and Prof. Westwood.

The following officers for 1867 were afterwards elected, namely:—President, Sir John Lubbock, Bart.; Treasurer, Mr. S. Stevens; Secretaries, Mr. Dunning and Dr. Sharp; and Librarian, Mr. Janson.

The President read the following Address:—

THE PRESIDENT'S ADDRESS.

GENTLEMEN,—

The Reports made annually to the Society by the Council relieve the President from the duty of addressing you on our internal affairs, our progress in the past year, or our prospects for the future; leaving him, therefore, the more free to bring before you the state of our Science itself, the principal observations which have been recorded, the most important works which have been published, and the most interesting discoveries which have been made during the past year.

So rapid, however, is the progress of Entomological Science, that it would be impossible for your President, even if he had the requisite knowledge—which I have not—to give you within the limits of an Address anything like an exhaustive *resumé* of the entomological literature for the past year. This is the less to be regretted because the reports of Pr. Gerstäcker and Mr. Dallas, in Wiegmann's 'Archiv' and the 'Zoological Record,' leave little to be desired in this respect, and we owe those two gentlemen much gratitude for the admirable and careful manner in which their reports are worked out.

The prize offered by the Council for the best Essay on the anatomy, economy, or habits of any insect, or group of insects, especially serviceable or obnoxious to mankind, has been again awarded to Dr. Wallace, whom I have to congratulate on having carried off the prize in two successive years. His memoir on Ailanthiculture, to which the prize was awarded last year, forms the second Part of the fifth Volume of our 'Transactions.' The other Parts published during the year 1866 have been no less than four in number, and contain the following papers:—

1. Characters of a new Genus and Species of Chalcidites. By Mr. F. Walker.

2. Remarks on Capt. Hutton's paper "On the Reversion and Restoration of the Silkworm." By Capt. J. Mitchell.

3. On the British Species of Agathidium. By Mr. D. Sharp.

4. Observations on some remarkable Varieties of Sterrha sacraria, with General Notes on Variation in Lepidoptera. By Mr. M'Lachlan.

5. Description of Papilio Godeffroyi. By Mr. G. Semper.

6. New Genera and Species of Gallerucidæ. By Mr. Baly.

7. Descriptions of new Hesperidæ. By Mr. Hewitson.

8. Longicornia Malayana, Part 3. By Mr. Pascoe.

9. Descriptions of new or little known Genera and Species of Exotic Trichoptera; with Observations on certain Species described by Mr. Walker. By Mr. M'Lachlan.

10. List of the Longicornia collected by the late Mr. P. Bouchard, at Santa Marta. By Mr. Pascoe.

11. Catalogue of Buprestidæ collected by the late M. Mouhot, in Siam, &c., with Descriptions of new Species. By Mr. Edward Saunders.

11. Notes on some Hymenopterous Insects collected by Mr. Peckolt at Catagallo, South Brazil. By Mr. Frederick Smith.

12. Notes on the Butterflies of Mauritius. By Mr. Trimen.

13. New Genera and Species of Psocidæ. By Mr. M'Lachlan.

The various objects, moreover, exhibited at our Meetings, and the observations to which they have given rise—which, thanks to our very excellent Secretary, Mr. Dunning, are carefully reported in our 'Proceedings'—have been both numerous and interesting. I trust, however, that I shall not be exceeding my duties as President, if I point out that the attention of our Members seems to be almost exclusively devoted to Systematic Entomology, and I cannot help wishing that we more frequently received communications relating to the anatomical and physiological departments of our Science.

Nevertheless our Members have been anything but idle during the past year, and our own publications can by no means be taken as a measure of their activity, for the 'Proceedings of the Zoological Society,' the 'Zoologist,' the 'Entomologist,' the 'Entomologist's Monthly Magazine,' and Mr. Stainton's 'Entomologist's Annual' contain many papers contributed by Members of our Society.

With the exception of a paper of my own, to which our late President referred in terms too complimentary on the occasion of his last Annual Address, the Number of the Linnean 'Transactions' for 1866 contains no entomological matter. The 'Proceedings' are, on the contrary, enriched as usual by numerous contributions, principally from Members of our Society. These comprise Mr. Smith's descriptions of Hymenopterous insects collected by Mr. Wallace in New Guinea, Sumatra, Sula, Gilolo and Salwatty; Mr. Walker's descriptions of Diptera from New Guinea, Salwatty and other Islands of the Eastern Archipelago; Mr. Hewitson's list of the Diurnal Lepidoptera collected by Mr. Wallace in the same Archipelago; Mr. Butler's list of Diurnal Lepidoptera collected by Mr. Whitely in North Japan; and Mr. Pascoe's memoir on the Australian Longicorns. Mr. Blackwall also communicates a short paper on the means by which insects move on dry, polished, vertical surfaces, and brings forward additional arguments in favour of his opinion that this is effected, not by the creation of a vacuum, but by means of an adhesive fluid emitted from the under surface of the feet. Dr. Kirk has a paper on the Tsetse; and Mr. Haliday a short notice of Dicellura, a remarkable genus allied to Prof. Westwood's curious Campodea.

In the 'Quarterly Journal of Microscopical Science' the late Mr. R. Beck, whose death is deplored by all lovers of Science, announced that he had observed a case of agamic reproduction, extending over three generations, in an Acarus belonging apparently to the genus Cheyletus. This is the first time that agamogenesis has been observed in the Arachnida. Mr. Tuffen West has, in the same excellent periodical, two short notices, one on the egg of Scatophaga, and the other on the cast-skin of an Ephemeron. They are illustrated by one of those beautiful plates for which Mr. West is so justly celebrated.

Mr. A. S. Packard has communicated to the Boston Natural History Society an interesting memoir "On the Development and Position of the Hymenoptera." His observations were made on a species of Bombus, and he shows that there are three changes "of skin during the so-called pupa state, in distinction from the larva and imago state, and it is highly probable that there are more. During the larval condition it would be safe to say that there are four distinct moultings. . . . . The genus Bombus, therefore, may be considered to undergo a series of at least ten moultings of the skin, and we are inclined to think further observations will tend to increase the number." Mr. Packard's observations certainly show that the transitions from the larva to the pupa on the one hand,

and from the pupa to the imago on the other, are more gradual than most entomologists would have been inclined to suppose. There is, he concludes, "no pause in the metamorphosis for a special biological design, such as obtains in the Lepidoptera and majority of the lower insects. The terms larva, pupa and imago are not therefore absolute terms." I need hardly say that even to the Lepidoptera the same observations might, in my opinion, be applied.

Mr. Packard is perfectly satisfied that Audouin, Latreille and Newman were correct in believing that the terminal portion of the so-called thorax in Hymenoptera is in reality abdominal. During this stage, he says, "the basal ring of the abdomen is plainly seen to be transferred from the abdomen to the thorax."

M. Balbiani, already so well known for his researches among the Infusoria, has communicated to the 'Comptes Rendus' a very remarkable memoir on the generation of the Aphis. If we consider that almost every one who has studied the anatomy of the Invertebrata must have had his attention particularly directed to the very interesting phenomena presented by the agamic reproduction prevalent in this family, and if we remember the numerous memoirs on the subject by Bonnet, Réaumur, Degeer, Kyber, Duvau, Morren, Steenstrup, Leydig, Leuckart, Owen, Huxley, and many others, we might well have thought that this problem if any in Natural History had been thoroughly exhausted.

Nevertheless, in opposition to the now almost unanimous opinion that the production of young by the viviparous females is a case of parthenogenesis, M. Balbiani comes forward and asserts that the viviparous specimens are hermaphrodites after all.

As regards the first stages in the formation of the egg, up to the appearance of the blastoderm, he agrees in the main with other observers.

Commencing with the viviparous individuals, he has satisfied himself that the whole inner surface of the blastoderm is lined with a delicate membrane, which extends like an envelope round the central vitelline mass. This membrane, with a portion of its contents, bursts through the posterior part of the blastoderm, and protrudes in the form of a hernia. This portion by degrees detaches itself from that remaining in the vitelline vesicle, and engrafts itself to the epithelial cells lining the ovarian chamber. The vitelline vesicle then separates into two secondary vesicles. These two vesicles or cells are the rudiments of the future male and female generative organs. Each of them becomes gradually covered by a generation of small cells, which, when once produced, continue to increase in size, and multiply on their own account. The group produced by the herniated vesicle engrafted on the epithelium represents the male element, and *gives origin to the fecundating corpuscles;* that which originates from the free vesicle remaining within the blastoderm produces the future female generative organs. The generative vesicle of the male mass increases its size, attaches itself to the female generative apparatus, and becomes the reservoir for the fecundating corpuscles. That of the female group, on the contrary, gradually disappears.

The colouring of the two groups is also very different. The female elements remain colourless, while the males cells are either yellow or green.

The contents of these cells become converted into a number of small daughter-cells, furnished with a membrane and a nucleus. These daughter-cells are after awhile replaced by innumerable small dark corpuscles, much resembling minute Amœbæ, but their form does not change. The large mother-cells lose their colour and transparency, *and break up into a sort of powder.* In many cases the Amœboid corpuscles undergo a further evolution into "small unequal bacilli, which are straight or diversely flexuose, immobile and colourless." We might, he adds, "easily be led to regard them as a parasitic vegetable production, if we had not before our eyes all the successive phases of the transformation of these elements." In addition to which he adds that they are readily soluble in alkaline fluids.

It would be a mistake to suppose that the process now described by Balbiani as the male generative organ has altogether escaped earlier observers. It was observed both by Huxley and Leydig, as indeed Balbiani points out, but was regarded as a pseudo-vitellus. I myself had observed a mass of small green cells in the pseudovum of Coccus,* but I regarded them as parasitic vegetable cells, and, as we have seen, the same idea occurred independently to M. Balbiani, but was not adopted by him for the reasons already given. My "green cells," however, do not correspond with the "pseudo-

* "On the Ova and Pseudova of Insects," Phil. Trans. 1859, pp. 362, 363.

vitellus" of Prof. Huxley, but the description given by M. Balbiani of the development of the bacilli suggests, in many respects, a disintegration of the natural tissues, and a development of parasitic growth, rather than the ordinary and natural production of sexual elements.

On passing to the oviparous form we shall meet with additional difficulties.

The "male apparatus," as already described, occurs alike in both sexes, in the males as well as in the females, and with characters scarcely differing from those which it presented in the viviparous specimens. The true male generative organs are homologically the same as the female. There are not two rudimentary organs of which one is developed in one sex and the other in the other; but there is a single original rudiment, which is developed in one manner in the female, in a different manner in the male, and which in both cases contains the so-called "embryonic male organ."

This "embryonic male organ" is evidently, therefore, a perfectly distinct organ from an ordinary testis, and, as M. Balbiani has observed it in other animals besides Aphides, we shall await with interest some further communications on the subject. In the female Aphis he describes it as contained in the ovary, and as producing cells which evidently correspond with the seminal corpuscles of the viviparous form. "These facts," he concludes, "evidently indicate that the egg has already, while in the ovary, undergone a first fecundation, *with which the male has nothing to do*, and the effect of which is limited to the production of the generative elements of the future animal."

Some years ago* I attempted to show that there are two distinct kinds of Spermatozoa among the Annulosa, and I ventured to suggest that their functions were probably different. But however much I might be tempted to claim these observations of M. Balbiani as confirmatory of my views, I cannot but feel that fresh evidence is required that his "embryonic male organ" has really the nature and functions which he attributes to it.

Although our late President, Mr. Pascoe, alluded briefly, in his last Address, to the remarkable discovery made by Prof. Wagner that certain dipterous larvæ possess the power of agamic repro-

* Phil. Trans. 1861.

duction, the fact is one so remarkable that I think I need not apologize for returning once more to the subject. It has been almost an axiom among entomologists that no larva possesses the power of reproduction; and when therefore M. Wagner, Professor of Zoology at Kasan, announced that he had discovered a case of asexual reproduction in the larva of a fly belonging to the genus Cecidomyia, his statement was received with an astonishment bordering on incredulity. Indeed the Editors of the 'Zeitschrift für wissenschaftliche Zoologie,' to whom Prof. Wagner had forwarded his memoir, kept it back for two years, because the statements made by him seemed to them almost incredible. These statements have now, however, been confirmed by other excellent observers, namely, Meinert, Pagenstecher, Leuckart and Von Siebold; and there seems no doubt about the main facts; namely, that the larvæ of certain flies continue, throughout the autumn and winter, to produce a series of successive generations of larvæ, the last of which are finally developed into perfect and sexually mature individuals. The females then, after copution, lay eggs, and thus the cycle commences again.

I say "certain flies," because it is now almost certain that the different observers have had different species under notice, and Prof. Wagner even believes that he has met with five distinct forms. Two only, however, have yet been obtained in a perfect state, one of which appears to have been bred both by Prof. Wagner and by M. Meinert, the other by M. Meinert alone. The first is a new species, which has received the name of Miastor Metraloas, and is most nearly allied to the genus Heteropeza, from which it is principally distinguished by the structure of the tarsus. The second is named by M. Meinert, Oligarces paradoxus.

Wagner and Meinert believed that the young larvæ originated from the general fatty tissue, and before the appearance of any special generative organs. Pagenstecher first called this in question, and expressed his belief in the existence of a proper "germ-stock" or ovary. Leuckart has clearly shown that this is the case, and that the early stages in the development of the pseudova, from which the secondary larvæ are produced, are the same as in the production of an ordinary dipterous egg. I entirely agree with him when he says that "Every one who is acquainted with the developmental history of insects, or who consults the existing observations on that subject by Stein, myself, Lubbock, Claus, and others, will agree with me when I assert that the germ-balls of our larvæ, with their contents, precisely reproduce the conditions of one of the so-called germ-chambers from the ovarian tubes of a female insect."

It is therefore evident that the developmental history of these pseudova follows the same course as other insects' eggs, which indeed I have elsewhere attempted to show is the case in all other groups of insects which possess the power of agamic reproduction:

It may be added that the subsequent development accords in essential points with that which has been observed in other insects. Miastor appears indeed to be a very favourable subject for such investigations, and has yielded to M. Mecznikoff the remarkable discovery that the mysterious "polar cells," which have been observed by so many naturalists and in such different groups of animals, re-enter the blastoderm, and finally pass into the germ-stock of the young larva. They thus apparently answer to the so-called "embryonal male organ" of M. Balbiani.

Prof. Leuckart, as we have seen, has clearly shown that the reproductive bodies in the larvæ of Miastor arise in the ovary, that they possess the rounded form, the germinal vesicle and spot, the vitelligenous cells, and in fact "all their first stages of development, in common with eggs." He is not, however, yet prepared to follow out his own views to their logical conclusion, but, as he says, "cannot quite determine to describe them as eggs. . . . . Just as the larval forms of an animal cannot be placed on the same level with the fully developed creatures, and regarded as such, so we must not transfer the denomination 'eggs' to structures which have only their first stages of development in common with eggs." These first stages, however, comprise just the special characteristics; the subsequent changes, such as the development of the chorion, &c., are mere external adaptations for the purpose of enabling the egg to brave its exposure to external circumstances. The ovum in Mammalia needs no such protection, and is not more specialized in this direction than that of Aphis or of Miastor; but no one would deny that the reproductive bodies of Mammalia are true ova.

If, moreover, we examine the reproductive bodies throughout the animal kingdom, we may find every gradation from the most specially developed egg—that, say, of a bird—to that of the viviparous Aphis or Coccus. One great difference between an egg and a bud is the place of origin, to which, as it seems to me, Prof. Leuckart does not attach sufficient importance.

He is, however, inclined to adopt the name of pseudovum for the reproductive bodies in Aphis and other similar cases, but he blames Huxley for attributing the same term to the "true eggs, which are capable of spontaneous development."

Now between a normal egg and the pseudovum of Aphis every intermediate term exists. No important morphological line of demarcation can be drawn. On the other hand, a body which is capable of spontaneous development, whatever its form may be, and whether it is susceptible of impregnation or not, is very different from one which requires impregnation as a necessary antecedent to development. Herein, then, lies a true difference, and I certainly think, therefore that (as, indeed, I suggested in the year 1856) it is convenient to have some term for self-fertile ova, whether susceptible of impregnation or not, whereby they may be distinguished from other ordinary eggs, to the development of which impregnation is a necessary antecedent.*

Prof. Leuckart's criticism, however, derives a certain amount of support from the name which Prof. Huxley has given to these reproductive bodies. The name "pseudovum," or "false egg," may be appropriate enough in the case of Aphis, or Coccus, or even of Daphnia. It is not, however, well adapted to that of Cynips, and still less to those of the bee or the silkworm moth. The so-called "pseudova" in these cases are not "false eggs;" they are, on the contrary, true eggs—and something more. They possess, in fact, all the characters of true eggs, combined with a greater amount of vital energy. "Euova" would seem therefore to be a more appropriate term for them than "pseudova."

Mr. Darwin's last edition of the 'Origin of Species' contains many illustrations from Entomology which were not present in the first. Several of these are of great interest. As an example, I take his remarks on the influence which insects have exercised on the beauty of flowers. If bees owe their honey to the flowers, flowers, on the other hand, it would appear, owe their beauty to the bees. "Flowers," says Mr. Darwin, "rank amongst the most beautiful productions of

* Even here, however, intermediate stages appear to occur. Many cases have been observed in which yolk division commences in unimpregnated eggs, and in insects the embryo is sometimes formed, before the vital energy of the ovum is exhausted and the process stops. It is even stated that young born from agamic eggs are particularly weakly, as if even after birth the absence of male influence showed itself in a want of vital energy.

Nature; and they have become, through natural selection, beautiful, or rather conspicuous, in contrast with the greenness of the leaves that they might be easily observed and visited by insects, so that their fertilization might be favoured. I have come to this conclusion from finding it an invariable rule that when a flower is fertilized by the wind it never has a gaily-coloured corolla. Again, several plants habitually produce two kinds of flowers; one kind open and coloured so as to attract insects; the other closed and not coloured, destitute of nectar, and never visited by insects. We may safely conclude that if insects had never existed on the face of the earth, the vegetation would not have been decked with beautiful flowers, but would have produced only such poor flowers as are now borne by our firs, oaks, nut and ash trees, by the grasses, by spinach, docks and nettles." Moreover, we obtain from these facts the best evidence that insects possess the faculty of perceiving and distinguishing colours. For as regards the vision, and indeed the other senses of insects, we have yet much to learn. We do not yet thoroughly understand how they see, smell, or hear; nor are entomologists entirely agreed as to the function or the structure of the antennæ. This interesting subject offers a most promising field for study, and I would particularly call the attention of entomologists to a remarkable memoir by Hensen on the auditory organ in the decapod Crustacea, which first appeared in the 'Zeits. f. wiss. Zool.,' vol. xiii. p. 319, and of which an abstract has been given in the 'Quarterly Journal of Microscopical Science,' vol. v. p. 31. Hensen has shown that (as had been stated by M. Faivre) the otolithes in the open auditory sacs of shrimps are foreign particles of sand, *introduced into the organ by the animal itself.* He proved this very ingeniously by placing a shrimp in filtered water without any sand, but with crystals of uric acid. Three hours after the animal had moulted he found that the sacs contained many of these crystals.

M. Hensen has also shown that each hair in the auditory sac is susceptible of being thrown into vibration by a particular note, which is probably determined by the length and thickness of the hair. It may be experimentally shown that certain sounds throw particular hairs into rapid vibration, while those around them remain perfectly still.

M. Baudelot has published, in the 'Annales des Sciences Naturelles,' a short memoir on the influence of the nervous system on the respiration of insects. M. Faivre had attempted to show that the respiratory movements depend entirely on the metathoracic ganglion, and that the posterior part of the ganglionic chain acts merely as a conductor. M. Baudelot has arrived at a very different conclusion: he experimented on the larva of the dragon-fly, and after cutting off the head found that for six hours the respiratory movements were strong and regular, while even after a lapse of twenty-one hours they were apparent, though weak, nor did they cease entirely until twenty-seven hours after the operation. Secondly, he bisected a specimen immediately behind the metathorax, notwithstanding which respiratory movements were continued in the abdominal portion for something more than twelve hours, and in one case even for twenty-four hours. Moreover, he arrived at similar results in the dragon-fly itself, and he concludes therefore that the respiratory movements of insects are not, like those of Vertebrata, under the rule of one special part of the nervous system, but that each ganglion acts for itself as a centre of force.

Prof. Faivre has also published, in the 'Annales des Sciences Naturelles' (New Series, vol. i.), some interesting investigations into the nervous system of insects. It is hardly necessary for me to remind the Society that we owe to our great entomologist Newport the interesting discovery that the nervous column in Articulata consists of two parts, an upper band with motor functions, and a lower ganglionic cord of sensitive nerve matter. He suggested, moreover, that the nerves had a double origin as well as a double function.

M. Faivre has succeeded in proving by experiment the accuracy of these views. After carefully exposing the prothoracic ganglion, he found that on irritating the under surface of the ganglion he obtained unmistakeable signs of pain, indicated by general movements; while irritation of the upper surface merely produced movement in the corresponding leg, action on the right side of the ganglion always affecting the right leg, that on the left side the left leg. But further than this M. Faivre found it possible to isolate the power of motion from that of sensation, so as to paralyze either at will without affecting the other. If he made a longitudinal section through the *upper* part of the ganglion on the side, the leg on that side lost all power of motion. If the insect walked the leg took no part in the movement, and if the leg itself was pinched it remained equally motionless. Yet its sensibility was unimpaired, and any irritation of it produced reflex actions *in the other legs*, and all the usual signs of discomfort, excepting indeed in the leg itself. Thus then the excitability was destroyed, though the sensibility was unaffected. After awhile, however, the former gradually returned.

M. Faivre was also able to effect the converse operation—*i. e.*, to destroy the sensibility without affecting the power of motion. To do this it was necessary to cut the inferior side of the ganglion, and especially to avoid going deep. In this case, as in the preceding, action on the right side of the ganglion affected the right leg, that on the left side the left one. Under these circumstances if the paralyzed leg is pinched no movements are produced either in it or in any other parts of the body; while, on the contrary, the paralyzed leg does move in the same manner as the others, under the stimulus of irritation applied to *any other* part of the body. Thus then if a superior longitudinal section be effected through the side of the ganglion, the leg is rendered motionless, but other parts can be stimulated through it. On the contrary, if an inferior longitudinal section be made, the leg can be moved by stimulus applied elsewhere, but is rendered incapable of transmitting sensation.

There is yet another manner in which the ganglion may be treated. If a lateral longitudinal section be carried through each side, the corresponding legs are completely paralyzed; and yet, the conducting properties of the ganglion being unaffected, irritation of the antennæ produces evident movements of the posterior feet, and, *vice versa*, irritation of the posterior legs produces movements in the head.

M. Faivre has made several experiments on other portions of the nervous system. The supra-œsophageal ganglion he finds to be quite without sensation. It may be pinched, pricked or torn, without any pain being manifested, thus presenting a remarkable contrast with other ganglia, and a not less remarkable analogy with the cerebral hemispheres of the, so-called, higher animals. It is curious that the commissures appear to gain sensibility as they quit the brain and approach the first subœsophageal ganglion.

The subœsophageal and other ganglia, so far as they have been examined by M. Faivre, present the same phenomena as the prothoracic; that is to say, they are motor above and sensory below; and an injury affects always the corresponding side of the body. He found the mesothoracic ganglion the easiest of all to examine, it being necessary for the purpose to remove only the membrane which unites the ventral surface of the prothorax with the mesothorax.

Finally, M. Faivre draws these principal conclusions:—

First. That even among the lower animals the distinction between sensibility and excitability holds good, proving thus the constancy and the generality of the physiological plan upon which the nervous system is established.

Secondly. The ganglionic chain of insects is the analogue of the spinal chord, and like the latter is divisible into motor and sensitive portions.

These investigations show clearly the correspondence which exists between the nervous system of insects and that of the higher animals.

Strictly perhaps the struggles and contortions of an insect when it is wounded are no absolute proof that it is capable of suffering, yet there are few who can entertain a doubt on the question. And so also, strictly speaking, no proof has yet been adduced that insects possess the gift of reason; still the study of their actions and habits leaves, to my mind, as little doubt in the one case as in the other.

Trees must be judged by their fruits and animals by their actions. Look, then, at the ants: they build houses, they keep domestic animals, and they make slaves; if we deny to them the possession of reason we might almost as well question it in the lower races of Man: insects cannot speak, indeed, but they evidently communicate by means of their antennæ, just like certain North-American Indians who cannot understand one another's language, but who can yet converse together with ease and fluency by a code of signs which are the same over a large area and among tribes whose spoken languages are entirely dissimilar.

In the face of the facts recorded by the Hubers and other observers, nothing but the force of preconceived ideas could make us hesitate to regard the ant or the bee as reasoning beings.

It is manifestly unfair to compare an insect with man, or even with the horse or dog. Reason is based on experience, and this the insect can never acquire owing to the shortness of its life. If the comparison is made at all, the ant or bee should be compared with a puppy or an infant, and it may well be questioned then to which an impartial observer would attribute the highest nervous organization. Every one knows that the movements of the body can be regulated only by long practice; a baby cannot command its arms or legs any more than its thoughts, and the power of regulating them is acquired as gradually in the one case as in the other.

Although, therefore, it cannot be denied that on the whole even the lowest savages have made more progress and shown more ingenuity, in many cases, than the ant or the hive bee, it may well be questioned whether this is owing to any superiority in their nervous organization, and whether it may not be accounted for by other causes, and especially by the shortness of insect life, which offers an insuperable obstacle to the accumulation of experience.

Of all living animals the chimpanzee and the gorilla, in their bones, muscles, viscera, &c., most nearly approximate to man, and the "determination of the difference between Homo and Pithecus" is, in the words of Prof. Owen, "the anatomist's difficulty;" but if we judge animals by their intelligence, as evidenced in their actions and mode of life, we may fairly claim for Entomology a high rank in Biological Science, for in that respect it is not the gorilla or the chimpanzee, but the bee, and, above all, the ant, which approach the nearest to Man.

A vote of thanks to the President was carried by acclamation.

A vote of thanks to Mr. Edwin Shepherd, on his resignation of the Secretaryship, an office which he had held for twelve years, during seven of which he was the principal acting Secretary, was carried by acclamation; and thanks were also voted to the other officers for 1866.

Abstract of the Treasurer's Accounts for 1866.

RECEIPTS.

				£	s.	d.
By Balance in hand, January 1st, 1866				11	14	10
Arrears of Subscriptions				22	1	0
Subscriptions for 1866				153	6	0
Admission Fees				25	4	0
Compositions				31	10	0
Tea Subscriptions				10	15	6
Sale of 'Transactions,' at Rooms	£49	15	3			
" at Longmans'	37	8	1			
				87	3	4
Dividend on £109 14*s.* 9*d.* Consols				3	5	10
Donation from W. W. Saunders, Esq.				5	5	0
				£350	5	6

PAYMENTS.

	£	s.	d.
To paid arrears for 1865:—Rent to Christmas	11	5	0
Fire Insurance to Lady-day, 1867	1	4	0
Librarian, 53 attendances	18	11	0
Tea, 13 Meetings	13	13	0
Attendance, Coals, Collector's Commission, &c.	5	2	4
Parcels, Postage, Stationery, &c.	11	11	4
Removal of Library	2	4	0
Printing 'Transactions,' 5 Parts	112	10	3
" 'Proceedings,' Circulars, &c.	12	6	9
Plates for 'Transactions,' Engraving, Printing and Colouring ...	74	19	3
Books purchased	24	12	0
Bookbinding	11	8	6
Rent, 3 quarters, to Michaelmas, 1866	33	15	0
Prize, for Essay on Ailanthiculture	5	5	0
Balance in hand	11	18	1
	£350	5	6

Liabilities and Assets of the Society.

Liabilities.

	£	s.	d.
Rent to Christmas	5	0	0
Loan from Mr. Dunning ...	45	0	0
	£50	0	0

Assets.

	£	s.	d.
Arrears of Subscriptions:— good,—(say)	17	17	0
Ditto, doubtful, £31 10*s.* 0*d.*			
Consols, £109 14*s.* 9*d.* (say)	100	0	0
Cash balance in hand	11	18	1
	£129	15	1
Less amount of Liabilities	50	0	0
Balance	£79	15	1

JOURNAL OF PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY OF LONDON.

1867.

February 4, 1867.

Professor Westwood, Vice-President, in the chair.

The President (by letter) nominated as his Vice-Presidents Messrs. Westwood, Stainton, and Frederick Smith.

Donations to the Library.

The following donations were announced, and thanks voted to the donors:— 'Proceedings of the Royal Society,' Vol. xv. Nos. 84—88; presented by the Society. 'Journal of the Linnean Society,' Zoology, No. 35; by the Society. 'On the Development of Chloëon (Ephemera) dimidiatum,' by Sir John Lubbock, Bart.; by the Author. 'Catalogue of the Longicorn Coleoptera of Australia,' by F. P. Pascoe, Esq.; by the Author. 'Catalogue des Lépidoptères des Environs de St. Pétersbourg,' par N. Erschoff; by the Author. 'The Zoologist' for February; by the Editor. 'The Entomologist's Monthly Magazine' for February; by the Editors.

Election of Members.

Herbert Edward Cox, Esq., of Croydon, was elected a Member; and Yeend Duer, Esq., of Cleygate House, Esher, an Annual Subscriber.

Prizes for Essays on Economic Entomology.

The Chairman announced that the Council had again resolved to offer two prizes of five guineas each for Essays, of sufficient merit and drawn up from personal observation, on the anatomy, economy or habits of any insect or group of insects especially serviceable or obnoxious to mankind. The Essays must be sent to the Secretary at No. 12, Bedford Row, on or before the 30th of November, 1867, when they will be referred to a Committee to decide upon their merits; each must be indorsed with a motto, and be accompanied by a sealed letter indorsed with the same motto and inclosing the name and address of the Author.

Exhibitions, &c.

Mr. Bond exhibited four specimens, two males and two females, of a Lasiocampa bred by Mr. Robert Mitford from larvæ found on the coast of Kent; he regarded them as merely a variety of Lasiocampa trifolii, differing from the normal form in colour and in the antennæ of the male, though he was informed that the larvæ also differed and were of a golden colour. The insect might be supposed to bear the same relationship to L. trifolii that L. Callunæ bears to L. quercus, and had very much the appearance to be expected in a hybrid between Lasiocampa trifolii and Odonestis potatoria. Other bred specimens of L. trifolii, from Cumberland, Hants, Dorsetshire and Devonshire, were produced for comparison.

Mr. Bond also exhibited several Fritillaries with unequally developed wings; and a remarkable variety of Dianthœcia capsincola from York.

Mr. Bond offered an explanation of the curious habit of Macroglossa stellatarum, frequenting stone walls, &c., as to which an enquiry was made at the previous Meeting (*ante*, p. xlix.). The object was to secrete itself in some hole or crevice: he had often noticed that the insect had a morning and an afternoon flight, but in the middle of the day grew tired, when it would seek out a wall or bank and creep up it until it found a hole or cranny wherein to rest.

Dr. Wallace corroborated this: when residing in the Isle of Wight he had observed the humming-bird hawk-moth resting in crevices of mud banks, &c., and on one occasion he had captured in a limpet-shell a specimen which was thus reposing.

Prof. Westwood exhibited a singular variety of Mamestra brassicæ caught by Mr. Briggs, of St. John's College, Oxford. Mr. Bond mentioned that he possessed a similar specimen.

Dr. Wallace said that on recently looking through Dr. Bree's collection of British Lepidoptera he had detected a Platypteryx Sicula mixed up with P. falcataria. The insect did not bear any label, and Dr. Bree had not any recollection of the capture of the particular specimen, though he had no doubt that it had been taken by himself some years ago along with P. falcataria in the neighbourhood of Stowmarket. If so, this was a new locality for the species, which in this country had hitherto been known to occur only in the neighbourhood of Bristol.

Mr. G. S. Saunders exhibited a nest formed by social caterpillars among the leaves of a Brazilian tree, a species of Zeyhera; it was about a foot in length, and formed a compact web between two small branches. The nest was collected in 1866 by Senor J. C. de Mello, at Campinas, Province of S. Paulo, and by him sent to Mr. Daniel Hanbury.

Mr. Wormald exhibited a collection of insects sent from Shanghai by Mr. William Pryer, amongst which was a single specimen of a wild Bombyx, having some resemblance to B. Huttoni.

Dr. Wallace exhibited an English cocoon of Bombyx Yamamai, one of two reared in 1866, at York, by Mr. Dossor.

Dr. Wallace also exhibited numerous specimens of the cocoon and imago of Bombyx Cynthia, and the silk thereof. One was a double cocoon, the joint work of two larvæ. Another cocoon, formed in 1865, and which in due course ought to have produced a moth in 1866, contained a still living pupa, which would probably hatch in

1867. He mentioned that though the moths were greedily eaten by fowls and other birds, the larvæ, though not hairy, were rejected; and that when Ailanthus leaves were not procurable the larvæ had been found by Captain Hutton to thrive on honeysuckle. The moths of B. Cynthia were subject to considerable variation in size and coloration. He had invariably found that at the commencement of the hatching out of a brood the males greatly outnumbered the females, whilst at the end the reverse was the case: he argued that in proportion as the individual was finer the time required for its metamorphosis was longer; hence in general the female, which was the larger and heavier insect, was preceded by the male, which was smaller and had less to mature. He thought Bombyx Guerinii and B. Ricini were probably only varieties or local forms of B. Cynthia. Lastly, Dr. Wallace mentioned that he had frequently observed a sound to proceed from the eggs of B. Cynthia, "a sort of click, a single sound, generally in the second week," which was attributed to "the parchment-like shell being pressed out with a spring by the effort of the larva within, and returning to its concave form."

Mr. F. Moore exhibited Bombyx Guerinii, of which only three or four specimens were known, and Bombyx Ricini, with its cocoons and silk, for comparison with the produce of Dr. Wallace's Ailanthery.

Mr. Alfred R. Wallace remarked that Dr. Wallace's theory on the relation between the size of the specimen and the period of development satisfactorily accounted for the fact that as a rule in Lepidoptera the male was smaller than the female. Owing to the precarious tenure of life of a Lepidopterous insect, which was not only exposed to the attacks of many enemies, but was also liable to destruction from mere change of temperature, it was important that the female should be impregnated almost as soon as hatched, and therefore that males should be in readiness at the time of her emergence. The males which first hatched became the parents of the future progeny; the progeny inherited the qualities of the parent; and thus in process of time the males which had a tendency to early hatching, the small specimens which required a shorter period for their development, predominated, while those which hatched later, the larger males, being without mates and therefore leaving no offspring, would constantly tend towards extinction, and finally leave the smaller males in possession of the field.

Mr. Janson exhibited a collection of Coleoptera from Vancouver's Island, amongst which Mr. Pascoe pointed out some fine Longicorns, a form resembling the Australian Hesthesis, Plectrura, Purpuricenus, Exops, &c.

Mr. C. A. Wilson, of Adelaide, South Australia, communicated the following notes on Cerapterus Macleayii and Calosoma Curtisii:—

"*Cerapterus Macleayii.*—Of the genus Cerapterus we have three species in this colony, C. Wilsoni, C. Macleayii and C. Hopei. The first of these is much the most rare, and from twice to three times the size of the others. Some years ago C. Macleayii was found frequently between the town (Adelaide) and the sea, at about two miles from the former and five from the latter, and always under dry cow-dung: after this, on nearing the sea, or rather gulf (St. Vincent), it gave place to C. Hopei. It has also been taken around Gawler under the same circumstances, that is, on land never yet turned up, where cattle, horses, &c., have long grazed, and under cow-dung of a particular age or state of dryness—dropped some days, but before all moisture had gone from it. Specimens of this beetle have, however, become scarce in all the former spots, on account of the traffic and disturbance of their places of rest; but on the 17th of November, 1866, I searched a large untilled paddock of about 134 acres, west of Adelaide, where cattle had grazed for some years, and obtained seven specimens of this Cerapterus; this was one specimen to about thirty or forty of their domiciles that I turned over, and all were found alone. I am not aware of any account of the habits of these Paussidæ having been published. There is a note in the Addenda to Westwood's 'Modern Classification,' stating that Mr. Macleay's brother had found an Australian species of Cerapterus residing in ants' nests: it is not said what kind of ant, the white (Termes) or the common (Formica): I suppose the former; if otherwise, the circumstance is quite unknown to me. Should the habits of the Cerapterus (of N. S. Wales?) be the same as here, I fancy this remark is an error from cursory observation. I think the Cerapteri only use their dry coverings as places of shelter, though how they come there and why first found there I confess I cannot tell. Perhaps they fly at night and hide in the day. I observed on this and former occasions the following facts: the white ants are in these plains found nowhere but under drying cow-dung; still hundreds of pieces in the most favourable conditions are without them. In the present case four of the pieces under which the Cerapteri were found had white ants under them, and three had not. Each of the beetles was lying under his canopy in a small depression of the ground, or with the earth slightly raised round him, and was always perfectly still: where there were ants they appeared to have no connexion with the beetle or in any way to disturb him or be aware of his presence, though running about when the coverings were raised. I also observed that where no ants were with the other Cerapteri there evidently never had been any. Nearly all these seven specimens on being disturbed or lifted by me crepitated several times, some as many as three times, before immersion in the methylated spirit I had with me, at the same time discharging from some part of the body a yellow fluid, which stained the abdomen and last pair of legs, but disappeared on immersion in the spirit.

"*Calosoma Curtisii.*—To obtain this species of Carabidæ I had to go three miles nearer to the gulf, to a place called the Reed Beds, a large tract of land several miles square, extending in some parts nearly to the gulf, and obtaining its name from several acres of reeds still growing at its furthest extremity. I have before given some remarks on the habits of this species, which I beg to refer to (see Proc. for 1864), and will now supplement. Though formerly, as there mentioned, rather numerous, and one year particularly so, at the foot of the North Adelaide hills, they seem almost entirely to have deserted them. As with the Cerapterus, the presence of cattle seems necessary to their maintenance, and though on the former occasions I found them mostly running about, and very seldom under dry cow-dung, I have reason from this day's observation (November 17, 1866) to think that they lay their eggs beneath it. In November, 1864, I captured near the Reed Beds as many as twenty-two; this was at a farm where many cows were kept, sandy in some parts, but good soil in others. Rather late in November, 1865, I repaired to the same spot, but did not find a single specimen; that, however, was a year of drought. The favourable and long-protracted rains of this year made me hope better things, and I was not disappointed. I took in about an hour and a half, from a space somewhat less than an acre, sixty-five of the Calosoma. Nearly all of them were under the half-dried cow-dung; under the first I lifted were four; under one as many as twenty. But few were running about, and these either round the deposits or from one to another. As usual they never once attempted to fly, though they have ample wings, and the day was sufficiently warm: they ran, but not very fast, and were easily taken. Under the piece of cow-dung where the largest number were found only two or three were at first seen, but others had gone below the surface of the ground, and on watching a slight kicking or disturbance of the earth took place, and the beetle was easily captured. The males and females, slightly differing in size, the latter being the largest, were much together, and I conclude it was late in their season, and that the eggs were being deposited beneath the surface under the cow-dung. There were not any larvæ about, though I had seen them at this time of year on a previous occasion. The beetles smelt strongly of the substance under which they burrowed, and I think they fed on it.

"Our large five-horned Copris has of late years spread in the Gawler districts from the same cause, *viz.* the numerous deposits from the cattle. Through this, while in a moist state, they pierce during the dark hours, going often a foot down, making large holes, and throwing up the earth behind them; and I have dug out from under one piece from twenty to thirty specimens, male and female. They first appear in June, when rain has fallen, up to September when leaving off."

Prof. Westwood observed that, in the note referred to, in the 'Modern Classification,' he undoubtedly was speaking of Formicidæ, and not of Termitidæ. Mr. Wilson did not seem to be aware that Paussidæ had been repeatedly found in ants' nests, and that several species had been sent from the Cape of Good Hope by Guienzius with the nests of the particular species of Formicidæ which they frequented.

Mr. A. R. Wallace remarked upon the rapidity with which the insects mentioned by Mr. Wilson had adapted their mode of life to the altered circumstances in which they found themselves placed; thirty years ago there was not a cow in South Australia, and yet members of three families of Coleoptera, so widely separated as the Paussidæ, Carabidæ and Copridæ, had already become habitual frequenters of cow-dung; and this was the more remarkable in the Calosoma, whose British congener was arboreal in its habits.

Mr. Gould exhibited Hylurgus piniperda, which was doing considerable mischief to Pinus insignis in several parks and plantations in Cornwall.

Mr. Pascoe called attention to an article on Atropos pulsatoria in Hardwicke's 'Science Gossip,' of the 1st of February, 1867, in which Mr. W. Chaney wrote as follows:—

"My first acquaintance with Atropos, or as it is generally called here the wood-louse, commenced about thirteen or fourteen years ago: at that time I lived in an old house in Brompton, near Chatham, and in my bed-room, which was also my library and museum, I had a very *olla podrida* of Natural History hanging about the walls; among the rest was a honey-comb. It was soon after the introduction of this to my list of curiosities that the strange ticking sound (which at the time sorely puzzled me) commenced, and that led me eventually to the investigation of the cause. I soon found that the noise proceeded from the comb, and on closer examination I saw a number of wood-lice travelling about from one cell to another, and appearing very busy in their explorations. After awhile the ticking commenced, which I quickly traced to a particular cell, and by the aid of a common convex lens I could perceive Atropos beating with its head against the side of the cell, the noise produced being quite as loud as the tick of an ordinary watch, thus confirming Mr. Derham's observations, 'and viewing them with a convex lens, I soon perceived some of them to beat or make a noise with a sudden shake of their body,' &c. From this time the honey-comb, which perhaps from its peculiar sonorous nature suited them so well, became the head-quarters of Atropos, and night after night, and sometimes by day, might be heard the tick, tick, tick, by the hour together; sometimes one, sometimes two or more, ticking away with all their might, as if to out-tick each other. At any time by carefully approaching the comb, and waiting a second or two quietly, they might with the aid of a lens be seen at their peculiar pastime. Since then I have lived in my present house, a comparatively new one, for about twelve years, and during that time have constantly heard the familiar tick from time to time, twice during the last week, October 8th and 10th. Atropos is very numerous here, seeming to prefer the mantel-piece, upon which are several vases filled with artificial flowers, and any night they may be seen by the dozen prying into any little crevice, or minutely surveying petal after petal of their floral habitation."

Mr. F. Smith said that he had a number of living Atropos which he had been observing for some time, but he had not yet been able to detect them making any sound.

Mr. M'Lachlan reiterated his disbelief that so soft an insect could be the author of the tapping noise attributed to it; and with reference to Mr. Chaney's observations, he should scarcely have thought that honey-comb was of a "peculiar sonorous nature."

Paper read.

Dr. Wallace read a paper "On some Variation observed in Bombyx Cynthia in 1866."

February 18, 1867.

Sir JOHN LUBBOCK, Bart., President, in the chair.

Donations to the Library.

The following donations were announced, and thanks voted to the donors:—'Bulletin de la Société Impériale des Naturalistes de Moscou,' 1865, No. III., 1866, No. II.; 'Annales de la Société Entomologique de France,' 4e Sér. Tome v., 1865; 'Stettiner Entomologische Zeitung,' 1867, Nos. 1—3; 'Proceedings of the Natural History Society of Dublin,' Vol. iv. Part iii.; presented by the respective Societies. 'Beskrivelse over Lophogaster typicus, en mærkvædig Form af de Lavere Tifœddede Krebsdyr,' by Dr. Michael Sars; 'Norges Ferskvandskrebsdyr, Første Afsnit, Branchiopoda. I. Cladocera Ctenopoda (Fam. Sididæ & Holopedidæ),' and 'Beretning om en i Sommeren 1863 foretagen Zoologisk-Reise i Christiana Stift,' by G. O. Sars; 'Entomologiske Undersœgelser i Aarene 1864 og 1865,' by H. Siebke; presented by the respective Authors.

Exhibitions, &c.

Mr. F. Moore exhibited specimens of Tomicus monographus, with portions of the staves of a cask destroyed by this beetle, and read the following note respecting its ravages:—

"An official report has lately been received at the India Office from the Military Department at Madras, relating to the destruction of the casks containing the malt liquors sent out to India from this country for the use of our troops, and which is caused by a small boring-beetle perforating the staves of the casks to such an extent as to entail very considerable loss of the liquor by leakage. From an examination made in India of a large number of the perforated staves, it is there supposed that the insect first effects a lodgment beneath the hoops, which offer it a temporary shelter, and that it then bores into the wood and works its way in all directions. A large proportion of the holes run at right angles to the surface of the staves and reach from one side to the other, thus allowing free exit to the liquor, but others again traverse the wood in all directions. In some casks these perforations are literally innumerable, and taking a portion of a stave before me as a guide it is calculated that in the cask to which it belonged there were not less than 134,400 perforations communicating with the outer surface, most of which served as the exit for *several* of the beetles, as upon cutting the stave lengthwise they were found in Indian-file in all directions. The larva is stated to be of a white colour and armed with a pair of powerful jaws. The beetle is also stated to be very similar in appearance to that which perforates the bamboo, but much smaller and more slender in proportion to its length; and to be precisely similar in outward appearance to the species which attacks the 'shola' of which pith-hats are made. It is unknown when this insect first made its appearance in India. It is extremely probable that at no period since the first importation of malt liquor for the troops has it been entirely absent, but in former years the stock on hand was much less than at present, and the insect was probably less destructive and consequently its presence was not officially reported. As far back, however, as 1855, when the then Deputy Commissary-General was on a tour of inspection in Burmah, the destructiveness of this beetle was brought prominently to his notice when at Tonghoo. From that date until the year 1862 the insects increased in numbers, and still continue to be very destructive; in some seasons the wastage has been less than in others, but the insect has never at any time been entirely unobserved. Up to 1862 the ravages of this pest appear chiefly to have been reported from stations in Burmah, but in the same year it was observed at Jaulnah, and probably at other stations also, and it has now broken out again in the last consignment of malt liquor received at Secunderabad. The most difficult and important inquiry connected with this subject is the question as to where the beetle first came from. The generally received opinion in India appears to be that the germ of the insect is already in the wood when the casks are sent from England, and that it becomes developed and makes its appearance after its arrival. To support this theory, however, no satisfactory evidence has been adduced. It is believed that all the staves undergo a process of steaming before being made into casks, and this of itself would be sufficient to destroy the germ of any insect; moreover, the insect has been found within a very short time after the arrival of the casks in India, and yet it has never on any occasion been detected in casks when first received from the ship. On the other hand, it has been suggested that the insect drops from the bamboos which form the coverings of the carts and boats, but an examination of the insect found in the bamboo in Madras appears to show that, although of the same genus, the bamboo-borer is larger than that which attacks the casks. The length of time after landing when the insect generally appears varies from a few weeks to several months. In the recent case at Secunderabad the casks when landed at Masulipatam were in perfect order, so much so that they attracted special notice: when they arrived at Secunderabad there was no trace of the insect, but after they had been a very short time in store the insects made their appearance, and continue to increase. Many causes have been brought forward as predisposing casks to the attacks of this insect. The first and most important is the use of unseasoned wood in making the casks. Committees were assembled at Calcutta some years ago to investigate the cause of the attacks of this insect, and its presence was ascribed by them also to the use of unseasoned wood in the casks. The fact that the use of unsuitable wood predisposes the casks to the attacks of these insects is not unlikely. It is well known in India that, if bamboos are cut at a certain season when the sap is in them, they will be assuredly attacked by the borer, whilst bamboos cut from the same spot at a proper time will as certainly be free from them. It has also been stated that a long inland journey by cart or boat tends much to cause the increase of the insect. It is difficult to give any accurate estimate of the damage caused by these insects. At times they are not very numerous, and by selecting the worst casks for immediate use the wastage is not excessive, but at other times they are so abundant that no amount of care or trouble can keep them under, and in a report last received from Tonghoo the wastage has risen to fifty per cent. The Assistant Commissary-General at Rangoon states that he has applied a strong infusion of cutch as a remedy to the casks, but that on the following day the insects were as active and vigorous as ever; observing that some salt-meat casks escaped, a strong brine was next thoroughly applied, but with no better success. Boiling water was afterwards tried, and after three applications was perfectly successful."

Mr. Moore added that Tomicus monographus was figured in Ratzeburg, but had not hitherto been found in Britain; the casks in question were made of oak, but probably not of British growth.

Mr. Newman exhibited a stem of Salix capræa, to show the mode in which, under the attacks of Sesia bembeciformis, the bark divides in three layers, as more fully described in the 'Entomologist,' ii. 140.

Mr. Newman exhibited a specimen of Naclia ancilla, *Linn.*, a moth new to Britain, taken on the Sussex coast by Mr. T. Wildman.

Mr. Newman exhibited the lock of a door, one of several which in 1866 were found at the Kent Waterworks, Deptford, to be completely filled and choked up with nests of Osmia bicornis, a portion having been forced out by the insertion of the key; the locks were in pretty constant use, so that the whole nest must have been built in the course of a few days.

Mr. Newman also exhibited two specimens of a Formica, resembling F. herculanea, which were supposed to have been found in decayed pine-stumps in Scotland; but he hesitated to announce it as a new British ant, in consequence of the doubt entertained by Mr. F. Smith.

Mr. F. Smith thought the specimens in question were distinct from Formica herculanea, and also from F. pubescens: they appeared to be identical with an ant from North America, which had been sent to him from New York as a representative of the European F. herculanea, but which in reality was a different insect. An examination of the specimens exhibited, particularly of the worker, led him to believe that they had been in some old collection for years; the pins were of very antique pattern, and the abdomen of the female had been stuck on with gum: he thought there must have been some mixing of specimens, and that these had by accident been included in a British collection: the evidence of the actual captor was wanting, and until that was forthcoming, or the species was recaptured, he could not but think that the supposed occurrence in Scotland was a mistake.

Mr. F. Smith exhibited a collection of Hymenoptera taken by Mr. Du Boulay at Champion Bay, N.W. Australia, containing a fine series of Formicidæ, comprising about fifty species; twenty-four of the genus Camponotus, six of Polyrhachis, eight of Ponera, one of Odontomachus, four of Crematogaster, one of Pseudomyrma, four of Pheidole, and four species of Cryptoceridæ, belonging to the genus Meranoplus. The collection also comprised twelve new species of Thynnidæ, three of Pompilidæ, eleven new species of Mutillidæ, thirteen of Apidæ, four of Vespidæ belonging to the genus Paragia, and two remarkably beautiful species of the genus Odynerus. Amongst the Formicidæ was a very beautiful species of ant, which Mr. Smith proposed to name Pheidole hyacinthina, from the resemblance of its body to the gem Hyacinthus.

Mr. S. Stevens, on behalf of Mr. Higgins, exhibited some Coleoptera and Lepidoptera also sent from Champion Bay by Mr. Du Boulay. Amongst the beetles were about a dozen new species, some fine Scaritidæ, Buprestidæ (Stigmodera), a new Cetonia, &c.

Mr. Stainton exhibited two specimens of the imago (one a dwarf), and a drawing of the larva, of Tinea oleastrella of Millière, which he had bred from the olive, the larvæ having been sent him by Mr. J. T. Moggridge, from Mentone, in November, 1866. Mr. Stainton had expected that when the Oleastrella made their appearance they would be referable to the genus Swammerdamia, but to his surprise they differed essentially from that genus, and came much nearer to Zelleria fasciapennella, though from the thicker palpi and narrower anterior wings they scarcely seemed congeneric with that species.

Mr. Stainton exhibited a crippled specimen of Margarodes unionalis, which also he had bred from olive: the species was on the Continent reputed to be very difficult to rear.

Prof. Westwood mentioned that on the 7th of February Prof. Rolleston had taken a hybernated specimen of Vanessa Urticæ on the wing, and being anxious to know whether any food or fatty matter had been stored up for winter consumption, he dissected it. The hybernated specimens were usually females, fecundation taking place in the autumn, the males then dying and the females lying torpid through the winter. The dissected specimen, however, proved to be a male, and in its abdomen was found a quantity of yellow greasy matter, which under a quarter-inch lens distinctly shewed oil-globules, demonstrating the secretion of fat for the purpose of hybernation.

Papers read.

Mr. A. R. Wallace read a paper "On the Pieridæ of the Indian and Australian

Regions:" forty-seven new species were described, many of which were exhibited; and the descriptions were preceded by introductory remarks on the geographical distribution of the Pieridæ and on the existence in that family of cases of mimicry.

Mr. Herbert Jenner Fust, jun., communicated a paper "On the Distribution of Lepidoptera in Great Britain and Ireland," showing the occurrence or non-occurrence of all the indigenous species, except the Tortrices and Tineæ, in provinces and sub-provinces, after the manner adopted with respect to plants in Watson's 'Cybele Britannica.'

Mr. Edward Saunders communicated a paper entitled "Notes on Rare and Descriptions of New Species of Buprestidæ, collected by Mr. Lamb at Penang." Fifteen new species were characterized, one of them being the type of a new genus, Xenopsis, closely allied to Castalia.

March 4, 1867.

Frederick Smith, Esq., Vice-President, in the chair.

Additions to the Library.

The following donations were announced, and thanks voted to the donors:— 'On certain Entomological Speculations, a Review,' by A. S. Packard, jun., M.D.; presented by the Author. 'The Zoologist' for March; by the Editor. 'The Entomologist's Monthly Magazine' for March; by the Editors.

Purchased: — Lepelletier de St. Fargeau et Brullé, 'Histoire Naturelle des Insectes Hymenoptères,' 4 vols. and 4 parts of coloured plates.

Election of Member.

Alexander H. Clarke, Esq., of 16, Furnival's Inn, E.C., was ballotted for, and elected a Member.

Exhibitions, &c.

The Secretary exhibited a box of Lepidoptera and Coleoptera collected in Madagascar and Mayotte by M. François Pollen, of Leyden, by whom they were presented to the Society; perhaps the most interesting insect was Sternotomis Thomsoni, *Buquet.*

Mr. Bond exhibited specimens of a small Ichneumon, parasitic on the larva of Dasypolia templi, no less than 447 having emerged from a single larva.

The Secretary exhibited drawings of the male and female of a species of Phasma, together with the larva and pupa of an Ichneumon which infested the female, and the imago of a species of Chalcididæ which was said to infest the egg of the Phasma; and read the following note, communicated by Prof. Huxley:—

"*Anisomorpha buprestoides.*—This Phasma, found by Titian R. Peale in South America, has come under my observation in the Santa Cruz Mountains, Jamaica, in one locality only, to which it curiously seems confined. As nothing appears to be known of some of its striking peculiarities, it may not be uninteresting to notice in detail the result of an attentive study of its habits and nature. It is of a dirty yellow-ochre colour, with its antennæ, which are long and slender, composed of alternate black and yellowish joints. The male, which is much smaller than the female, is about $1\frac{3}{4}$ inch in length, and the female $2\frac{3}{4}$ inches. The superior wings are rudimentary; the inferior are large, delicate and transparent; and as the latter far exceed the tegmina in size, and therefore require some provision for their defence, the anterior portion is greatly thickened, serving as a plate, beneath which the other part is folded longitudinally. In the prothorax lie two elongated spindle-shaped glands, about one-fourth of an inch in length, which secrete a white fetid fluid. These are surrounded by a network of nerves, by the contraction of which, at the will of the insect, the fluid is discharged through two raised pores which are situated in the anterior portion of the prothorax. When disturbed or attacked they make use of this means of defence, and the pungent odour produced by the milky fluid is as powerful as it is offensive. These insects are rarely seen otherwise than in a state of copulation, the male lying along the back of the female. When feeding, the male leaves his position on her back, still however remaining in apparent sexual contact. The young females are wingless till nearly full grown, and lead a single life up to that period. The larva resembles the imago, but is apterous; the pupa has rudimentary wings. With regard to the habits of these Phasmidæ, they are lucifugous and gregarious. During the day they hide themselves in the holes of trees, and amongst brushwood where it is sufficiently dense to exclude the light, and also in the cellars and behind the boarding of houses. In these nooks they arrange themselves in thick clusters. At dusk they issue forth to feed, and at break of day return to their hiding-places. Their mode of progression is extremely slow, except when alarmed, and they seldom make use of their wings. They are found in greatest numbers in the months of May, June and July. They subsist in this locality entirely upon the leaves of the Bignonia chinensis, which shrub forms a hedge in front of Belmont. Any evening after dark, by the light of a lantern, hundreds of pairs may be counted feeding greedily upon the young leaves of this hedge. It is very interesting to watch the curious and rapid manner in which they cut the leaf, taking a narrow curved strip from right to left, and then eating back as hastily in the opposite direction till the entire leaf is consumed. The eggs of this insect are cylindrical, about one-eighth of an inch in length, tuberculated, with an oval depression on one side, and fitted with a valve at one end which is surmounted by a single tubercle in the centre: they lay them during the day in their hiding-places, one by one. The female is infested by the larvæ of some Ichneumon fly, of which it is to be regretted no specimens have been procured, owing to a series of unlucky accidents happening to the pupæ, just as they had become matured. These larvæ are three-eighths of an inch in length, and are provided with two minute hooks, by means of which they fix themselves to the interior of the insect. As many as seven have been found in one Phasma. Upon being taken out they make vigorous but unsuccessful attempts to creep; becoming partially exhausted as it were from these efforts, they gradually become quiet, and in a few hours they change to a dark brown chrysalis. After remaining in the Phasma until the period arrives for their transformation into the pupa state they find their way out singly and at intervals, and in a few hours assume the chrysalis form. The Phasma appears to suffer no inconvenience, and, what is most curious, no injury from them; it is unknown in what manner they make their egress from the body of the host. The eggs also are victimized in a similar manner by a minute species of Ichneumon fly, one of which has fortunately been obtained; it is probably one of the Chalcididæ: all the transformations take place within the egg, and when fully developed the perfect Ichneumon fly emerges therefrom. No parasitic insects have as yet been found to infest the male. It appears to me that the name Anisomorpha buprestoides is an incorrect appellation, as this Phasma is isomorphous. Perhaps the name of Phasma graveolens would be less open to objection, and it would at the same time express one of its striking peculiarities, *viz.* the offensive fluid secreted by the glands.'—Charles B. King.

Mr. Bates observed that the author of the note was probably in error in attributing the name of Anisomorpha buprestoides to the species in question, which seemed to be a true Phasma.

Mr. F. Smith remarked upon the peculiarity of all the transformations of the Chalcidite parasite taking place within the egg of the Phasma; such a mode of development was novel, if true, but he suspected some error of observation.

Mr. M'Lachlan suggested that the cocoon of the Chalcis had been mistaken for the egg of the Phasma.

Mr. A. R. Wallace requested the assistance of Members in making observations to enable him to clear up a difficult point. Mr. Darwin had arrived at the conclusion that, as a rule in the animal kingdom, brilliant colouring was due to sexual selection: being struck, however, by the apparent exception to this rule presented by the bright hues of many larvæ, principally of Lepidoptera, which, being sexless, could not owe their gaudy attire to sexual selection, Mr. Darwin had inquired whether Mr. Wallace could suggest any explanation of this seeming contradiction of the rule. A theoretical explanation occurred to him, and it was for the purpose of ascertaining whether this theory was well or ill founded that he asked the aid of others. Many caterpillars were mimetic, imitating the leaves or flowers on which they fed, and thus obtaining protection from their enemies; others were hairy or spinose, and were probably thereby preserved from attack; whilst others again possessed neither of these modes of protection, but were conspicuous by their lively coloration. Holding that nothing in nature was without its cause, nothing without its object, and believing in the principle of natural selection or the preservation of the fittest, he concluded that this conspicuous colouring must be in some way useful to those larvæ which were endowed with or had acquired it; but in what way was it useful to them? Just as certain moths were agreeable and others distasteful to birds, so also he did not doubt that certain larvæ were agreeable and others distasteful to birds; but distastefulness alone would be insufficient to protect a larva unless there were some outward sign to indicate to its would-be destroyer that his contemplated prey would prove a disgusting morsel, and so deter him from attack. A very slight wound was sufficient to kill a growing caterpillar, and if seized by a bird, even though afterwards rejected as nauseous, its death would nevertheless ensue; the distasteful larvæ therefore required some distinctive mark, something by which they may be contrasted with and separated from the agreeable larvæ, in order that they might be freed from the attacks of birds. Brilliant coloration would be such a distinction as was required; the larvæ which were attractive to birds, when not exterminated, were doubtless preserved from extinction by other protective qualities; whilst those larvæ which were distasteful to birds, and were not protected either by mimicry, hairiness, offensive smell, or otherwise, might be distinguished by their colour from those upon which birds delighted to feed. Mr. Wallace's suggestion therefore was that, as a rule, the brilliantly coloured larvæ were those which were distasteful to birds: it was on this point that he wished to collect observations and statistics, and he should be glad if any who kept birds, and particularly indigenous birds, would make experiments with different larvæ, to ascertain which were eaten and which rejected.

Mr. Pascoe remarked that toads ate Carabidæ, notwithstanding their offensive smell; and a larva which to one species of bird would be disgusting might to another be attractive.

Mr. J. J. Weir and Mr. M'Lachlan respectively referred to the larvæ of Cucullia and Diloba, both of which were conspicuous, but apparently free from attack.

Mr. Bates suggested that information was also wanted as to what larvæ were most liable to be infested by Ichneumonidæ, and inquired whether amongst the British Lepidoptera there were many, or any, whose larvæ were not subject to the attacks of Ichneumons; and if any, were they conspicuous larvæ?

Papers read.

The following papers were read:—"Notes on the genus Raphidia," by Dr. Hagen, translated from the French by Mr. M'Lachlan. "Description of a new Carabideous insect from Japan," (Damaster auricollis, *n. sp.*), by Mr. Charles O. Waterhouse. "Note on a genus of Dynastid-Lamellicorns, belonging to the family Pimelopidæ," (genus Dipelicus, *Hope*), by Mr. C. O. Waterhouse.

New Part of 'Transactions.'

Trans. Ent. Soc., third series, vol. v., part 5, containing Dr. Wallace's Prize Essay on the Oak-feeding Silkworm from Japan, and being the first part published for 1867, was on the table.

March 18, 1867.

Professor Westwood, Vice-President, in the chair.

Donation to the Library.

The following donation was announced, and thanks were voted to the donor:—'Annales de la Société Linnéenne de Lyon,' vols. 12, 13; presented by the Society.

Election of Members.

Dr. Arthur E. Davies, Royal College of Surgeons, Edinburgh, was elected a Member. M. Barbier-Dickens, 1bis, Rue Paradis Poissonière, Paris, was elected a Foreign Member. F. Archer, Esq., 3, Brunswick Street, Liverpool, was elected an Annual Subscriber.

Catalogue of British Insects.

The Chairman announced that the Council had in contemplation the publication of a general Catalogue of British Insects, but so little attention was paid to the

Diptera that there would be great difficulty in compiling even an approximately complete list of the indigenous species of that Order. Entomologists throughout the United Kingdom were requested to collect Diptera, noting the times and localities, and to assist the Council in the preparation of the Catalogue.

Papers read.

The following papers were read:—"Descriptions of New Species of Cryptoceridæ," by Mr. Frederick Smith. The new species were eight in number, four of the genus Cryptocerus from South America, three of Meranoplus from West Australia, and one of Cataulacus from Borneo.

"On Species and Varieties," by Captain Thomas Hutton, F.G.S. After referring to an assertion by Dr. Bree in 'The Field' newspaper, February 4, 1866, that the identity of the species Attacus Cynthia and A. Ricini "is proved by their breeding together, and by the produce after three or four generations having a tendency to return each to its separate type," an opinion in some measure endorsed by Dr. Wallace, who was "inclined to agree with Dr. Bree that there is but one species, modified by climate, food, and domesticity," Captain Hutton continued as follows:—

"That these opinions are erroneous will, I think, become apparent when we consider that Bombyx Huttoni, which cannot be domesticated, and the cultivated Bombyx Mori of China, two undoubtedly distinct species, will likewise breed together, and produce prolific eggs, as is the case with several other species, so that Dr. Bree's opinion at once meets with a substantial refutation; besides that there being, as he says, a tendency to return each to its separate type, is a contradictory admission that the insects belong to distinct species, since if they belong to separate types they clearly do not belong to the same specific type. Were they of the same species there would be no tendency to revert, because there would be nothing to revert to, and Attacus Ricini when uncrossed by A. Cynthia shows no tendency to revert to that species. The very fact of there being this tendency to revert shows that the species are distinct, and that the cross being contrary to the laws of Nature, an effort is being made by her to cast out the cross and return to the original and separate types. But if the mere fact of species breeding together is to be accepted as a proof of identity, then does Dr. Bree very satisfactorily prove that the horse and the ass are of the same species, and that the apparent degeneracy of the latter is, according to Dr. Wallace's view, to be attributed to modification by climate, food, and domesticity. It may, however, be objected in this case that the progeny are not prolific *inter se*, which greatly alters the case; nevertheless the progeny are prolific if crossed again either by the horse or the ass. I am, moreover, of opinion that the power of producing offspring is not due to the near affinity of *species;* but is altogether dependent upon the fact that the parents, being of the same *genus*, must necessarily possess the very same structural model, without the least reference to or interference with specific characters. But if Attacus Cynthia and A. Ricini are to be regarded as one and the same species, modified by climate, food and domesticity, how comes it to pass that specific characters have been obliterated and others acquired? Diminished brilliancy of coloration might doubtless be induced by climate, food, and other causes, but there would be no change of typical or specific characters, while colour, under an alteration of treatment, might easily be restored; but I would ask, if A. Ricini be only a modified variety of A.

Cynthia, how have the rows of black spots on the larvæ of the latter become obliterated, and the covering of white down on the body of the imago of A. Ricini been acquired? For these black spots are not merely superficial and evanescent marks, which, like the white powder on the body of the larva, can be removed, but are actual typical dermal marks and colouring of structure, and are no more capable of obliteration than are the spots and roses of the leopard and other species. Climate and food could exercise no influence over such marks, because they are imprinted by nature in the epidermis as typical and specific characters, and are always present whether the insect occurs in the temperate mountains of Mussooree or under the tropical sun of Assam, precisely as are the spots on the leopard, whether found in Southern India or bordering on the snows of the Himalaya. Were I to admit that such specific distinctions could be obliterated, and others acquired by a change of food, climate and domesticity, it would reduce me to the necessity of adopting Darwin's theory that our present species were formerly mere varieties of some types that have died out; while if A. Ricini has in truth descended from A. Cynthia and has attained permanent specific characters of its own, which is undoubtedly the case, then can it no longer be considered as identical with A. Cynthia from which it first proceeded as a variety, and thus on the Darwinian principle are the species proved to be distinct, and Dr. Bree's opinion is again refuted. . . . . Experiments instituted in India in 1859, by crossing the wild Himalayan silkworm, Bombyx Huttoni, with the long-domesticated Bombyx Mori of China, Cashmere and Milan, produced the following results. The crossing was reciprocal, the wild female pairing with the domesticated male, and the domesticated female with the wild male. The coupling of the wild male with the domesticated female was effected with the greatest difficulty, and all the eggs thus obtained shrivelled and were unproductive. With regard to the other cross, the difficulty was somewhat less, because the domestic males readily and eagerly sought the females, which however were shy, and several, though not all, produced eggs. Very few of these however were prolific, the greater number, as in the former case, withering and drying. The few larvæ produced from this cross retained all the intractable habits of the wild species, and were accordingly placed upon trees in the open air, where in due time they spun. In the larvæ, cocoons, and moths, there was no perceptible difference from the wild race. Similar experiments were again tried and carried on even to a second cross with the domestic stock, but it was found that, cross as one might, through every stage the insect invariably reverted to the wild B. Huttoni, and neither in appearance nor in habits at all resembled the domestic species. The wild stock then preponderated, and Nature refused to promote the cross. Experiments with B. Mori and B. Crœsi, and others with Attacus Cynthia and A. Ricini, produced exactly the same results, Nature always favouring the strongest or healthiest species. Hence it is evident that Nature, so far from approving of these intercrossings, has in every case shown a strong disposition to revert to the most natural or to the strongest species, and that in every instance she has succeeded. It may be objected that when, as in my opening remarks, I declare that there is no tendency to revert unless the parents are of different species, I contradict my former remarks on the reversion and restoration of the silkworm (see Trans. Ent. Soc., 3rd series, vol. ii.); this however is not the case, for the object of reversion is to cast out something that is unnatural and inimical to a species, so that Nature, in order to preserve her types, always endeavours to cast out the effects of a cross; and where, as in B. Mori, the constitution of the insect has been destroyed by long-continued domestication, the effort is to revert from a sickly to a healthier condition, and not to a different species." The remainder of the paper was a criticism of the Darwinian theory of Natural Selection, the writer's views being principally enforced by arguments beyond the province of the Entomological Society.

April 1, 1867.

Sir JOHN LUBBOCK, Bart., President, in the chair.

Donations to the Library.

The following donations were announced, and thanks voted to the donors:—'Exotic Butterflies,' Part 62; and 'Illustrations of Diurnal Lepidoptera,' Part 3, Lycænidæ, by W. C. Hewitson; presented by the Author. 'On the Data afforded by the Burchellian Collection as to the Geographical and Modificational Ranges of certain Brazilian Insects,' by J. O. Westwood; by the Author. 'The Zoologist' for April; by the Editor. 'The Entomologist's Monthly Magazine' for April; by the Editors.

Exhibitions, &c.

Mr. S. Stevens, on behalf of Mr. Higgins, exhibited six specimens of Damaster blaptoides from Japan: the species appeared to be very local, and to be found only near Nagasaki, whilst its smaller congener D. Fortunei was found in the North of Japan.

Mr. Pascoe exhibited, and read the following description of, a new species of Toxotus from Greece:—

TOXOTUS LACORDAIRII.

"T. (♂) fuliginens, pube griseo-argentea tectus; segmentis duobus ultimis abdominis, femoribusque apicibus exceptis luteis; tibiis anticis et intermediis dimidio basali lutescentibus; antennis basi luteis, articulo tertio quinto longiore.

(♀) mare vix robustior; in toto nigrescens, sparse argenteo-pubescens; tibiis intermediis et posticis articulis basalibus dilatatis; antennarum articulo quinto tertio duplo longiore.

Long. 8 lin.

"The male somewhat resembles T. quercus, but in the comparative length of the joints of the antennæ it is more like T. meridianus. The female is scarcely stouter than the male, and differs from it, as well as from all other European species of the genus, in having the third and fourth joints of the antennæ equal, and the two together not longer than the fifth; as well as in having the basal joints of the four posterior tarsi as broad as the succeeding joints: the same is also the case with the anterior tarsi, but the character occurs in other species. In both sexes the two tubercles on the prothorax are strongly marked and have a slightly linear form.

"I have not dwelt on colour, as that will probably be found to vary. The pair from which the above descriptions were made have been for some years in my cabinet, and were originally obtained at Mr. Stevens's, from a collection made in Greece."

Mr. Edward Sheppard read the following extract from the 'Daily News' of the 29th of March, 1867:—

"According to the Melbourne papers just received, enormous swarms of beetles have been noticed lately in Victoria, Australia. In the early part of January a swarm was noticed near Ararat, in Victoria, flying in a column about twenty yards broad, and keeping in compact order. They cast a dark shadow on the ground, and they were an hour in passing the spot from which they were seen. At a certain point they turned off at right angles. The Eucalypti in the neighbourhood of these insects have been stripped of every particle of foliage. Great numbers of the beetles fall to the ground during the flight. The noise they make while flying is like that of a hurricane playing in the rigging of a ship. The colour of these beetles is a dark bronze."

Mr. Bates said that Anoplognathus was found amongst Eucalypti, but he thought the insect referred to was more probably a grasshopper than a beetle: it was not probable that Coleoptera would thus migrate in swarms.

Mr. Weir and Mr. Wallace referred to the clouds of Coccinellæ which were commonly observed in the hop-growing districts of Kent.

Mr. M'Lachlan mentioned that Dr. Brauer had recently described, under the name of Pharyngobolus Africanus, the earlier stages of a species of Œstridæ, the larva of which had been detected in the throat of the African elephant.

Mr. F. Smith exhibited an ichneumon, Rhyssa persuasoria, placed in his hands by Mr. Bond, which appeared to have worked its long ovipositor, bradawl-fashion, through a piece of fir-wood, in quest of the larva of Sirex juvencus, on which it is parasitic; part of the ovipositor had been left in the wood. Mr. Bond had some years ago found at Bournemouth two ichneumons with their ovipositors so firmly fixed into wood that he was unable to remove them. Mr. Smith had always hitherto supposed that the Rhyssa inserted its ovipositor into the holes made by the Sirex, instead of making a hole for itself in the tree: if the latter were the rule, how did the ichneumon detect the presence of the larva within the wood, and know where to insert its ovipositor? Mr. Edward Doubleday, however, had told him that he had seen twenty or thirty specimens of the female of a Pelecinus which had perished with their elongated abdomens inserted into the stem of a tree, whence they had been powerless to extract them; the male had a clavate abdomen, but that sex had never been met with by Mr. Doubleday.

Mr. Bates inquired whether an ovipositor was not, homologically, a modification of one of the abdominal segments.

Mr. Smith thought it was rather a modification of the aculeus.

Mr. Wallace suggested the converse, namely, that the sting was a modified ovipositor, and that its use as a weapon of defence was a secondary and acquired use.

Mr. G. S. Saunders exhibited a number of Poduridæ, found near Stokesley, in pools or puddles consequent upon the melting of the snow, which had recently lain on the ground in the North of Yorkshire for two or three weeks.

The President believed them to be Podura (Anura) tuberculata of Templeton, though their shrivelled state rendered them difficult to identify with certainty.

Mr. Wallace mentioned that he had received a letter from Mr. Jackson Gilbanks, of Whitefield Castle, Wigton, on the subject of the distastefulness to birds of brightly coloured larvæ; the writer had frequently observed the dislike, or rather the "abhorrence and dread," of pheasants, partridges, young wild ducks and tomtits for the "gooseberry caterpillar:" it did not, however, clearly appear whether the writer referred to the larva of Abraxas or the grub of Nematus.

Paper read.

Professor Westwood communicated a paper entitled "Descriptions of New Species of Mantispidæ in the Oxford and British Museum."

May 6, 1867.

Professor Westwood, Vice-President, in the chair.

Donations to the Library.

The following donations were announced, and thanks voted to the donors:— 'Proceedings of the Royal Society,' No. 89; presented by the Society. 'Proceedings of the Holmesdale Natural History Club for the year 1865-66;' by the Club. 'List of Coleoptera collected in the Mountains of Lycoming County,' 'List of Coleoptera collected near Fort Whipple, Arizona, by Dr. Elliott Cones, in 1864-65,' 'Additions to the Coleopterous Fauna of the United States,' No. 1, and 'Revision of the Dasytini of the United States;' by the Author, Dr. J. L. Leconte. 'Muscardine,' and 'Revue de Sériciculture Comparée,' for 1863-64-65-66 (Nos. 1—9); by M. Guérin-Méneville. 'Essai d'une Faune Monographique de l'Archipel Indo-Néerlandais, I. Monographie des Scutellérides, II. Monographie des Piérides;' by the Author, M. S. C. Snellen van Vollenhoven. 'Natural History of the Tineina,' vol. ix.; and 'The Tineina of Syria and Asia Minor;' by the Author, H. T. Stainton, Esq. 'A Monograph of the British Psocidæ;' by the Author, R. M'Lachlan, Esq. 'Stettiner Entomologische Zeitung,' 1867, Nos. 4—6; by the Entomological Society of Stettin. 'The Zoologist' for May; by the Editor. 'The Entomologist's Monthly Magazine,' for May; by the Editors. W. S. Macleay, 'Illustrations of the Annulosa of South Africa;' Chenu, 'Encyclopédie d'Histoire Naturelle,' Coléopterès, vol. i.; Blanchard, Castelnau and Brullé, 'Histoire Naturelle des Insectes;' Hentschius, 'Epitome Entomologiæ Systematicæ secundum Fabricium;' 'Prodromus Lepidopterorum Britannicorum,' by a Fellow of the Linnean Society; Schmiedleins, 'Einleitung in die nähere Kenntnis der Insectenlehre;' Panzer, 'Deutschlands Insectenfaune oder Entomologisches Taschenbuch für 1795;' Nees von Esenbeck, 'Hymenopterorum Ichneumonibus affinium Monographiæ;' Fuessly, 'Archives of Entomology;' Humphreys, 'The Genera and Species of British Butterflies;' presented by J. W. Dunning.

Election of Members.

J. Sidebotham, Esq., of 19, George Street, Manchester, was elected a Member.
M. S. C. Snellen van Vollenhoven, of Leyden, was elected a Corresponding Member.

Exhibitions, &c.

Mr. S. Stevens exhibited a number of Australian Coleoptera, chiefly Carabidæ, selected from a collection sent by M. Damel, from the district of Cape York.

Professor Westwood had recently received from a correspondent in New South Wales six or eight Cimicidæ of the family Reduviidæ (probably Enicocephalus tasmanicus, *Westw.*, Tr. Ent. Soc. ii. 24), which were described as flying, or rather dancing, in the air like midges, and which possessed a pleasant musk-like scent, which communicated itself to the letter in which they were enclosed.

Mr. Stainton exhibited cases of Coleophora lixella, the larva of which, when young, was found to feed on Thymus serpyllum, but afterwards transferred itself to a species of grass: cases were shown which were found on grass, but composed of portions of the leaf or calyx of thyme.

Mr. Stainton had intended to have also exhibited the larva of Hyponomeuta egregiella, but the specimen had, during the afternoon, begun to spin up in the box, and was invisible: the larva had been previously found by M. Millière, at Cannes, on Erica scoparia, and a month ago Mr. Stainton detected it at Fontainebleau, on Erica cinerea.

The Secretary read a letter from Mr. R. W. Fereday, Corresponding Member, of Christchurch, Canterbury, New Zealand, dated 4th of February, 1867, from which the following is an extract:—

"I have much satisfaction in communicating to the Society the capture of a specimen of Cynthia Cardui, in the province of Canterbury, on the 5th January last. The plains of Canterbury are separated from the west coast of the island by a range of mountains; one of these is named Mount Torlesse, and is about 6000 feet above the level of the sea: immediately adjoining are some lower hills, and it was at the summit of one of these, about 3000 feet above the sea, that I met with this butterfly, and made the capture. It was flying about and settling on a piece of rock, the herbage up to the top of the hill being tolerably luxuriant amongst the stones. It is the only specimen I have seen, and have not heard of any one else having seen one in this colony. It is so precisely like my English specimens in size, colour and markings, with one exception, that I entertain no doubt of the identity of the species. I attribute the exception to a local variation; it is with respect to the round spots on the hind wings, which in my British specimens have no distinct centres, whilst in this specimen ocelli take the place of mere spots; it is, as it were, a spot of bright light blue, the same colour as the small blue marks at the anal angle of the hind wings, introduced into the centres of the normal spots of the English specimens. I enclose a photograph of it. I do not recollect whether any of the British examples have the blue centres to the spots. If the insect is Cynthia Cardui, of which I do not entertain a doubt, this capture is important, as it will add the link which will complete the circuit of the globe in the range of this species."

Mr. Bates observed that all the Australian specimens of Pyrameis Cardui have ocellate spots on the hind wings, like Mr. Fereday's New Zealand example; it was a local modification, which, being constant, went to show that there had not been any recent immigration of the species into Australia or New Zealand. With regard to the supposed universal distribution of P. Cardui, Mr. Bates thought this was an error: the typical form of the species, no doubt, occurred in Europe and North America, in Asia and Java, and in South Africa, and the above-mentioned race occurred in Australia and, as now appeared, in New Zealand; but the South American specimens which were reputed to be P. Cardui were, in fact, a rosy variety of P. Huntera.

The Secretary read a letter from Mr. C. A. Wilson, Corresponding Member, dated Adelaide, 27th of February, 1867, in which the writer gave the following account, on the authority of his brother, Mr. Theodore Wilson:—"One day in December last, while stopping for a while under a tree at Cockatoo Valley, I saw a centipede actually slain by the heat. He dropped from a branch of the tree under which I was standing, and immediately made off at a great rate to find shelter, but he unfortunately came upon a piece of sand which was so intensely hot that he could not make any headway; his pace became slower, he turned about and savagely bit the leaves and sticks near him, then struggled, turned on his side, and gave up the ghost. In a minute or two he was shrivelled up like a piece of bark. I felt the sand where he was; it was so hot that it would have blistered my fingers had I kept them there a short time." Mr. C. A. Wilson also announced the discovery, by Mrs. Kreusler and Mr. Odewahn, of Gawler, of a species of Xenos, being the first time that a Strepsipterous insect had been detected in Australia.

Mr. Frederick Smith had received from Mr. F. G. Waterhouse, of Adelaide, and exhibited to the Meeting, specimens of Paragia decipiens, upon which the Xenos was parasitic, and read the following note:—

"In the Transactions of the Society (2nd series, vol. v., p. 127) will be found a paper on the geographical distribution of the Stylopidæ: it is there shown that aculeate Hymenoptera from all quarters of the globe have been attacked by some members of that parasitic family; it also appears to be proved that these attacks are most general among the genera of the families of Fossores and Vespidæ. Among the Apidæ these attacks are confined to the Halicti and Andrenidæ; it is true that the genus Bombus has been mentioned as having been subject to attack, but this circumstance requires confirmation. Numerous instances have been recorded of attacks on species of the genera Sphex and Pelopæus, but they have been observed to occur most frequently among the Vespidæ. Stylopized Hymenoptera have been found in Europe, India, China, Celebes, Mauritius, Gambia, Brazil, Chili, North America, and Canada, and a single instance has been noticed in Tasmania, but at the time of the publication of my paper (1859) no instance of attack had been discovered in Australia. A recent communication from that country has been received by Mr. Waterhouse, announcing the discovery of a hymenopterous insect attacked by one of the Stylopidæ. The insect in question is the Paragia decipiens of Shuckard: it was taken by Mrs. Kreusler on the Gawler River, Adelaide, South Australia: specimens of the wasp were forwarded by letter; the Stylops is described as having four-jointed furcate antennæ, belonging probably to the genus Xenos, or to a genus closely allied. This is, I believe, the first notice of the capture of one of the Stylopidæ in Australia. Of the four specimens of Paragia sent, number one has the remains of a male pupa-case beneath the third segment of the abdomen; the second and third specimens are similarly attacked; the fourth specimen has portions of two male pupa-cases beneath the third segment. It is rather remarkable that no female Stylops is found, as in British Hymenoptera they are found in the proportion of at least ten or twelve to one male."

Professor Westwood mentioned that a Homopterous insect captured by Mr. Wallace appeared to have upon it the remains of a Strepsipterous insect, and it would be within the recollection of Members that Herr Nietner had found stylopized ants in Ceylon.

Paper read.

Mr. Bates read a paper "On a Collection of Butterflies formed by Thomas Belt, Esq., in the interior of the Province of Maranham, Brazil." During three months of the year 1866 spent at the gold mines of Montes Aureos, Mr. Belt obtained no less than 364 species of butterflies; of these nine were described as new, and the paper contained some interesting observations on distribution, variation and mimicry. One new genus was characterized under the name of Pseudopheles, allied to Pheles and Esthemopsis.

New Part of 'Transactions.'

Trans. Ent. Soc., third series, vol. v., part 6, being the second part published in 1867, was on the table.

June 3, 1867.

Sir John Lubbock, Bart., President, in the chair.

Donations to the Library.

The following donations were announced, and thanks voted to the donors:— 'Annales de la Société Entomologique de France,' for 1866; presented by the Society. 'The Journal of the Royal Agricultural Society,' 2nd Series, Vol. iii. Part 1; by the Society. 'Proceedings of the Entomological Society of Philadelphia,' Vols. iv. and v., and Vol. vi. No. 1; by the Society. 'Verhandlungen der K. K. zoologisch-botanischen Gesellschaft in Wien,' Vol. xvi.; by the Society. 'Characters of some New Genera of the Coleopterous Family Cerambycidæ,' by Francis P. Pascoe, F.L.S , &c.; by the Author. 'The Zoologist' for June; by the Editor. 'The Entomologist's Monthly Magazine' for June; by the Editors.

Exhibitions, &c.

Mr. Pascoe exhibited some Coleoptera from Graham's Town, collected by Mr. Schiffman; amongst them were a new Pycnopsis, a new Ceroplesis, three new species of the European genus Stenidea, a new form of Rhipiceridæ, a new genus of Prionidæ belonging to Lacordaire's "groupe Closterides," and a new genus allied to Cerambyx.

Mr. T. W. Wood (who was present as a visitor) exhibited several specimens of Vanessa Milberti from British Columbia, all agreeing in this particular—that the light coloured scales of the wings appeared to have been abraded, suggesting the notion that the light-coloured scales had been less firmly attached than the dark-coloured.

Mr. Stainton exhibited the larva, pupa and imago of Earias siliquana, sent to him by Professor W. C. Williamson, of Manchester, who wrote as follows:—"The moth has almost destroyed the cotton crops in Egypt; it eats into the ovary of the flower in its early larval state, and goes into chrysalis in the cotton-ball, utterly destroying the cotton. Its ravages have extended over both Upper and Lower Egypt. The moth is of a bright green colour, like our little English prasinana of the oak; can you identify it? The insects have come to me through the Foreign Office and the Manchester Chamber of Commerce." Mr. Stainton observed that the moth had hitherto been considered a great rarity, and he had been able to identify it as the Earias siliquana of Herrich-Schäffer by the aid of two specimens lately brought from Egypt by Mr. Pickard-Cambridge; Dr. Staudinger, when compiling his Catalogue of European Lepidoptera, did not possess a specimen. The insect was closely allied to the Earias chlorana of this country, which feeds in the terminal shoots of osiers.

Mr. Bond exhibited a small moth, belonging to the Tortrices, captured during the preceding week, in Darenth Wood, by Mr. E. G. Meek, and which he believed to be new to the British list.

Mr. Bond also exhibited a variety of Adela DeGeerella (male), captured at Charlton in 1866, and having the wings entirely suffused with bright golden.

Mr. F. Smith exhibited an old razor-case in one of the compartments of which was a nest of Odynerus quadratus: the case had been allowed to lie on a shelf near an open window, and entry was effected through a hole in the bottom. In August, 1866, it was sent to Mr. Smith, with a request that he would name the occupant; but he was then unable to determine the species, as several wasps of the genus Odynerus were known to construct similar nests in crevices of old walls, holes in posts, and frequently in banks; and various instances of the construction of their nests in odd situations were on record. Thus Prof. Westwood had mentioned an instance of O. quadratus building its nest in the folds of a piece of paper; Mr. Curtis had discovered a nest of O. parietum on the top of a book; and a friend of Mr. Smith's had once brought him an octave flute, which had been left in an arbour during a few days' absence, and in the bore of which O. quadratus had built its mud-cells. The cells constructed in the razor-case produced ten males and four females; the cells were placed in various positions, necessitated probably by the form of the case and the confined space; the four female cells and six of the male cells were placed transversely, the rest were in a longitudinal direction; one cell was empty, and was placed obliquely to the sides of the case. The development of the insects was as follows: on the 20th of March, 1867, they were still in the larva state; by the 10th of May they had changed to pupæ; on the 22nd of May six males came forth; on the 25th three males; on the 30th one male; on the 1st of June three females appeared; and on the 3rd another female. Not a single parasite was obtained. Mr. Smith added that he had bred most of the species of Odynerus, and had found that the number of males always exceeded the number of females, in the proportion of three to one, or thereabouts.

Prof. Westwood was able to add another instance to the list of curious localities for wasps' and bees' nests. Mr. Higgins had a Peruvian drinking-vessel in the form of some uncouth imaginary quadruped, the mouthpiece being in the back of the animal, and in this cup, at the extremity of one of the creature's legs, a bee had built its nest.

Mr. M'Lachlan remarked that he had recently seen the male (S. linearis, *Klug*) of the sawfly, Strongylogaster cingulatus, in some numbers near Croydon; although the female was generally very abundant, the male was very rarely seen. He alluded also to the apparent total absence of males of many species of Tenthredinidæ, as, *e.g.*, in Selandria stramineipes, the females of which were universally abundant, in company with the Strongylogaster, on the young fern in spring. It would almost seem as if these were cases of parthenogenesis.

Mr. Janson mentioned Tomicus villosus as a nearly parallel case among the Coleoptera; it was true Ratzeburg figured an insect which was said to be the male, but, though myriads of the female were found annually, he believed that the male had never been detected in this country.

The President exhibited a specimen of one of the wingless Diptera which he had found at Farnborough, Kent, under bark, in company with Thysanura. He believed it to be the Epidapus venaticus of Haliday (see Walker, Ins. Brit. Diptera, iii. 56).

Mr. S. Stevens exhibited specimens of Gordius aquaticus [but see below], numbers of which were that morning observed on the ground in his garden at Kennington after the heavy rain of the previous night. A nephew of his had also seen the Gordius at Ashford on rose-trees. Mr. Weir had noticed them at Brixton, and Mr. Bond near the Regent's Park, on bushes.

Prof. Westwood enquired whether any Member present had noticed any constant variation in colour, or markings, or other external character, by which the sex of larvæ could be determined? Mr. F. Smith said that he had once found a lot of Anthophora larvæ, which, instead of the usual ivory-white, were of a saffron-yellow colour; but they produced male and female Anthophoræ indiscriminately. Mr. Stainton remarked that larvæ of Chœrocampa Elpenor and Porcellus occurred of two different colours, but he could not say whether the differences were sexual. Mr. Bond, however, had kept the two forms of C. Elpenor separate, and each form had produced both sexes.

July 1, 1867.

Sir John Lubbock, Bart., President, in the chair.

Donations to the Library.

The following donations were announced, and thanks voted to the donors:—'Exotic Butterflies,' Part 63, by W. C. Hewitson; presented by the Author. 'The Entomologist's Monthly Magazine' for July; by the Editors.

Election of Member.

Dr. George William Davidson, of 13, Union Place, Edinburgh, was ballotted for, and elected a Member.

Exhibitions, &c.

Mr. Busk (who was present as a visitor) mentioned, on the authority of Dr. Cobbold, that the small worm exhibited at the previous Meeting was not Gordius aquaticus, but Mermis nigrescens.

Mr. M'Lachlan exhibited Ciniflo ferox from Folkestone, where that spider had been captured by Dr. Knaggs; and living specimens of a spider and a large centipede, which were found in the hold of a ship recently arrived from Manilla with a mixed cargo, principally consisting of sugar and hemp.

The Secretary exhibited branches and the fruit of an orange-tree infested with some insect, with regard to which information was requested by Mr. Charles Moore, Curator of the Botanic Garden, Sydney, New South Wales. Prof. Westwood discovered two species of Coccus upon the branches, but was unable to detect anything but mould upon the fruit.

Mr. Stainton exhibited a collection of Micro-Lepidoptera obtained from the larvæ which he had collected whilst at Cannes and Mentone in February and March: the collection comprised upwards of thirty species, amongst which may be specially mentioned a fine series of Depressaria rutana, from larvæ on Ruta angustifolia on the rocks at Monaco; a specimen of Phibalocera quercana, bred from Arbutus; two species of Gelechia, bred from larvæ feeding on Silene Nicæensis, and forming sand-cocoons amongst the roots of that plant (one species being probably identical with our G. marmorea); a new species of Zelleria, allied to Z. hepariella, for which M. Millière proposes the name of Phillyrella, bred from the flowers of Phillyrea angustifolia; and a Nepticula, bred from the cork-tree. Mr. Stainton remarked that, in addition to the species bred, there were a number of different larvæ which he failed to rear, and among them was another species of Nepticula on the cork-tree with a very peculiar mine.

The Hon. Thomas De Grey exhibited Eupœcilia anthemidana and E. rupicola from Norfolk; and mentioned that he had on the previous day captured in Kent five specimens of Hypercallia Christierninana.

Mr. A. R. Wallace exhibited a collection of Malayan Cetoniidæ, in illustration of the paper mentioned below.

Papers read.

"Observations on Dzierzon's Theory of Reproduction in the Honey-bee," by Mr. John Lowe, of Edinburgh. With a view to test the truth of the theory that "all eggs which come to maturity in the two ovaries of a queen-bee are only of one and the same type, which when they are laid without coming in contact with the male semen, become developed into male bees, but, on the contrary, when they are fertilized by male semen, produce female bees," from which theory, if true, we might, in the words of Von Siebold, "expect beforehand that by the copulation of a unicolorous blackish brown German and a reddish brown Italian bee, the mixture of the two races would only be expressed in the hybrid females or workers, but not in the drones, which, as proceeding from unfecundated eggs, must remain purely German or purely Italian, according as the queen selected for the production of hybrids belonged to the German or Italian race," the writer set to work to obtain hybrids between Apis mellifica and Apis Ligustica, and also between Apis mellifica and Apis fasciata, and the result of his experiments was that Ligurian queen-bees fertilized by English drones and Egyptian queen-bees fertilized by English drones, both produced drones which, as well as the workers, were hybrid in their characters, and bore unmistakeable evidence of the influence of the male parent. From this the Author drew the conclusion that the eggs of a queen-bee which has been fertilized by a drone of another race, whether they develope into drones or workers, are in some way affected by the act of fecundation, and that both sexes of the progeny partake of the paternal and maternal character or race; from which it followed that Dzierzon's was not the true theory of reproduction in the honey-bee. Specimens of the hybrids were exhibited to the Meeting, and Mr. Frederick Smith (who did not consider Apis Ligustica to be specifically distinct from Apis mellifica), after an examination of the specimens, corroborated Mr. Lowe's statement that the hybrid drones distinctly showed characters peculiar to Apis mellifica in combination with the characters which distinguish A. Ligustica and A. fasciata respectively.

"A Catalogue of the Cetoniidæ of the Malayan Archipelago, with Descriptions of the New Species," by Mr. A. R. Wallace. In this Catalogue 181 Malayan Cetoniidæ are enumerated, 70 of them being described as new. The following are brief diagnoses of the novelties:—

Heterorhina Florensis.—Nigra, nitida; thorace utrinque macula magna triangulari rubra; elytris singulis macula magna oblonga subquadrata flavo-testacea; ♂ cornubus duobus divergentibus, recurvatis. ♂ 11 lin., ♀ 10 lin. Flores.

H. Malayana.—Nigra, nitida; thorace lateribus et fascia lata postica rubris; elytris singulis macula magna elongata flavo-testacea; femoribus rubris; ♂ cornubus duobus rectis, non divergentibus, sed apicibus dilatatis. ♂ 11 lin. Penang.

H. nigrotestacea.—Nigra, nitida; clypeo quadrato, integro; capite cornu parvo depresso; elytris macula magna quadrata testacea, ad suturam interrupta; subtus immaculata, processu sternali longo incurvato. 9 lin. Malay Peninsula, Siam.

H. Borneensis.—Viridis; thorace punctato, macula magna centrali nigra; elytris rubro-nigris, fasciis una mediana alteraque apicali viridibus; capite cornu parvo dilatato, clypeo rotundato, recurvato, minime emarginato. 9 lin. Borneo.

H. mitrata.—Præcedenti similis, sed cornu acuto et clypeo elongato, bidentato. 10 lin. Penang.

H. modesta.—Nigra, elytris singulis macula magna obliqua viridi-sericea; clypeo quadrato, margine antico integro, vertice obscure carinato. 9 lin. Tondano, Celebes.

Clinteria Bowringii.—Nigra, opaca, elytris singulis macula magna laterali roseo-cinnabarina. 7 lin. Java.

C. Malayensis.—Nigra, subtus nitida, supra opaca, subænea; thorace punctis 4, elytris singulis maculis 2 flavis, una magna, altera apicali minore. 6½ lin. Penang.

C. Flora.—Supra nigro-brunnea; thorace punctis 2 et macula marginali fulvo-luteis; elytris singulis fascia lata longitudinali brunneo-rufa, punctis 2 discalibus maculisque marginalibus et apicalibus fulvo-luteis. 7 lin. Flores.

Agestrata Parryi.—Subconvexa, læte viridis, subtus viridi-cuprescens; tibiis cupreis, apicibus nigris; tarsis rufo-cupreis, nigro-terminatis; antennis nigro-rufis. 27 lin. Borneo.

Lomaptera striata.—Viridis, lata, subconvexa; pygidio conoideo, transverso, compresso, vix carinato; thorace punctato; elytris punctato-striatis; tarsis viridi-cupreis. 15—17 lin. Borneo, Penang.

L. Timoriensis.—Nigra, polita; thoracis disco tenuiter punctato; elytris lateribus distincte, disco obsolete punctato-striatis; pygidio conoideo, obtuso. 10—12 lin. Timor.

L. agni.—*L. pullæ* simillima; viridi-ænea vel purpurea, subtus magis purpurea, nitidissima; thorace valde lobato, scutellum tegente; elytris lateribus rugosis; corpore subtus lævi, processu sternali longo, recto, apice incurvato. 15 lin. Penang.

L. Esmeralda.—Intense viridis; thorace lævi, lateribus punctatis; scutello distincto; elytris basi lævibus, deinde punctatis et rugoso-striatis: processu sternali elongato, incurvato. 12 lin. "N. Hebrides, Solomon or Fidji Is.'

Lomaptera Ceramensis.—*L. Arouensi* simillima et ejusdem staturæ; viridi-ænea, tenue punctata; pedibus pilis rufis vestitis. Ceram.

L. Cambodiensis.—Præcedenti simillima, sed clypeo minus punctato, scutello minimo, elytris in medio transverse subangulatis, et processu sternali magis recto. 13 lin. Cambodia.

L. concinna.—Minor, nitide viridis; elytris punctato-substriatis; pedibus, antennis, clypei apice, et abdominis segmentis 2 ultimis, purpureo-cupreis. 10¾ lin. Aru.

L. australis.—Læte virens, nitida; elytris tenuissime transverso-striatis; ♂ pygidio conoideo, tibiis anterioribus inermibus. 13—15 lin. Cape York, Lizard Island.

L. inermis.—Viridis; capite, pedibus, pygidio et elytrorum apice viridi-rufis; tibiis rufis, anterioribus inermibus. 14 lin. New Guinea.

Plectrone, n. g.—Differs from *Chalcothea* in the form of the thorax and elytra, and in the remarkably spurred hind tibiæ of the male. (Includes *Macronota nigro-cærulea*, Waterhouse, and *M. tristis*, Westwood).

Macronota Celebensis.—Rufo-castanea, glaberrima; corpore et abdomine, thorace et elytris in medio, antennis et tarsis, nigris; scutello, elytrorum singulorum macula in medio alteraque ad apicem, fasciisque subtus lateralibus, luteis. 10 lin. Tondano, Celebes.

M. castanea.—Nigra, nitida; elytris disco late castaneis, lateribus sparse punctatis, postice ad suturam striatis, subtus pilis nigris vestitis. 9 lin. Macassar, Celebes.

M. nigerrima.—Nigra; clypeo minime emarginato; thorace convexo, subheptagono, bituberculato, rugoso-punctato; elytris basi latis, abrupte attenuatis, ad suturam depressis et valde striatis, pone humeros elevatis et foveolatis, lateribus transverse rugosis. 7½ lin. Menado, Celebes.

M. vidua.—Nigra; thorace creberrime punctato, linea mediana punctisque 4 albis; elytris punctatis et striatis, maculis 12 parvis albis. 7 lin. Philippine Islands.

M. guttulata.—Nigra; elongata et attenuata; elytris costatis, punctis albis rotundatis sparsis decoratis. 8½ lin. Philippine Islands.

M. variegata.—Nigra; thorace tricarinato, interstitiis crusta rugosa cinereo-fulva vestitis; elytris subplanis, nigro rubro et cinereo variegatis, subtus rude punctatis, lateribus cinereo-aureis. 8 lin. Penang.

M. cervina.—Lata, plana, fulvo-cinerea; capite parvo, antice vix emarginato; thorace heptagono, carina mediana postice abbreviata, alterisque lateralibus conniventibus; elytris maculis 4, striis 2 lateralibus alterisque basalibus, nigris; pygidio maculis 2 rotundatis, nigris. 6½ lin. Malay Peninsula.

M. corticalis.—Rufo-ochracea, pallida; capite linea nigra mediana, clypeo nigro, integro; thorace grosse punctato; elytris planis, valde striato-rugosis, maculis parvis 5 subquadratis, nigris. 7 lin. Penang.

M. thoracica.—Elongata; capite et thorace aureo-fulvo vestitis; elytris nigris, undulatis et carinatis, punctatis, singulis maculis 4 fulvis; antennis pedibusque rufis. 9 lin. Tondano, Celebes.

M. Mouhotii.—Nigra, creberrime punctata, dense hirsuta; thorace medio, scutello toto, elytris singulis maculis 4 suturaque in medio, et pygidio macula rotundata, aureo-rufis. 8 lin. Siam, Cambodia.

M. carbonaria.—Nigra, obscura; clypeo elongato, emarginato; thorace heptagono, convexo, punctato, postice in medio rotundato; elytris subplanis, basi dilatatis, postice attenuatis, striis 4 abbreviatis; sterno convexo, processu parvo, mucronato. 9 lin. Java.

Macronota marmorata.—Ochraceo-cinerea; thorace macula subannulari nigra; elytris nigro marmoratis et maculatis; pygidio maculis 2 nigris; antennis, tibiis tarsisque nigris; tibiis posticis spinis 2 terminalibus, dilatatis, foliaceis. 9½ lin. Sarawak.

M. Annæ.—Nigra; thorace marginibus et lineis 2 divergentibus cinereo-fulvis; elytris fulvo-rubris, tertia parte apicali nigra, lineis 3 transversis et sutura apicali cinereo-aureis. 7½ lin. Penang.

M. antennata.—Nigra, lanugine flavescente vestita; thorace Y-signato; elytris rufo undulato-fasciatis, sutura in medio punctisque 6 albo-flavis. 4 lin. Penang.

Schizorhina Aruana.—*S. Whitei* similis, sed minor, elongata, purpureo-cuprea, luteo-maculata; elytris lineis punctorum 6 ornatis. 9 lin. Aru.

S. Bouruensis.—*S. Whitei* similis, sed colore viridi obscuriore, thorace immaculato, et elytris linea suturali interrupta. 10—11½ lin. Bouru.

Anacamptorhina fulgida.—Æneo-aurata, fulgida, tibiis rubro-cupreis, tarsis nigris; ♀ clypeo vix emarginato, elytris singulis striis 4 punctatis. 9½—10½ lin. New Guinea.

Euryomia rustica.—Lata, convexa, nigra; elytris postice maculis 2 rotundatis et epimeris ochraceis; pygidio et corpore subtus ochraceis, abdomine basi et sterno in medio nigris. 7½ lin. Sarawak.

E. raja.—Forma ut in *E. rustica*, supra viridis; clypeo tumido; thorace antice albo-marginato; elytris fasciis 10 brevibus marginalibus; epimeris, pygidio, et corpore subtus cinereo-argenteis. 9½ lin. Penang.

E. trivittata.—Depressa, nigra; thorace vitta mediana alterisque lateralibus inæqualibus rubris; elytris maculis 2 subquadratis rubris. 7½ lin. Bouru, Moluccas.

E. cincta.—Nigra; thorace rugoso-punctato; elytris striatis, lateraliter punctatis, post medium linea alba interrupta, interdum macula basali magna fulvo-rubra. 7—8 lin. Penang.

E. bella.—*E. regali* similis, sed major, scutello nigro, elytris lineis rubris interruptis et maculis 2 apicalibus sanguineis. 8 lin. Batchian.

E. Celebensis.—Nigra, supra opaca; thorace angulis externis sanguineo-marginatis; elytris maculis 4 et epimeris aureis; subtus immaculata, aut macula utrinque abdominali basali alba. 7 lin. Celebes, Macassar, Tondano.

E. æthiessida.—Nigra, subtus nitida, supra opaca; thorace maculis 2 anterioribus fulvis; elytris maculis 4, fasciam transversam formantibus; subtus maculis 16 ovatis albis ornata. 7 lin. Philippine Islands.

E. papua.—Nigra, supra opaca; thorace punctato; elytris striatis et impressis; pygidio fere toto aurantiaco; subtus abdomine maculis 4 utrinque elongatis albis. 7 lin. New Guinea, Mysol.

E. lateralis.—Supra obscure purpureo-nigra, subtus nigra, nitida; elytris striatis, lateribus striato-punctatis, maculis fulvo-ochraceis marginatis; subtus corpore toto maculis marginalibus aureo-fulvis vel ochraceis. 7 lin. Ceram.

E. perviridis.—Viridis, supra opaca, subtus (cum clypeo) nitens; thorace immaculato; elytris punctato-striatis, singulis maculis 4 vel 5 marginalibus rufo-ochraceis; pygidio et corpore subtus rufo-ochraceo maculatis; antennis et tarsis nigris. 7—8½ lin. Amboyna, Ceram, Matabello.

Euryomia tenera.—*E. Malayensi* similis, sed minor; elytris apicem versus maculis linearibus 6 vel 8 albis; subtus thorace et corporis lateribus albis. 6½ lin. Penang, Java.

E. aspera.—Obscure viridis; thorace grosse punctato; elytris punctatis et striatis, asperis, maculis 6 marginalibus et apicalibus albis. 6 lin. Penang.

E. Moluccarum.—Forma ut in *E. Malayensi*, supra viridis; clypeo nigro; thorace punctis 2 discalibus maculisque lateralibus (sæpe obsoletis), et elytris singulis punctis 3 discalibus et 4 vel 5 marginalibus, ochreo-flavis; epimeris ochreis; subtus nigra, lateribus aureo-flavo maculatis. 8—9 lin. Batchian, Gilolo, Kaioa, Morty, Celebes.

E. vernalis.—Supra læte viridis, opaca; elytris singulis maculis 4 vel 5 marginalibus ochreis; subtus nigra, nitida, convexa, lateribus crusta rufo-ochrea vestitis. 8 lin. Philippine Islands.

E. Bowringii.—*E. rufovittatæ* similis, sed major, thorace immaculato, elytris lineis brevibus marginalibus et punctis apicalibus albis. 7 lin. Borneo, Penang.

E. sinuata.—*E. teneræ* similis, viridis; elytris ♀ ad apicem valde sinuatis, singulis maculis 6 parvis albis; subtus nigra, lateribus albo-maculatis. 6 lin. Malacca, Borneo.

E. labecula.—Viridis; clypeo nigro; capite maculis 2, thorace 2 vel 4, elytris singulis 8, albis; subtus nigra, maculis lateralibus albis. 6 lin. Macassar, Celebes.

E. incerta.—Nigra, supra viridi-obscura vel viridi-rufa, sæpe rufo-varia; thorace albo-marginato, sæpe bipunctato; elytris maculatis, pone medium maculis 4 in fasciam curvatam dispositis. 5 lin. New Guinea, Waigiou, Mysol, Aru, Timor.

E. fulvipicta.—Viridis; capite lineis vel maculis lateralibus, thorace marginibus lateralibus, et elytris singulis vitta obliqua, macula magna marginali, fasciaque curvata apicali, fulvis; pygidio infra fulvo-marginato; subtus viridi-nigra, thorace antico, sterno, et abdomine late fulvo-aureo marginatis, processu sternali dilatato; antennis rufis, pedibus rufis vel nigris. 6 lin. Ceram, Amboyna.

E. cretata.—Nigra, thorace lateribus et maculis 2 rotundatis albis; elytris obscure viridibus, regione suturali apicem versus nigra, singulis maculis 4 linearibus et 5 subrotundatis cretaceis; subtus lateribus argenteis. 5 lin. Macassar, Celebes.

E. aromatica.—Obscure viridis; thorace bipunctato; elytris singulis maculis 5 vel 6, una mediana lineari, altera marginali gemina; subtus nigro-viridis, hispida, processu sternali valde dilatato. 6 lin. Batchian, Morty, Kaioa.

E. Penanga.—Nigra, parva, subquadrata; elytris singulis macula magna subquadrata rubra; pygidio et lateribus corporis et abdominis cinereo-albis. 4½ lin. Penang.

Cetonia ciocolatina.—Magna, subtus purpureo-cuprea, supra fusco-brunnea, opaca; elytris lævibus, sutura versus apicem elevatis, apice spinosis, lateribus et fasciis paucis brevibus versus apicem luteis. 16 lin. Tondano, Celebes.

C. inanis.—Viridis, subtus metallica, supra obscura, opaca; clypeo metallico, punctato, margine integro; thorace elytrisque marginibus punctatis, horum apice ad suturam minime producto, rotundato; subtus lateribus valde striatis, processu sternali ad apicem valde dilatato. 12 lin. Java.

C. Celebica.—Nigro-cuprea, nitida, punctata; elytris singulis maculis 6 fulvis, apice ad suturam acuto nec spinoso; subtus cuprea, corpore et abdominis lateribus rufo-aureo maculatis. 10½ lin. Tondano.

Cetonia dubia.—Plana, depressa, lateribus angulatis, supra olivaceo-cuprea, subtus cupreo-æneu; thorace elytrisque albo-maculatis; processu sternali non dilatato, incurvato. 8—10 lin. Philippine Islands.

C. obtusa.—Nigro-ænea; thorace punctato, albo-marginato; elytris truncatis, punctatis, utrinque bicarinatis, transverse albo-maculatis; subtus purpureó-cuprea, corpore pedibusque pilis pallidis vestitis. 6½ lin. Java.

C. arrogans.—*C. mandarineæ* similis, sed thorace maculis parvis rotundatis fulvis, elytris ad suturam minus spinosis; subtus rufo-maculata et pilis rufis vestita. 7 lin. Philippine Islands.

C. porcina.—Rufo-brunnea; clypeo bidentato, recurvato; thorace viridi-brunneo, limbo lato ochraceo interne angulato; elytris ochraceo maculatis et punctatis; subtus æneo-cuprea, crusta ochracea fere tota vestita. 7 lin. Java.

C. Solorensis.—Rufo-cuprea, pallida, subviridis, hirsuta; clypeo emarginato; thorace punctato, utrinque maculis 3 parvis flavis; elytris punctatis, maculis sparsis flavis; subtus abdomine cupreo-metallico, corpore valde hirsuto. 9 lin. Solor.

C. crassipes.—Supra olivaceo-brunnea, hirta; elytris apicibus ochraceo-brunneis; subtus rufo-nigra, thorace et sterno ochraceis, nigro-irroratis, abdomine ochraceo-marginato; pedibus posterioribus valde crassis. 7 lin. Penang.

Cetonia? megaspilota.—Nigra; clypeo bidentato; supra maculis 20 nacreis; subtus processu sternali divergente, maculis irregularibus nacreis. 8 lin. Philippine Islands.

Cetonia? irrorata.—Nigra, nitida, subconvexa, grosse punctata, lateribus albo-irroratis; elytris sinuatis, apice truncatis; subtus corpore et femoribus pilis albis vestitis. 7 lin. Philippine Islands.

STERNOPLUS, n. g.—Type, *Cetonia Schaumii*, White.

EUREMINA, Westw., n. g.—*Cremastocheilorum* habitu, nonnullorum necnon *Cnemidarum* (*Rutelidarum*); *Macromati* tamen magis affine.

Euremina agnella, Westw.—Nigra, nitida; capite et pronoto rude punctatis; elytris nigris, basi rufis, colore rufo in marginem lateralem et ad suturam longitudinaliter extenso, in medio profunde sulcatis et striolis in sulcis impressis. 5½ lin. Penang.

New Part of 'Transactions.'

A new Part of the 'Transactions' (Third Series, Vol. iii. Part 4), being the third Part published during 1867, and containing a further instalment of Mr. Pascoe's "Longicornia Malayana," was on the table.

Addendum.—The specimen of Ciniflo ferox exhibited by Mr. M'Lachlan (*ante*, p. xci.) was remarkable from the fact of its abdomen being completely covered with a luxuriant fungoid growth.

November 4, 1867.

Professor WESTWOOD, Vice-President, in the chair.

Additions to the Library.

The following donations were announced, and thanks voted to the donors:—'Transactions of the Linnean Society,' Vol. xxv. part 3, and Index to Vols. i.—xxv.; 'Journal of the Linnean Society,' Zoology, Vol. ix. No. 36; presented by the Society. 'Proceedings of the Zoological Society,' 1866 and 1867, Part 1; by the Society. 'Journal of the Agricultural Society,' 2nd series, Vol. iii. Part 2; by the Society. 'Annales de la Société Linnéenne de Lyon,' new series, Vol. xiv.; by the Society. 'Annales de la Société d'Agriculture, &c., de Lyon,' 3rd series, Vols. ix. and x; by the Society. 'Mémoires de l'Académie des Sciences, &c., de Lyon,' classe des Sciences, Vols. xiv. and xv.; by the Academy. 'Bulletin de la Société des Naturalistes de Moscou,' 1866, Nos. 3 and 4; by the Society. 'Mémoires de la Société de Physique, &c., de Genève,' Vol. xix. Part 1; by the Society. 'Mémoires de l'Académie des Sciences, &c., de Belgique,' Vol. xxxvi, and 'Bulletins,' 2nd series, Vols. xxii. and xxiii.; by the Academy. 'Schriften der physikalisch-ökonomischen Gesellschaft zu Königsberg,' Vols. vi. and vii.; by the Society. 'Stettiner Entomologische Zeitung,' 1867, Nos. 7—12; by the Entomological Society of Stettin. 'Memoirs read before the Boston Society of Natural History; being a new series of the Boston Journal of Natural History,' Vol. i. Parts 1 and 2; and 'Proceedings,' Vol. x., and Vol. xi. sheets 1—6; by the Society. 'Annals of the Lyceum of Natural History of New York,' Vol. viii. Nos. 11—14; by the Lyceum. 'Proceedings of the Essex Institute,' Vol. iv., Vol. v. Nos. 1 and 2; by the Institute. 'Proceedings of the California Academy of Natural Sciences,' Vol. iii. Part 3; by the Academy. 'An Inquiry into the Zoological Relations of the first-discovered Traces of fossil Neuropterous Insects in North America; with Remarks on the difference of Structure in the Wings of living Neuroptera,' by S. H. Scudder; by the Author. 'View of the Lepidopterous Fauna of Labrador,' and 'Revision of the Fossorial Hymenoptera of North America, I. Crabronidæ and Nyssonidæ,' by A. S. Packard; by the Author. 'Notes on the Lepidoptera of America,' No. 1, and 'Descriptions of American Lepidoptera,' No. 1, by A. R. Grote and C. T. Robinson; by the Authors. 'Neuroptera and Orthoptera of the Province of Moscow' (in Russian), by B. Oulianine; by the Author. Sepp's 'Nederlandsche Insecten,' 2nd series, Vol. ii. Nos. 9—16; by M. Snellen van Vollenhoven. 'Bidrag till Reduviidernas Kännedom,' by C. Stal; by the Author. Hewitson's 'Exotic Butterflies,' Part 64; by W. W. Saunders, Esq. 'Entomological Papers, 1862—1866,' by the Rev. Hamlet Clark; by the (deceased) Author. 'Catalogue of Longicorn Coleoptera collected in the Island of Penang by James Lamb, Esq.,' Part 2, and 'Diagnostic Characters of some new Genera and Species of Prionidæ,' by F. P. Pascoe; by the Author. 'Apterous Lepidoptera,' by J. Jenner Weir; by the Author. 'Illustrated Natural History of British Moths,' by Edward Newman, Nos. 6—11; by the Author. 'The Zoologist,' July to November; by the Editor. 'The Entomologist's Monthly Magazine,' August to November; by the Editors.

The following additions by purchase were also announced:—"Genera des Coléoptères d'Europe,' livr. 132—135. Gerstäcker's 'Bericht der Entomologie, 1863 und 1864,' Part 2.

Exhibitions, &c.

Mr. M'Lachlan exhibited a species of Mantispidæ from Bahia; he believed it to be the female of Trichoscelia notha, from the male of which, described and figured by Erichson, it differed in being half as large again, in having the anterior femora unarmed, the abdomen ochreous beneath, and provided with a long flexile ovipositor; in all other characters it agreed with Erichson's insect. The species was especially remarkable by the lobate dorsal ridge of the abdomen, and by the greatly dilated and compressed posterior tibiæ, resembling the pollen-bearing organs of a Bombus.

Mr. M'Lachlan exhibited, on behalf of Mr. B. Cooke, two examples of gynandromorphism. The first, a sawfly, Dolerus madidus of Klug, the left-hand side presenting male characters, the right side female characters. The second, a Trichopterous insect, Limnephilus striola of Kolenati, in which the palpus, antenna and wing on the right-hand side were of the male form and on the left side of female form, whilst the abdomen was wholly female: this specimen was captured by Mr. Cooke near Manchester.

Mr. M'Lachlan also exhibited two monstrosities, both sawflies, which he had received from Prof. Zeller. One was an example of the rare European species, Hylotoma fasciata of St. Fargeau, in which the left posterior tibia was two-jointed, the second joint being greatly dilated. The other, a specimen of Tenthredo scalaris of Klug, with five wings, three on the right side, the anterior and posterior being perfectly normal, whilst the intermediate one combined the neural characters of both.

Mr. Bond exhibited three recent additions to the list of British Lepidoptera, namely, Psyche crassiorella, *Bruand*, Grapholitha ravulana, *H.-S.*, and Coccyx vernana, *Knaggs* (Ent. Mo. Mag. vol. iv. p. 122; see also p. 154).

Mr. T. W. Wood (who was present as a visitor) exhibited a number of pupæ of Papilio Machaon, Pieris Brassicæ and P. Rapæ, exhibiting various shades of colour corresponding with the colours of the surfaces to which they were attached; and read the following

Remarks on the Coloration of Chrysalides.

"All Lepidopterists are probably aware of the very great variability in the colouring of the chrysalides of butterflies, and I am able to state, as the result of some years of observation, that their colours are more or less derived from the objects in their immediate vicinity. It is obvious that this assimilation of their colours to their surroundings is of great use to them, tending to their concealment and consequent immunity from the attacks of enemies during their period of exposure in a helpless state. The specimens of chrysalides on surfaces of different colours which I now exhibit are, I trust, sufficient to convince you of the truth of this statement. I find, as the result of my experiments, that the skin of the chrysalis is photographically sensitive for a few hours only after the caterpillar's skin has been shed, and, as might be expected, by putting the specimens in the sunshine at the time of changing, and surrounding them as much as possible with any desired colour, the most successful results have been obtained. Under these conditions the specific markings are almost entirely overpowered if necessary to the assimilation of colour; and these markings are, in fact, entirely overpowered in the exhibited green varieties of Papilio Machaon and Pieris Rapæ. I have not had an opportunity of seeing the former species in its natural haunts, but the latter I have observed, and have found the green variety of the chrysalis on a green leaf, and on a door which was painted green (specimen shown). There are also before you green specimens of Pieris Brassicæ which were under a vine on the side of a house which was of a stone-colour, with many others taken from the adjoining side of the same house, where there was no vine to affect their colour, but only the somewhat dirty stone-coloured surface; I particularly noticed that there were no green specimens to be seen on this side, although their number was very considerable, and they were attached at various heights, some very near the ground, and others at the house-top under the projecting eaves. Some of the darkest specimens shown on blackened surfaces were exposed to a very subdued light in a dark corner, and the detached ones so strongly suffused with black were taken from a tarred fence. One of the chrysalides of Pieris Brassicæ on a white surface, now exhibited, is almost an albino. I also exhibit green, reddish, and dusky chrysalides on surfaces of similar tints. Specimens kept in the dark would be interesting; I have one of P. Brassicæ which was placed on whitish wadding in a box from which light was excluded, and it is of a light colour, although possessing all the specific markings, but from this solitary example no conclusion can be drawn. Mr. A. G. Butler has informed me that he also has made some experiments with chrysalides of P. Rapæ, and has procured a reddish tinge by means of a red surface, besides other colours. The gilded chrysalides deserve mention here; those of Vanessa Urticæ I have hardly ever found except when concealed by nettle-leaves; those on fences, walls, tree-trunks, &c., being of similar colours to those objects, and mottled more or less. The fine chrysalis of Vanessa Polychloros, when amongst foliage, is coloured like a withered elm-leaf; I have not unfrequently found it of a light reddish brown, with a cluster of metallic silver (not golden) spots on the back at the juncture of the thorax with the abdomen: this colouring also gives place to mottled grayish when the individual is on a wall or other object. The metallic appearance is probably of service in giving the insects an uneatable look, and is not necessarily connected with the possession of Ichneumon in their interiors, as one or two of my entomological friends think, for I have had very fine butterflies out of very metallic chrysalides; indeed I consider this to be the normal colouring, it being the most beautiful by far. I would venture to suggest another reason why the gilding, when amongst leaves, is of service in the way alluded to: it is this—that the Vanessa chrysalis is quite loosely attached, hanging only by the tail, so that, even if it could assume the green colour by which it is surrounded, it would be rather dangerous to it than otherwise, for it would then appear to birds very much like a green caterpillar swinging in the air, but as it is it looks more like a piece of gold or brass than anything else, and birds probably do not think of touching it. There are doubtless many instances of the absence of variability in chrysalides, but I think they would all be found to be mimics of some disliked or dangerous insect. The chrysalis of Aporia Cratægi is very conspicuous and not very variable, but I have been much struck by its strong resemblance to the caterpillar of the currant-bush moth (*Abraxas grossulariata*), as both are speckled with black on a whitish ground, and the moth caterpillar is extremely abundant in the same localities, and is probably disliked by birds. The pupa of the moth is very remarkably coloured with yellow bands on black, giving it a waspy appearance, and I recollect being afraid when a child to touch it, thinking it would sting. I feel convinced that by the proper use of gilded surfaces the gilded chrysalides of Vanessa, and perhaps of other genera, would be obtained, and I hope to be able to try the experiment next season; also to obtain colours with coloured glass, as it is probable that the strongest effects would be obtained by that means. There can be no doubt that disguise will be found to be carried to as great a length in chrysalides of butterflies as in any other class or stage of insect life, as their evading observation, and consequent security during a considerable portion of their lives, must depend *solely* upon this power which they unconsciously possess."

Mr. A. G. Butler (who was present as a visitor) stated that he had obtained a red or rosy chrysalis of Pieris Rapæ, which had undergone its transformation in a piece of scarlet cloth; and pupæ upon glass were generally of a pale slate-colour.

Mr. J. Jenner Weir said that, whatever might be the explanation, he could speak to the fact that metallic chrysalides were for some reason or other obnoxious to birds and free from their attacks.

Mr. Bond combatted Mr. Wood's theory; he had had thousands of pupæ of Papilio Machaon, and had often had the brown variety of pupa on a green ground-colour, whilst in some seasons he obtained no brown specimens at all: as regards Pieris Rapæ, he had noticed that the pupæ of the second brood were generally rather paler than the first brood; but in the same green-house, the doors and wood-work of which were painted white, he had found chrysalides of all the exhibited colours, many of them quite as dark as those shown by Mr. Wood on black surfaces; on the same wall, built of particularly red bricks, he had found all the colours except the red; on the same twig of the common garden rocket, subject to precisely the same external influences, he had often noticed three or four pupæ of Anthocharis Cardamines, and at times the twig would produce red, green and white varieties, while at other times all the pupæ were of the same colour.

Papers read.

The following papers were read:—

"A Revision of the Australian Buprestidæ described by the late Rev. F. W. Hope," by Mr. Edward Saunders.

"Descriptions of some new Species of Diurnal Lepidoptera," by Mr. W. C. Hewitson.

"A Monograph of the Genus Thais of the Family Papilionidæ," by the Rev. Douglas C. Timins. The following seven species were enumerated and figures of each exhibited:—

"1. *Thais Cassandra* (Boisd. Icon. pl. iii. fig. 1, 2; Hübn. Pap. fig. 910—913. *T. Hypsipyle*, Godt. Pap. Fr. ii. pl. 2 C, fig. 1, 2; larva figured by Boisduval Rambert et Graslin, Coll. Icon. Chenilles Papil. pl. ii. fig. 1—3). The larva feeds on several species of Aristolochia: it varies much in colour, but is generally pale reddish, spotted with black. The pupa state lasts from November to March; the pupa is reddish brown, the wing-cases yellowish. I have found this species at Cannes and Hyères: it is of very short duration and very sluggish, frequenting marshy grounds, where it flies lazily from flower to flower, settling with expanded wings. Near Cannes it is very common in some marshy meadows on the road to Auribeau; at Hyères it is comparatively rare; near Horace Vernet's chateau, about ten miles from Hyères, it is plentiful on a patch of marshy ground. This species usually appears on the wing in March, about the 15th, and after a fortnight few good specimens are to be seen. The time of appearance, however, varies much: in forward seasons it appears in February, but in 1864 and 1865 it was not on the wing until April. Slight varieties occur, the black markings on the upper side of the anterior wings being more or less diffused, and sometimes the ground-colour of these wings is almost white. This was the case in some specimens which I reared at Oxford in 1861, from larvæ collected at Hyères in 1860. I have reared Cassandra in December by placing the pupæ in a very warm situation; the perfect insects, however, offered no variation from the ordinary type.

2. *T. Hypsipyle.* This species is closely allied to Cassandra; indeed Boisduval's opinion was that the two were merely local varieties of one species. This, however, is not the case, because Hypsipyle and Cassandra occur in the same localities, though at different times. Hypsipyle is generally (not always) paler than Cassandra, at least in the female; the black markings are less diffused; there is in the female a crimson dot upon the third black marginal band counting from the outer edge of the anterior wings; the second crimson spot on the hind wings is absent in the female. The antennæ are *brown* with a blackish club in both sexes of Hypsipyle, but *black throughout* in Cassandra. This species may be considered, I think, identical with the Thais (Papilio) Polyxena of Ochsenheimer. Two constant varieties are described by Boisduval; his *var.* A differs from the type by the narrow costal bands of the anterior wings, the second of these bands only being of the usual breadth: this *var.* is said to occur in Calabria. The *var.* B is described as being of a deep ochre-yellow and as possessing three or four red points on the fifth costal band: this variety has been found commonly in the Morea, and may, I think, possibly be a distinct species. This species is further distinguishable from Cassandra by its yellow larva, with black dorsal band, six rows of spines, yellowish red bordered with black, and (according to Hübner) a lateral series of black points, forming a triangle. The pupa is not unlike that of Cassandra in form, but is *grayish brown* in colour. The larva of Hypsipyle is found about August, feeding on Aristolochia rotunda and (as Boisduval says) on A. Clematitis also. The perfect insect flies over marshy places in April. It thus appears later than Cassandra: its flight is sluggish. I have found both the type and the *var.* A at Cannes.

3. *T. Caucasica.* This is said to abound near Smyrna in April and May. The larva and pupa seem to be altogether unknown.

4. *T. Cerisyi.* This species is easily distinguishable by the long tails on the hind wings. The larva and pupa seem to be unknown. This species occurs near Smyrna, and also in some of the islands of the Grecian Archipelago: it appears on the wing in April and May, and is of short duration.

5. *T. Henrietta* (new species). Expands $2\frac{1}{2}$ inches. Antennæ and palpi black; thorax black, spotted with yellow. Abdomen also spotted with yellow. Wings deep golden yellow; fore wings with the base black, then a red costal spot bordered with black, then a black costal band, then another broad crimson spot edged with black, then a black spot, then two small red spots, then a row of black crescents, and a second row of crescents reaching to the edge of the wing. Hind wings have the base black, the disk marked with crimson and black, the nervures black, a crimson spot on the upper margin and a row of five large crimson spots bordered with black, and a row of yellow crescents deeply edged with black. The fringe of all the wings is dark golden yellow. A single specimen of this beautiful insect, taken near Smyrna, was in the cabinet of the late M. Meissonier, of Hyères: that gentleman informed me that it was a new and undescribed species: he wished me to describe and figure it, and lent me the specimen for that purpose shortly before his death.

6. *T. Medecicasta* (*Papilio Rumina*, Hübn. tab. 394, 395; *P. Rumina-australis*, Esper; *La Proserpine*, Ernst, Pap. d'Europe). The larva lives on several species of Aristolochia: it is usually of a brownish yellow colour, with many longitudinal black lines, and six rows of spines, orange-coloured. The pupa is not unlike that of Cassandra. This species passes the winter in the pupa state, and appears on the wing in May. I have found it near Grasse in May, also, not uncommonly, near Hyères. Its flight is not so sluggish as that of Cassandra: it is partial to localities where the beautiful rose-coloured Cistus (*Helianthemum album*) grows. There is one hill in particular near Hyères upon which this plant is found in remarkable profusion, and here Medecicasta may be seen in some plenty. I have observed that this insect seldom flies after 2 or 3 P.M., while Cassandra is partial to the afternoon sunshine, and may be seen on the wing until 4 P.M. or even later. There is a variety of this species figured, under the name of Thais Honnoratii, by Boisduval (Spec. Gen. des Lépid. plate 1 B, fig. 4), which appears only to be found in the neighbourhood of Digne: it is smaller than the type; the crimson spots are much enlarged upon the lower wings, and upon the upper wings are much more numerous (and also larger) than in the type; the second and third costal bands are very small. This variety is exceedingly rare, and specimens fetch about £1 each in the Paris dealers' shops; I have been told, however, by an old French entomologist, that they have been known to fabricate this variety, by selecting small individuals of Medecicasta and dexterously colouring them by means of crimson scales borrowed from other specimens, the black scales of the second and third costal bands being neatly removed and their place supplied by yellow scales. I have followed most authors in giving Honnoratii as a variety of Medecicasta: if, however, this be the case, it is rather curious that it should only have occurred in one locality out of several in which Medecicasta abounds. The statement, moreover, that it has been reared from a larva identical with that of Medecicasta must be, I think, received with caution. I knew a French collector who had at one time two thousand larvæ of Medecicasta, and not one produced Honnoratii.

7. *T. Rumina.* This species is pretty closely allied to the preceding. It is, however, somewhat smaller, and frequently of a darker yellow, but this difference is by no means constant. The best distinctive marks perhaps are as follows:—a white subdiaphanous spot near the apex of the fore wings (occasionally absent), the absence of a crimson patch on the lower edge of the fore wings, and the much greater extension of the black marks near the outer edge. The outline of the fore wings is also different from that of Medecicasta, the curve of the costa especially. The larvæ of Rumina are grayish, with small longitudinal black markings and six rows of short reddish spines. The pupa is ash-coloured, in form similar to that of Cassandra. This species is chiefly found in Southern Spain, Portugal and North Africa: it has, however, occurred (very rarely) near Hyères, and it is said near Cannes also. April and May seem to be the months for its appearance in the perfect state. It is subject to considerable variation, and I am not certain whether the specimens from Cannes are not in reality varieties of Medecicasta."

New Part of 'Transactions.'

A new part of the 'Transactions' (third series, vol. iv. part 2), published in August, being the fourth part issued for 1867, and containing a continuation of Mr. Baly's "Phytophaga Malayana," was on the table.

November 18, 1867.

Prof. WESTWOOD, Vice-President, in the chair.

Donations to the Library.

The following donations were announced, and thanks voted to the donor:—'Journal of the Linnean Society,' Zoology, Vol. ix. No. 37; and 'Proceedings of the Linnean Society;' presented by the Society.

Election of Members.

Frederick Bates, Esq., of Leicester, and H. J. S. Pryer, Esq., of Highgate, were severally ballotted for, and elected Annual Subscribers.

Exhibitions, &c.

Mr. Bond exhibited eight specimens of Sterrha sacraria, bred from the egg by Mr. Rogers, of Freshwater, Isle of Wight; together with two females by which the eggs were laid. One of the females was captured at midday on the 14th of August, 1867, and on the 16th laid three eggs; the other was taken at "sugar" on the 16th of August, and on the 19th laid six eggs. All the nine eggs were hatched on the 23rd and 24th of August, and the larvæ were fed on Polygonum aviculare. On the 14th of September three larvæ began to spin up, on the 19th four more, and on the 23rd the remaining two. The moths emerged, one on the 17th of October, two on the 19th, three on the 25th, and two on the 27th; one died in pupa. The times of development in the cold and wet season of 1867 thus agreed very nearly with those of the specimens bred by Mr. Hellins in the hot and dry season of 1865, and described by Mr. M'Lachlan (see Trans. Ent. Soc. 3rd series, vol. ii. p. 453, pl. xxiii. figs. 2—7), and the food-plant was the same; but the specimens now exhibited were unlike Mr. Hellins's specimens, being all of the same pattern, plain, buff-coloured, but very dark.

Mr. M'Lachlan mentioned that this species, which was originally described by Linnæus from specimens captured in Barbary, and which was extremely abundant at the Cape of Good Hope, had been found as far north as Perthshire.

Mr. Stainton exhibited a specimen of Ebulea catalaunalis, a new British Pyralis. It was captured at Cheshunt on the 18th of September last, by Mr. W. C. Boyd, whose attention was attracted by its peculiar flight, resembling that of a house-fly. The insect was quite distinct from Nascia cilialis; but in consequence of Stephens having erroneously given catalaunalis as a synonym of cilialis, continental authors were in the habit of quoting the latter insect as identical with catalaunalis.

Mr. Higgins exhibited a large collection of butterflies from Labuan and Borneo; amongst them were Ornithoptera Brookiana, Prothoe Calydonia, Amathusia, &c., &c., and several species hitherto unique among Mr. Wallace's captures.

Mr. Trimen exhibited a fine species of Papilio from Uruguay, allied to P. Americus of Kollar.

Prof. Westwood had recently received from Dr. Hooker the cocoon and chrysalis of a Saturnia, from the larva of which the Chinese obtained the "gut" used by fishermen: the moth was not yet known, but he hoped to breed it. The "gut" was in fact the silk-reservoir of the larva, which was drawn out about twenty-four hours before the larva would in the ordinary course begin to spin, the precise time being of great importance; it was dipped first in vinegar, then in water, after which the silk-vessel was capable of being extracted in many cases to the length of from twenty to thirty feet.

Mr. Janson said that in the South of Europe "gut" was obtained from the common silkworm.

Prof. Westwood added that one of the Saturnia cocoons contained a Chalcis and another Hymenopterous parasite, but the pupa was nevertheless quite perfect.

Mr. M'Lachlan mentioned that Dr. Balbiani had recently called the attention of the Soc. Ent. de France to the facility with which the silkworm disease might be communicated to the healthy larvæ of other Lepidoptera. He had taken larvæ of the same brood of Bombyx neustria, and fed some upon healthy leaves of Scorzonera, others upon leaves of the same plant which he sprinkled with water in which diseased silkworms had been pounded; the former were healthy and well developed, the latter were small, soon filled with corpuscles, and died at the first moult. Dr. Balbiani had also inoculated with muscardine the larvæ of clothes-moths, by throwing on the infested clothes a powder formed of the *débris* of muscardined silkworms; the infection being more rapid and certain when the powder was fresh, less so when dried.

Mr. Stainton had to record a new habitat for the larva of a Tinea; Mr. Swanzy had shown him the larva-case of a Tinea which was taken from the horn of a kooloo from Natal, and there could be little doubt that the larva must have been burrowing in the horn of the living animal.

Mr. Swanzy added that, since Mr. Stainton's visit, he had found a living larva in the horn.

Mr. Trimen had seen the skull of a hartebeest, the base of which was eaten by what he had no doubt was the larva of a Tinea.

Mr. Trimen exhibited a grasshopper of the genus Pœcilocerus, of which he had found the pupæ *in copulâ:* it was not an isolated case, but he had seen hundreds of pairs of the nymphs at Natal at the beginning of the present year.

Mr. Trimen exhibited a Mantis with minute fore legs, remarkable for its resemblance to a Phasma.

Mr. Bates remarked that its likeness to a Bacillus was very close, and suggested that it would be found to feed upon Bacillus, which, deceived by the imitation of its own form, would fall an easy prey to the Mantis.

Mr. M'Lachlan reported that Boreus hyemalis had been lately taken by Messrs. Douglas and Scott, amongst moss, near Croydon.

December 2, 1867.

Sir John Lubbock, Bart., President, in the chair.

Additions to the Library.

The following donations were announced, and thanks voted to the donors:—'Proceedings of the Zoological Society,' 1867, Part ii.; presented by the Society.

'Descriptions of American Lepidoptera,' No. 2, by A. R. Grote and C. T. Robinson; by the Authors. Newman's 'Illustrated Natural History of British Moths,' No. 12; by the Author. 'The Zoologist' for December; by the Editor. 'The Entomologist's Monthly Magazine' for December; by the Editors. Also, a portrait of Lyonet; by H. Hartogh Heys v. d. Lier.

The following additions, by purchase, were also announced:—'British Moths,' Nos. 1—5; 'Genera des Coléoptères d'Europe,' Livr. 136.

Election of Members.

W. C. Boyd, Esq., of Cheshunt; Herbert Druce, Esq., of Ealing; A. H. Haliday, Esq., of Carnmoney, County Antrim; and Joseph Ince, Esq., of 26, St. George's Place, S.W.; were severally ballotted for, and elected Members.

Exhibitions, &c.

Mr. Pascoe exhibited a new species of Thysia from Sumatra, which he proposed to describe under the name of T. viduata; and pointed out that T. tricincta of Laporte, from Java, was distinct from T. Wallichii of Hope, from Upper India.

Mr. Pascoe also exhibited several other interesting Coleoptera, including new forms of Trogositidæ from Penang, of Tenebrionidæ from Ceylon, Sumatra and N'Gami, of Brenthidæ from Batchian, of Curculionidæ from Peru, of Anthribidæ from the Philippine Isles and Malacca, and of Lamiidæ from Java and Malacca.

Prof. Westwood exhibited the only known British specimen of Serropalpus striatus, captured some years ago in Leicestershire. It was the identical insect recorded in the 'Zoologist' for 1844, p. 701.

Prof. Westwood also exhibited a small spherical nest, made of mud, with a white silken casing inside; it was found on the common ling near Reigate, in July, 1866, on the occasion of the Society's visit to Mr. W. Wilson Saunders, and was then thought to be the nest of a spider. It had, however, produced the hymenopterous Eumenes atricornis.

Mr. F. Smith remarked that the Eumenes atricornis of Curtis was the coarctatus of Linnæus; he had found many of the females at Bournemouth, carrying off a Lepidopterous larva (probably Eupithecia nanata) which fed upon ling. It was an error to suppose that the larvæ of Eumenes were fed upon honey.

Mr. F. Smith exhibited a piece of dead willow-wood found at Mitcham, in which were no less than ten cocoons of Megachile Willughbiella within a radius of an inch. The burrows or perforations in the wood were lined with rose-leaves, but the same species of leaf-cutting bee did not always confine itself to the same kind of leaf—rose, elm, laburnum, and others were used; in one instance he had known them to use lilac-leaves, and he believed that they would take almost any leaf that happened to grow near the nest. Some species made an inner lining of a different kind of leaf from the outer coating; he had known Megachile argentatus to form an inner lining of the petals of Lotus corniculatus, and M. centuncularis of the petals of the scarlet geranium.

Papers read.

The following papers were read:—

"Contributions to a Knowledge of the Coleoptera," part 1; by Mr. Pascoe.

"On some Undescribed Species of South-African Butterflies, including a new Genus of Lycænidæ;" by Mr. Roland Trimen. Eighteen new species were exhibited and described, including two species of Papilio, an Acræa, a Panopea, a Deloneura (n. g.), three species of Zeritis, an Aphnæus, four Lycænæ, a Pyrgus, two Cyclópides, and two Pamphilæ.

New Part of 'Transactions.'

The publication was announced of Trans. Ent. Soc., 3rd series, vol. iv. part 3; being the fifth Part issued during 1867.

January 6, 1868.

Sir John Lubbock, Bart., President, in the chair.

Additions to the Library.

The following donations were announced, and thanks voted to the donors:— 'Journal of the Linnean Society,' Zool. No. 38; presented by the Society. 'Bulletin de la Société Imperiale des Naturalistes de Moscou,' 1867, No. 1; by the Society. 'Zeitschrift des Ferdinandeums für Tirol und Vorarlberg,' iii. 13; by the Ferdinandeum. 'Tijdschrift voor Entomologie,' Ser. 2, Vol. i. Parts 3—6, Vol. ii. Part 1; by the Entomological Society of the Netherlands. 'Proceedings of the Essex Institute,' Vol. v. Nos. 3 and 4; by the Institute. Hewitson's 'Exotic Butterflies,' Part 65; by W. Wilson Saunders, Esq. 'On certain Scales of some Lepidoptera,' 'On the Plumules or Battledore Scales of Lycænidæ,' and 'Further Remarks on the Plumules or Battledore Scales of some Lepidoptera;' by the Author, John Watson, Esq. 'On the Lepidopterous Insects of Bengal;' by the Author, F. Moore, Esq. 'The Entomologist's Annual for 1868;' by H. T. Stainton, Esq. Newman's 'British Moths,' No. 13; by the Author. 'The Zoologist' for January; by the Editor. 'The Entomologist's Monthly Magazine' for January; by the Editors.

The following additions by purchase were also announced:—'Record of Zoological Literature,' Vol. iii. 'Naturgeschichte der Insecten Deutschlands,' Coleoptera, Vol. i. Part 2. No. 1.

Election of Members.

Alfred Newton, Esq., Professor of Zoology in the University of Cambridge; Stephen Barton, Esq., of Bristol (previously an Annual Subscriber); G. A. J. Rothney, Esq., of Addiscombe; and the Baron Edgar von Harold, of Munich; were severally ballotted for, and elected Members.

Exhibitions, &c.

The Rev. Douglas C. Timins exhibited a specimen of Charaxes Jasius bred (from a Continental pupa) at Winchelsea. Also, three abnormal specimens of Argynnis Lathonia, from the neighbourhood of Boulogne; one had the outer margin of the anterior wings strongly incurved, another had the right fore-wing of but half its proper size, and the third was remarkable from the suffusion of the black markings of the wings.

The Secretary read a letter from Mr. J. Caldwell, of Mauritius, dated Port Louis, November 3, 1867, respecting the occurrence of Papilio Phorbanta in Madagascar. Referring to Trans. Ent. Soc., third series, Vol. v. p. 330, Mr. Caldwell wrote as follows:—

"Mr. Trimen considers it probable that, in the collection examined by Mr. Bates, I may have mixed up the Malagasy insects with the Mauritian. This did take place after I had packed those for England; but I may almost venture to state positively that those I sent home were *all* taken from the original Malagasy collection before any mixture was possible."

Mr. F. Smith exhibited two specimens of a Polistes captured at Penzance by a lady residing in that town; one specimen was caught in the summer of 1866 on the window-sill of a house, and three more were taken at the end of July or beginning of August, 1867, in the very same situation in the window of the same house. The insect did not agree exactly with any described species of Polistes, but appeared to be intermediate between the North-American P. biguttatus and the Brazilian P. versicolor. The captor suggested that they had probably been introduced in wood from a dock-yard situate about a hundred yards from her house; but Mr. Smith could scarcely believe that they were imported: the species of Polistes were not wood-boring wasps, but paper-makers, and their slight nests were attached to the outside of a tree, post, wall, &c.; untrimmed wood was not imported from America. (See the 'Entomologist's Annual' for 1868, pp. 87, 96).

Mr. Bates also had difficulty in believing that an insect with the habits of Polistes could have been imported; the nests were mere strings of cells hanging by a peduncle from the rafter of a house, a shrub, the trunk or branch of a tree; they were of loose construction, incapable of withstanding exposure. Such a nest could hardly be transported in safety, either with timber on board ship or washed across by the gulf-stream. Such was the rapidity of life in Brazil, and so quick the succession of broods, that the eggs would not remain unhatched during the voyage, and if hatched the young larvæ must perish. Nor did he think it likely that perfect wasps would be brought over alive; at any rate the specimens would be worn, and very different from those exhibited.

Mr. M'Lachlan exhibited a Trichopterous insect new to Britain, Neuronia clathrata of Kolenati, captured at Bishop's Wood, Staffordshire, by Mr. Chappell, of Manchester.

The Secretary exhibited a small box of South-American Coleoptera, sent to the Society by Mr. F. Schickendantz, of Pilciao, who found them on the flowers of a new species of Hydnora.

The Secretary exhibited specimens of the coffee-tree attacked by the "borer," and of the larva, pupa and imago of the insect, which had done great damage in the coffee-plantations of Southern India. These were sent by the Rev. G. Richter, Principal of the Government Central School, Mercara, Coorg. The insect proved to be a species of Clytus.

The Secretary made the following observations on the nomenclature of Australian Buprestidæ adopted by Mr. Edward Saunders in a paper read at the meeting of the 4th of November, 1867 (*ante*, p. ci.):—

"The rejection by Mr. Edward Saunders, in his 'Revision of the Australian Buprestidæ described by the Rev. F. W. Hope,' of certain published names, in favour of the names given by Mr. Hope in the so-called 'Synopsis of Australian Buprestidæ,' raises a question of some importance as regards priority of nomenclature.

"I have always understood the rule to be this—that the specific name by which an insect is to be called and known is the name under which a sufficient description of the species was first published.

"Names contained in a paper which is privately printed, but not published, rank only as MS. names: however freely the paper may be disseminated among the author's friends, however wide the circle of his acquaintance, it must still remain inaccessible to the public,—it is not published within the meaning of the rule.

"What then are the facts concerning the paper which Mr. Edward Saunders (following Laporte and Gory and others) cites as Hope's 'Synopsis of Australian Buprestidæ'?

"The paper in question consists of thirteen printed pages, at the top of the first of which is the word BUPRESTIDÆ; this is the only title which it bears. There is no title-page, preface, introduction or explanation whatsoever; no author's name, no printer's name, no date; no name of any bookseller or of any place at which the public might obtain it; and as to many of the insects described, there is nothing to show that they are Australian species, or to point out the collections in which the type-specimens were deposited.

"At the same time there is no doubt that the author was Mr. Hope, that the date of printing was the year 1836, that the insects are all from Australia, and (when no other collection is mentioned) were in Mr. Hope's own cabinet; and lastly, besides the descriptions of sixty-six new species, the paper contains references to all the previously-described Australian Buprestidæ, (twenty-seven in number) so that 'A Synopsis of Australian Buprestidæ' would have been a very appropriate title to have given it.

"There can be little doubt that a print of this paper was in the hands of Laporte and Gory when they prepared their Monograph of the Buprestidæ, and it must be admitted that they cite the 'Synopsis of Australian Buprestidæ' as if it were a published work. Other writers have done the same, probably following Laporte and Gory, without having their attention directed to the question of publication or non-publication. It is true also that Hope himself (Col. Man. iii. 173) in 1840 speaks of 'a Prodromus which I published some few years back.' 'Published' in the sense of being communicated to his entomological friends, I have no doubt it was; but 'published' in the sense of being made accessible to or obtainable by the public, I believe it never was.

"Out of sixty-six forms described by Hope in 'Buprestidæ' as new species, it appears from Mr. Edward Saunders' investigations that three are unrecognizable, the type-specimens having been lost, and fourteen sink either as synonyms or varieties. Of the remaining forty-nine, the Hopeian names were in twenty-eight instances adopted and rightly applied by Laporte and Gory; fourteen have been published subsequently to 1836 under names different from Hope's, and these have been rejected by Mr. Edward Saunders, and the unpublished Hopeian names preferred. Of the residue, seven in number, descriptions (under Mr. Hope's names) are now for the first time about to be published by Mr. Edward Saunders.

"The necessity for the laborious examination which Mr. Edward Saunders has made is sufficient evidence that the insects in question have not become known, and do not pass current in the entomological world, by the names assigned to them by Hope. Such of his names as are in use have come into use in consequence of their adoption and publication by Laporte and Gory. So far from the printing of 'Buprestidæ' having given them currency, it seems that Laporte and Gory in some cases applied Hope's names to the wrong insects; and it is the species to which the names were thus erroneously applied that are known by the names which Hope intended for other insects.

"I submit that the unpublished names of the anonymous print 'Buprestidæ' must give way to published names, whatever the date of the latter may be."

Prof. Westwood argued that Mr. Hope's paper, though privately printed, had in fact been so widely disseminated as to amount to publication; at any rate, that it might be treated as published *sub modo*—*i.e.* as against all persons who had notice of its existence.

The Secretary remarked that, if that were so, the Hopeian names would prevail over those of Laporte and Gory; and as publication must be taken to be notice to all the world, every author subsequent to Laporte and Gory had, through the publication of their Monograph, constructive, if not actual, notice of the existence of Hope's descriptions. But he thought the ground untenable, and that even as against Laporte and Gory (and *a fortiori* as against those who had only constructive notice, through them, of the existence of the unpublished paper) the Hopeian names were of no authority. The adoption of them was not obligatory on Laporte and Gory, but was commendably courteous to Mr. Hope. In one instance only had they knowingly rejected Mr. Hope's name, Calodema Kirbii. Upon this Prof. Lacordaire (who probably thought that Hope's descriptions of 1836 were published) had remarked "MM. de Castelnau et Gory ont changé à tort le nom de l'espèce en celui de Cal. regalis." (Gen. Col. iv. 61). But the reason why Laporte and Gory did not adopt Hope's name was doubtless this, that there was already a Stigmodera Kirbyi of Guérin, described in the 'Voyage de la Coquille.' Calodema with Laporte and Gory was only a division of Stigmodera; when it was recognized as a separate genus, the two names Calodema Kirbii and Stigmodera Kirbyi might have co-existed, if regalis had not been published in the interim. That the publication of Calodema Kirbii, Coleop. Man. iii. 173, fig. frontisp. (1840), was subsequent to Laporte and Gory's regalis might be seen by reference to the Manual itself.

The President, Mr. Bates, Mr. M'Lachlan, Mr. Pascoe and other members, agreed that accessibility to the public could alone constitute publication within the meaning of the rule of priority in nomenclature.

Papers read.

The following papers were read by the Secretary:—

"Remarks on Mr. Wallace's Pieridæ of the Indian and Australian Regions"; by Mr. W. C. Hewitson.

"On the Coffee-borer of Southern India"; by the Rev. G. Richter. (A species of Clytus; see above, p. cix.).

"On Burmeisteria, a new genus of Melolonthidæ"; by Mr. Frederic Schickendantz.

New Part of 'Transactions.'

Trans. Ent. Soc., third series, Vol. v., part 7, being the sixth part published during the year 1867, was on the table.

ANNUAL MEETING.

January 27, 1868.

Sir John Lubbock, Bart., President, in the chair.

An Abstract of the Treasurer's Accounts for 1867 was read by Mr. Grut, one of the Auditors, and showed a balance in favour of the Society of £75 8*s*. 4*d*.

The Secretary read the following:—

Report of the Council for 1867.

In accordance with the Bye-Laws, the Council begs to present the following Report.

Since the last Anniversary we have elected eighteen Members or Subscribers; but death has deprived us of four, Mr. Bakewell, the Rev. Hamlet Clark (lately Vice-President), Mr. W. F. Evans (formerly Secretary) and Mr. J. Aspinall Turner. Add to these the number of resignations and defaulters, and the Society is numerically weaker than at the date of the last Report.

The prizes offered for Essays on Economic or Utilitarian Entomology induced two competitors to enter the lists; but the Council has not felt justified in awarding a prize to either.

The additions to the Library have been almost entirely due to private benefaction.

The year 1867 is conspicuous for the extent of the Society's publications. Each country Member has received, in return for his subscription of one guinea, 750 octavo pages of letter-press and fifteen plates, of which eleven have been coloured. The Council has been enabled to publish this unusual number of entomological memoirs mainly through the liberality of Mr. Dunning. The scheme for the separate publication of the 'Phytophaga Malayana' has been abandoned; and the plan of devoting an entire volume to a special work, of which the long-continued incompleteness of several volumes is a necessary consequence, has not met with general approval. The 'Longicornia Malayana' (vol. iii.) will be finished as soon as circumstances will permit; the Secretary has now in hand sufficient material to complete volumes iv. and v.; and the Third Series of our 'Transactions' will accordingly be closed. In future the series will be abolished, and the 'Transactions' of each year, beginning with 1868, will form a distinct volume, complete in itself, and distinguished simply by the year of its publication.

The usual classified summary of income and expenditure shows the following results:—

Receipts.	£	Payments.	£
Contributions of Members	196	Publications	322
Sale of publications	77	Library	5
Interest on Consols	3	Prize Essay	5
Extraordinary items	6	Rent and Office Expenses	83
Donations	122		
	£404		£415

Upon these figures the Council has to remark—(1), that, as compared with 1866, the receipts from Members and from the sale of publications both exhibit a decrease; (2), that notwithstanding the payment of five quarters' rent of the Society's apartments in Bedford Row, there is a diminution of £17 in the charge for general management, caused by the liberality of the Linnean Society in giving us the use of their Meeting-room rent free; (3), that even the large sum of £322 does not represent the total cost of production of the 'Transactions,' since the Society has to thank Messrs. Saunders, Smith and Stainton for the engraving of two-thirds of the plates; and (4), that the excess of expenditure over income has been defrayed out of the cash balance brought forward from 1866, leaving a cash balance in hand of £1 10*s*. 4*d*.

Arrangements have been made for the compilation of a synonymic 'List of the Insects of the British Isles.' In the preparation of this List, it is desired to conform to recognized rules of nomenclature, but that the classification shall accord with modern views. The primary object is—not to give prominence to special or peculiar theories, either of arrangement or nomenclature, but to show what insects are known to inhabit our country, and by what names they are to be designated. Numerous citations of authors would serve only to encumber the Catalogue, without any commensurate advantage: it is hoped that, by a judicious selection, the List may serve to refer the student not only to the author who is responsible for the name of the insect, but also to a good description or figure of each species, and to so much as is known of its life-history and habits.

It is intended that the different Orders shall be issued separately, but according to a uniform plan, so that the whole may eventually be combined, and form a permanent record, and as complete a Catalogue as present knowledge will allow, of the Insect Fauna of the United Kingdom. A work of this magnitude must necessarily occupy a considerable time. In the case of the Coleoptera and Lepidoptera, which have most frequently and recently been handled, there is less urgent need for a Catalogue than in the case of the other Orders, and it is hoped that a commencement may be made with the Hemiptera, Hymenoptera or Neuroptera. The Council cannot hold out the expectation of very speedy progress; but the fact that Messrs. G. R. Crotch, Doubleday, Douglas, Eaton, Sir John Lubbock, M'Lachlan, Rev. T. A. Marshall, Scott, Dr. Sharp, F. Smith, Stainton and Walker are already engaged upon various groups will be sufficient to show that the work has been undertaken in earnest, and has been entrusted to competent workers.

Finally, the Council for 1867 can only repeat what its predecessors have said before, that with greater resources the Society could do much greater good. The action of the Executive is continually impeded by want of funds. No one has yet been bold enough to suggest a larger annual contribution. To increase our income we must increase the number of our Members. How long shall it be said that the Entomological Society of London, in spite of its pleasant Meetings, its useful Library, its costly publications, its almost microscopic subscription, can barely muster a couple of hundred supporters?

January 27, 1868.

The following were elected Members of the Council for 1868:—Messrs. Bates, Dunning, Grut, Sir John Lubbock, M'Lachlan, Salvin, G. S. Saunders, W. W. Saunders, F. Smith, Stainton, S. Stevens, Trimen and Westwood.

The following Officers for 1868 were afterwards elected:—President, Mr. H. W. Bates; Treasurer, Mr. S. Stevens; Secretaries, Messrs. Dunning and M'Lachlan; Librarian, Mr. E. W. Janson.

Sir John Lubbock read the following Address:—

THE PRESIDENT'S ADDRESS.

GENTLEMEN,

The labours of Entomologists have been neither less earnest nor less successful during the past year than in those which have preceded it; and it would be utterly impossible for me, within the limits of our Annual Address, even if in other respects I were capable of doing so, to give an account of all the various works and memoirs on our Science which have appeared since our last Anniversary.

We may fairly congratulate ourselves both on the number and the value of the communications read before our own Society, the power of publishing which we mainly owe, as you have already heard, to the great liberality of our very excellent Secretary, Mr. Dunning, to whom the Society is in other ways also so much indebted.

The memoirs read before the Society during the past year have been as follows :—

1867.

JANUARY 7.—Choreutidæ and Crambina collected in Egypt in 1864, and Crambina, Pterophorina and Alucitina collected in Palestine in 1865, by the Rev. O. Pickard-Cambridge; determined and the new species described by Professor Zeller.

A Monograph of the Genus Hestia; with a tabular view of the Danaidæ. By Mr. A. G. Butler, F.Z.S.

FEBY. 4.—On some Variation observed in Bombyx Cynthia in 1866. By Dr. Wallace.

„ 18.—On the Pieridæ of the Indian and Australian Regions. By Mr. A. R. Wallace.

On the Distribution of Lepidoptera in Great Britain and Ireland. B Mr. Herbert Jenner Fust, jun.

New Species of Buprestidæ collected by Mr. Lamb in Penang. By Mr. E. Saunders.

MARCH 4.—Notes on the Genus Raphidia. By Dr. Hagen.

Description of a new Carabideous Insect from Japan (Damaster auricollis, n. sp.) By Mr. C. O. Waterhouse.

Note on a Genus of Dynastid-Lamellicorns, belonging to the Family Pimelopidæ (Genus Dipelicus, *Hope*). By Mr. C. O. Waterhouse.

„ 18.—Descriptions of new Species of Cryptoceridæ. By Mr. F. Smith.

On Species and Varieties. By Capt. Thomas Hutton, F.G.S.

APRIL 1.—Descriptions of new Species of Mantispidæ in the Oxford and British Museums. By Professor Westwood.

MAY 6.—On a Collection of Butterflies formed by Thomas Belt, Esq., in the interior of the Province of Maranham, Brazil. By Mr. H. W. Bates.

JULY 1.—Observations on Dzierzon's Theory of Reproduction in the Honey-bee. By Mr. John Lowe.

A Catalogue of the Cetoniidæ of the Malayan Archipelago, with Descriptions of the new Species. By Mr. A. R. Wallace.

NOV. 4.—A Revision of the Australian Buprestidæ described by the late Rev. F. W. Hope. By Mr. E. Saunders.

Descriptions of some new Species of Diurnal Lepidoptera. By Mr. W. C. Hewitson.

A Monograph of the Genus Thais of the Family Papilionidæ. By the Rev. Douglas C. Timins.

DEC. 2.—Contributions to a Knowledge of the Coleoptera, Part 1. By Mr. Pascoe.

On some undescribed Species of South-African Butterflies, including a new Genus of Lycænidæ. By Mr. Roland Trimen.

I need not dwell on these memoirs, nor on the numerous entomological contributions which have appeared in the 'Zoologist,' the 'Entomologist,' the 'Entomologist's Monthly Magazine,' or Mr: Stainton's 'Annual,' because they are in the hands of all our members.

The 'Journal of the Linnean Society' also contains entomological memoirs by Messrs. Pascoe (2), Butler, M'Lachlan (2), Spruce, and Bates.

The 'Zeitschrift für Wissenshaftliche Zoologie' has been particularly rich this year in entomological communications.

Dr. H. Landois has published in it a very interesting memoir* on the sounds produced by insects. He commences with a short historical sketch of the subject, referring especially to the observations of Aristotle, "the greatest of naturalists;" he might almost have said "the greatest of men." He then describes successively the mechanism by means of which sound is produced among the Orthoptera, Coleoptera, Diptera, Homoptera, Lepidoptera, Hymenoptera and Neuroptera.

The number of insects which emit audible sounds is very large, and there can be no doubt that many more produce tones which, though inaudible to us, are perceptible to one another. This is shown by the fact that many species which are apparently silent possess arrangements evidently intended for the production of sound.

The familiar sounds of the Orthoptera have no claim to be regarded as a voice, but are produced by rubbing one part of the body against another. A few, but very few, of the Lepidoptera emit sounds, which are made by rubbing the palpi against the trunk, and cease if the palpi are removed.

Among the Coleoptera also sounds are generally produced by friction, and the wings often produce a humming noise during flight. In the genus Melolontha there is a second source of sound, which may almost be called a voice. In the large trachea, immediately behind each spiracle, is a chitinous process or tongue, which is thrown into vibration by the air during respiration, and thus produces a humming noise.

Similar structures occur in many Diptera, Hymenoptera, Neuroptera

* Zeits. f. Wiss. Zool. Vol. xvii. Pt. 1.

and Homoptera, and to them, even more than to the vibrations of the wings, the characteristic sounds produced by so many of these insects are ascribable. The "song" of the Cicada, for instance, is thus produced by the metathoracic ganglia, but without the assistance of figures it would be difficult to give any idea of the machinery which is described in detail by Dr. Landois, and of which I will here only observe that it differs considerably in different insects.

In the Diptera and Libellulina it is by the four thoracic spiracles that the sounds are produced, while in Hymenoptera, as for instance in Bombus, the abdominal spiracles are also musical. The sounds produced by the wings are constant in each species, excepting where there are (as in Bombus) individuals of very different sizes. In these the larger specimens give generally a higher note. Thus the male of Bombus terrestris hums in A′, while the large female is a whole octave higher. There are, however, small species which give a deeper note than larger ones, on account of the wing-vibrations not being of the same number in a given time.

Moreover, a tired insect produces a somewhat different note from one that is fresh, on account of the vibrations being slower.

Indeed, from the note produced we can calculate the rapidity of the vibration. Thus the house-fly, which produces the sound of F, vibrates its wings 21,120 times in a minute, and the bee, which makes the sound of A′, as many as 26,400 times, or 440 times in a second. On the contrary a tired bee hums on E′, and therefore vibrates its wings only 330 times in a second.

This difference is probably involuntary, but the change of "tone" is evidently under the command of the will, and thus offers another point of similarity to a true "voice." A bee in the pursuit of honey hums continually and contentedly on A′, but if it is excited or angry it produces a very different note. Thus, then, the sounds of insects do not merely serve to bring the sexes together; they are not merely "love-songs," but also serve, like any true language, to express the feelings.

Dr. Landois describes the muscles by means of which the form of the organ is altered, and the tone is, no doubt voluntarily, affected. We can indeed only in few cases distinguish the differences thus produced; but as even we, far removed as we are in organization, habits and sentiments, from a fly or a bee, can yet feel the difference between a contented hum and an angry buzz, it is highly improbable that their power of expressing their feelings should stop here. One can scarcely doubt but that they have thus the power of conveying other sentiments and ideas to one another.

In conjunction with M. Thelen, Dr. H. Landois has also communicated to the Zeits. f. Wiss. Zool. another memoir, on the means by which the spiracles, or rather the tracheæ immediately behind the spiracles, are opened or closed. The mechanism consists of four principal parts, the bow (verschlussbugel), the lever (verschlusskegel), the band (verschlussband), and the muscle (verschlussmuskel). The contraction of the latter, acting on the lever, causes the band and bow to meet, and thus close the passage. When the muscle relaxes, the natural elasticity of the parts causes them to separate again, and thus leave the tracheal tube open. They describe the details of the apparatus in a considerable number of species.*

Dr. H. Landois has also published a memoir on the ocelli of caterpillars. After describing them in detail, he comes to the conclusion that they do not essentially differ from compound eyes, and that if many of them were grouped together they could hardly be distinguished from compound eyes. In each so-called ocellus the cornea is divided into three lenses, corresponding to three nerves, each with a separate terminal enlargement forming the so-called crystalline bodies. Each ocellus therefore might be regarded as in reality composed of three. On the other hand, the three arches of the cornea are so closely connected together that they give the impression of forming a single cornea. The three lenses also are very closely pressed, and the three nerves unite into one. Under these circumstances Dr. Landois regards the ocelli of caterpillars as a connecting-link between single and compound eyes, and proposes for them the name of 'ocelli compositi.'†

Dr. August Weissmann‡ has published a long and interesting memoir on the metamorphoses of Corethra plumicornis. The larva of this fly is the beautiful transparent creature, about half an inch in length, which all lovers of Natural History must have watched floating horizontally among the green vegetation of our clear ponds, and ready, in spite of its apparent delicacy and crystalline transparency, to pounce on any little unwary victim which may come within its reach. At

* Zeits. f. Wiss. Zool. 1867, Vol. xvii. Pt. 2.

† Zeits. f. Wiss. Zool. Vol. xvi. Part 1. ‡ Id.

each end of the body are two kidney-shaped air-vesicles, which serve partly no doubt for respiration, but partly also as floats.

From its extreme transparency this beautiful larva offers a very favourable object for study, and Dr. Weissmann has described the changes which the different organs pass through. His descriptions also are illustrated by numerous figures. It will be impossible for me to recapitulate his observations, but I will cursorily refer to a few of those which have struck me as being most interesting.

The large black eye of the full-grown larva, and which is also that of the imago, does not exist at birth. The eye of the embryo and young larva becomes, as in many Crustacea, only a secondary optical organ.

In opposition to the views of M. Lacaze-Duthiers, Dr. Weissmann regards the external sexual organs as appendages, and not as the representatives of segments. The internal sexual organs, as appears to be the case in all insects, are present even at birth. So also are the rudiments of the tracheæ, which however do not contain, and indeed are not in a condition to contain air. It is still more surprising that some even of the muscles of the imago, as for instance the wing-muscles, are distinctly indicated, not indeed by true muscles, but by bands of undifferentiated tissue, which gradually enlarge and acquire the character of true muscle.

Dr. Weissmann describes minutely the gradual formation and enlargement of the different organs. This is effected by an infolding of the hypodermis or cellular layer of the skin, so that the new organ does not, as in most other cases, lie inside the old one, but is formed by an inverted fold of skin lying inside the body. The new organs also arise in the same manner, the thickening and subsequently the inversion of the skin taking place beneath one of the sensitive hairs. The neurilemma of the nerve proceeding to this hair develops itself, according to Dr. Weissmann, into all the soft parts of the new organ, whether muscle, trachea or tendon. In the formation of pupal air-vesicles, however, a trachea fulfils this function. The external appendages of the imago, such as the wings and legs, are formed, though not of course fully developed, during the larva stage; and Dr. Weissmann refers the position of the antennæ to a muscular act on their part, for which he brings forward strong reasons, though it is the first time, so far as I am aware, that any movement in the external organs of the imago has been observed during the pupal condition. From the high development reached by the antennæ, as well as the legs of Corethra, during the larva state, there seems no great improbability in this view.

From a pupa of this kind to a pro-imago, as it has been called, of Ephemera or Chloeon, there is but a step, even if so much.

In fact the so-called pupa of Corethra ought to be called a pro-imago rather than a pupa. Its functions, with one single exception, are in full activity. Though it does not feed, it swims and appears as active and vivacious as the larva. It can see perfectly well, and on the approach of danger darts rapidly to a place of greater security.

Thus, then, it affords a remarkable illustration of the arguments I have elsewhere brought forward with the view of proving that the so-called larvæ and pupæ are not homologous terms in different insects. Even among the Diptera, while in Corethra the wings and legs of the imago are already formed, and the mouth parts only require a slight final modification when the so-called larva turns into a pupa, at the corresponding period in Musca the very reverse is the case, and the head itself can scarcely be said to have any existence.

Dr. Weissmann concludes his valuable memoir by a comparison of the development of Corethra with that of Musca.

In Corethra the larval segments develop themselves directly into those of the imago, and the appendages of the head into the corresponding organs of the perfect insect. The thoracic appendages are formed during the last stage of the larva, by outgrowths of the hypodermis round a nerve or a trachea, from the cellular envelope of which the cellular tissues in the interior of the organ are formed. The larval muscles in the abdomen are received almost unaltered into the imago. The muscles peculiar to the imago develop themselves, in the last larval state, from indifferent cellular bands, which are present even in the egg. The genital glands date from the embryo, and develop gradually; all the other systems of organs pass directly, with little or no change, into the imago. The fatty tissue is small. The pupa condition is short and active.

In Musca the thorax and head rise independently from the corresponding parts of the hypodermis of the larva, and the abdomen only through direct alteration of the eight last abdominal segments. The thorax and head develop themselves from "imaginal disks" which have their origin in the embryo. First, after the formation of the pupal barrel-like envelope from the chitin skin of the larva, the imaginal disks develop themselves into the head and thorax. There is a destruction of all the organic systems, which are re-formed at the expense of the fat body. The genital glands are present in the embryo, and develop themselves gradually. The pupa condition is protracted, and the insect is inactive.

It is remarkable that even in the same Order such great differences in development should occur. Similar cases, however, are well known in other parts of the animal kingdom.

The principal difference between Corethra and Musca resides in the imaginal disks, and Dr. Weissmann proposes therefore to divide the metabolic insects into two divisions, " Adiscota " and " Discota." He admits, however, that between these two extremes all possible intermediate stages are to be met with.

The same journal contains a short paper by M. Mecznikow, on the Embryology of Hemiptera, and a memoir by M. W. Brasius, on the loss of weight of Lepidoptera during the change from the larva to the imago.

Dr. C. Kupfer has published a short memoir on the early stages of development in Chironomus, as to which he does not altogether agree with the views of Weissmann.

M. Hensen* has published a memoir on the auditory organ of Locusta, in which he confirms the description given by Von Siebold. He also endeavours to prove that there is an identity of plan between this organ and the ear of Crustacea, comparing the auditory rods of the former with the hairs of the latter. He admits that the rods have at their apex a large cell, of which the hairs show no trace ; but he argues that the rods of Locusta are primary structures, while the auditory hairs of Crustacea have never been examined until after several changes of skin ; and he thinks that if the auditory hairs were examined before the first moult, corresponding cells might probably be found at their apex. In any case he does not think that the mere presence of these cells is sufficient to destroy the analogy.

He concludes therefore that these auditory rods, like the auditory hairs of Crustacea, are thrown into vibration, when they are fitted, by

* Zeits. f. Wiss. Zool. Vol. xvi. Pt. 2.

their form and elasticity, to vibrate in a period corresponding to the exciting sound.

I must confess, however, that they appear to me very ill adapted for any such function, and I am disposed to regard them, not as hairs, but as modified nerve-terminations, corresponding to the rods in the eye of insects.

The fourth number of the sixteenth volume of the same journal is entirely composed of a very admirable paper by M. E. Mecznikow. This young naturalist, already one of our most zealous observers, promises to take a high rank among biologists, and the memoirs which he has already produced justify us in expecting great things from him. In the present memoir, after some introductory observations, he describes the development, first of Simulia, secondly of Miastor, thirdly of Corixa, fourthly of Aphis rosæ, and lastly of Coccus (Aspidiotus) nerii.

Both in the viviparous Cecidomyia and in Aphis M. Mecznikow has satisfied himself that the germinal vesicle divides and subdivides itself, the cells thus formed arranging themselves in a layer around the yolk, and thus forming the blastoderm. M. Weissmann, on the contrary, maintained that the blastodermic cells arose independently in the outer layer of the yolk: M. Mecznikow's statement is, however, most probable in itself, and is fully corroborated by his figure, the accuracy of which there is no reason to doubt. It is true that he did not actually see the division take place either in Cecidomyia or in Aphis. He relies on the absolute similarity of the first two cells with the germinal vesicles, and their unlikeness to anything else in the egg; secondly, on their absence as long as the seminal vesicle is present, and their presence as soon as it has disappeared. I must, however, confess that I have never found in any insect egg any trace of this process, nor was Prof. Huxley more fortunate. Moreover, according to Leuckart, the blastodermic cells in Aphis arise successively not by division of, but by budding from, the germinal vesicle. As soon as the blastodermic cells have arranged themselves round the yolk, the hindmost of them increases in size, becomes darkened by granular contents, and thus forms a "pole-cell" or "directive vesicle," similar to those which have been observed in so many animals that we may almost regard their presence as general at this stage throughout the animal kingdom.

It is true that in this very paper M. Mecznikow expressly states no such body exists in Corixa, in Aspidiotus or in Aphis. It is, however, difficult to believe that so fundamental a difference should exist in the embryology of animals belonging to the same class, and in fact I might appeal to one of M. Mecznikow's own figures (pl. xxviii. fig. 11) to prove that, in direct opposition to his statement, pole-cells do occur in Aphis. In that figure the blastoderm is represented, no doubt correctly, as a single layer of cells, except at the hinder end, where there are three extra cells. These three extra cells appear to me to be the pole-cells, in confirmation of which I would only ask any one to compare this figure with pl. xxiv. fig. 11, which represents the corresponding stage in Cecidomyia. It is true that the pole-cells of Aphis are not so dark or so large as those of Cecidomyia, but these are not essential characteristics, and on the other hand the part played by the blastoderm at this spot offers so much similarity, as we shall see, with that of the pole-cells of Cecidomyia as to leave very little room for doubt.

The dark colour and large size of the pole-cells in Cecidomyia are, however, favourable conditions which have enabled M. Mecznikow to throw light on their history and functions, concerning which we have hitherto been in complete ignorance. Guesses have indeed been hazarded, but, as is usual in Science, they have all been wrong. The pole-cell, which is at first single, divides into two, and these again subdivide into four similar but smaller cells. In the mean time the blastodermic cells have formed themselves into a regular membrane enclosing the yolk on all sides, and for some little time the pole-cells lie completely outside this membrane. Soon, however, they re-enter, in what manner is not stated, but are still easily distinguishable by their dark colour. They remain for some time without further change, and even when the embryo has largely increased in size, and thus become opaque, they can at any time be brought into view by a slight pressure.

When at length the segments of the body are indicated, the œsophagus and rectum formed, and the rudiments of the mandibles and two pairs of maxillæ are already evident, the four pole-cells separate themselves into two groups of two, without, however, having undergone any further change. In embryos somewhat farther advanced, each pair of pole-cells is found to be enclosed in a special organ occupying a definite position in the embryo. These organs are of an oval form and are composed of small cells, which do not differ either in form, size or contents from the ordinary embryonal cells. At one end of each gland is a short duct, which at first consists of a single row of embryonal cells. Subsequently the pole-cells commence to divide themselves anew, and thus form the vitelligenous and germinal vesicles, while the walls of the organ and its epithelial cells are composed of ordinary embryonal cells.

It appears then, in short, from these remarkable observations, that the pole-cells, after remaining for some time outside the blastoderm, re-enter it, collect round themselves a sufficient mass of the ordinary embryonal cells, and thus form the rudiments of the new generative organs.

To judge from M. Mecznikow's description and figures, very much the same thing appears to happen in Aphis. The cells, indeed, which I suppose to be the pole-cells do not differ from the rest either in size or colour, and cannot therefore be traced throughout the developmental changes, as in Cecidomyia. The blastoderm, however, in their neighbourhood—*i.e.* at the hinder end of the egg—projects into the yolk and forms the pseudovitellus and the rudiment of the future generative organs, as was first described by Huxley in his celebrated memoir on this subject. We see, then, not only that the generative organs are present in the embryo, but even *that they are the very first organs to make their appearance.* Before a single appendage is indicated, before the mouth or any one of the internal organs is traced out, the essential parts of the generative organs are already in their place.

It is true that the two cases in which this remarkable fact has been observed are both instances of agamic reproduction. I have, however, shown, in my papers published in the 'Philosophical Transactions' for 1857, 1858 and 1861, which appear to have escaped M. Mecznikow's notice, that the agamic reproduction in insects closely resembles that by means of impregnated eggs, and I can hardly therefore suppose that there would be any fundamental difference in the development of the generative organs themselves.

It will be observed that there is nothing in M. Mecznikow's observations to confirm the remarkable statements of M. Balbiani, to which I alluded in my last Address. It is satisfactory to know that this gentleman is about to publish his memoir in full, with figures.

Considerations of time and space prevent me from referring to many other parts of M. Mecznikow's memoir which are of great interest, but there are one or two points which I cannot pass over altogether in silence.

In opposition to the views generally held by entomologists (see, for instance, Westwood's 'Modern Classification of Insects,' vol. ii. p. 414), he denies that the needle-like organs contained in the labium of Homoptera represent the mandibles and maxillæ, though he admits that they do so in the Heteroptera. He describes the larva of Teleas, a minute species allied to Pteromalus, which oviposits in the eggs of Gerris, as much resembling, both in its first form and also in its remarkable changes, the extraordinary larva of Rhynchites, which was discovered by Dr. Filippi.* In the viviparous Cecidomyia he confirms the interesting observation, first made by Zaddach in Mystacides, that the antenna of the larva is originally post-oval. Lastly, I may mention that Mecznikow declines to accept Weissmann's division of metabolic insects into "Discota" and "Adiscota."

Dr. Möller has published a memoir on the influence exercised upon insects by external conditions. One of the most interesting parts is that in which he gives cases where the colour of a species depends on that of its habitat. Thus, for instance, Elaphrus riparius, he says, in sandy districts, is of a clear brown colour; in meadow lands, on the contrary, green. Again, the larva of Amphidasys betularia is yellowish green when it lives on the birch; ashy gray when on the oak; yellowish brown when on the elm; yellowish green clouded with rust-colour when on willows or poplars. He also gives a list of the species which he has observed in ants' nests.†

The Ann. des Sci. Nat., 5th ser., t. vii., contains a paper by M. Claparède (which has also been translated in the 'Annals and Magazine of Natural History' for May last) on the "Reproduction of Aphides." M. Claparède pronounces decidedly against M. Balbiani's theory of the hermaphroditism of Aphides, as to which I ventured to express my own doubts in my Address of last year. M. Claparède appears to have overlooked the fact that M. Balbiani's so-called "testis" had been already observed by Huxley. In reply to this criticism M. Balbiani (*lib. cit.* p. 30) promises shortly to publish his memoir *in extenso*.

* Ann. d. Sci. Nat. 1851.

† 'Die Abhängigkeit der Insecten von Ihrer Umgebung,' v. Dr. L. Möller.

Dr. E. Bessels has a memoir in the Zeits. f. W. Zool. for 1867, p. 545, on the development of the sexual organs in Lepidoptera. He does not appear to have seen my papers on the same subject in the 'Philosophical Transactions.' He mentions that a friend of his bred a specimen of Lasiocampa catax, which remained no less than seven years in the pupa state.

Mr. Lowe, at one of our Meetings, read a paper on Dzierzon's theory of the agamic character of the drone-producing eggs of the bee, and exhibited some drones produced by a Ligurian queen which had been impregnated by an ordinary drone. He argued that if impregnated eggs produced females only and the drones were always descended from unimpregnated eggs, then a queen thus impregnated ought to produce hybrid workers, but pure drones, while those which he exhibited certainly differed in many respects from pure Ligurian males. This observation, however, is not so conclusive as it appears at first sight. The alteration of climate and of food might influence the colour of the drones, or it might be supposed that the queen, though apparently pure, contained some German blood, which thus showed itself. Moreover, we know cases, both in animals and plants, where the ovary is deeply affected by the influence of the male. And, lastly, it is stated that the pure Italian drones show considerable variability.

The most probable explanation of the phenomenon, however, is I think, that these drones are the produce of the workers, which, being descended from a marriage of an Italian mother with a German father, would naturally produce a mixed offspring.

Dr. H. Landois, in a short paper on the development of the sexes in insects, also combats the views of Dzierzon as to the parthenogenesis of bees. He maintains that the sex of the bee depends on the character not of the egg, but of the nourishment. In support of this he asserts that he has removed eggs from drone-cells and placed them in those of workers, and that invariably the grubs hatched from them have produced, not drones, but ordinary workers. He also refers to the well-known possibility of developing young worker-larvæ into queens, which, however, I need hardly observe is not a case of change of sex; and also the difficulty presented by the cross between the common and the Italian bee. When, however, Dr. Landois observes that the females of insects require a longer time for their development than the males, on account of their more complete development, he forgets that in the hive bee the queen comes to maturity in sixteen days, while the workers require twenty-one, and the drones twenty-four. Of course if Dr. Landois were correct in his statement that the sex of an insect depends upon its nourishment, it follows that it must be undetermined even until some time after the hatching of the egg. No one indeed has yet ascertained that, in the case of the bee, the sex is determined in the embryo, but from analogy it is most probable that this is the case.

Moreover, as Prof. Siebold has pointed out (Zeit. f. Wiss. Zool. 1867, p. 525), the food of all bee-larvæ is the same for the first six days, and that of the drones and workers even longer—a fact which seems fatal to M. Landois' theory. M. Siebold expresses, in courteous language, a doubt, which I think most naturalists will share, whether there is not perhaps some mistake in M. Landois' experiment.

In the same number of the 'Zeitschrift' M. Kleine also makes some remarks on M. Landois' theory. He also points out that the food of workers and drones is identical; and as regards the difficulty presented by the crossing of the Italian bee with an ordinary drone, he observes that Italian drones under any circumstances vary considerably, and that even when of pure breed many of them cannot be distinguished from the northern variety. He adds, moreover, that before the introduction of the Italian variety, drones closely resembling Italians sometimes made their appearance.

Moreover, as long ago as 1862, Berlepsch had performed Landois' experiment of transferring eggs, but with very different results. He took six eggs out of drone-cells and placed them in ordinary cells. Two perished, but four produced drones. Again he transferred six other eggs from ordinary cells into drone-cells. One perished, the other five produced larvæ which reached a certain size, and were then destroyed by the bees. Berlepsch examined them and found that they were males. It is evident, therefore, that the transference of eggs from male cells to female cells, or *vice versâ*, does not have any effect on the sex.

M. E. Bessels * has also taken great pains to settle this interesting question. In spite of several attempts, made with the greatest care, he was unable successfully to perform the transference experiment. In every case the bees removed the obnoxious egg. By varying the experiment, however, which he did in a very ingenious manner, he induced the

* Zeits. f. Wiss. Zool., Vol. xviii. Pt. 1.

queen bee to perform it for him. He took an ordinary queen and placed her in a hive with a comb containing drone-cells only. She was for some time disturbed by this unusual state of things, but after awhile made a virtue of necessity, and commenced laying her eggs in the drone-cells. These eggs in due time produced ordinary workers.

Again, M. Bessels took a young virgin queen, and by clipping her wings rendered her incapable of marriage. He then placed her in a hive with a comb which had no drone-cells, in spite of which her eggs produced nothing but drones. As far as they go, these two experiments, ingenious as they are, seem to me less conclusive than those of Berlepsch. Under ordinary circumstances the bees appear to regulate the food of the young larva according to the nature of the cell in which it is placed, but we cannot take for granted that they would do so under such exceptional conditions as when all the cells were of the same character.

M. Bessels' next experiment, however, is not open to this objection. He took combs which contained drone-cells only, and placed them in a hive which he deprived of its queen. The bees, in the usual manner, selected two or three of the larvæ, altered the form of the cells, and commenced feeding them with royal food. The drone larvæ, however, did not thrive under this unnatural treatment, but perished; not, however, until the generative organs were sufficiently developed to show that they were true males. This experiment he repeated three times, always with a similar result.

M. Bessels does not seem to have been aware that Huber had already made this experiment. Huber could not indeed induce an ordinary queen, during her course of laying workers' eggs, to lay in a drone-cell, but he did cause a "retarded," or, as we should say, virgin queen, to lay in worker cells and even in royal ones. In these cases the workers fed the larvæ respectively with worker food and royal food, but Huber expressly tells us that males only were produced, though in the former case they were of small size from insufficient nourishment. This experiment of Huber's, which seems conclusive, appears to have been overlooked by Dr. Landois as well as by his opponents.

In the 'Comptes Rendus' for November is a short notice of a memoir, by M. Lespès,* on blind Coleoptera. He has examined the nervous system of Aphænops Leschenaultii (one of the Carabidæ), of Adelops

* 'Comptes Rendus,' 1867, p. 890.

pyrenæus and Pholeuon Querilhaci (Silphidæ), of Claviger Duvalii, and of Langelandia anophthalma. He finds not only the optic nerve has disappeared, but also that the brain itself is profoundly altered, for as he expresses it, "Les ganglions cérébroides, au lieu de former une sorte de masse transversalement disposée dans la tête, ont la forme de deux corps ovales allongés placés presque parallèlement."

In the 'Geological Magazine' for September last is a short but interesting paper by Mr. Dawson on palæozoic insects. The first belongs to the carboniferous period. Insects representing the Orders Neuroptera, Orthoptera and Coleoptera were long ago observed in the coal-fields of England and Westphalia. Until last year, however, though the coal-beds of Nova Scotia are rich in vegetable remains, no remains of insects had been observed in them. The species now described by Mr. Scudder, under the name of Haplophlebium Barnesii, after its finder, is referred to the Ephemerina, and must have measured no less than seven inches across the wings. "We can easily understand," says Mr. Dawson, "that the swamps and creeks of carboniferous Acadia, with its probably mild and equable climate, must have been especially favourable to such creatures, and we can imagine the larvæ of these gigantic Ephemeras swarming on the deep black mud of the ponds in these swamps, and furnishing a great part of the food of the fishes inhabiting them, while the perfect insects, emerging from the waters to enjoy their brief space of aërial life, would flit in millions over the quiet pools and through the dense thickets of the coal-swamps."

Mr. Scudder describes four insects from the Devonian shales of New Brunswick, under the names of Platephemera antiqua, Homothetus fossilis, Lithentomum Harttii and Xenoneura antiquorum. These are the oldest insects yet known to us, but Mr. Scudder is satisfied from the plants with which they are associated, that there can be no doubt of their belonging to the Devonian period. They are all Neuropterous, and allied to the Ephemeridæ. In the opinion of Mr. Scudder, however, they show a "remarkable union of characters now found in distinct orders of insects," and he lays special stress on the presence in Xenoneura of a stridulating or musical apparatus, much like that of the cricket. In addition to the interest of finding such an organ among the Neuroptera, this observation brings before our imagination, as Mr. Scudder says, "the thrill and hum of insect-life that enlivened the solitudes of these strange old forests."

Mr. Kirkby also, in the 'Geological Magazine,' describes three insect-wings from the coal-measures of Durham, and considers that they probably belonged to insects allied to the Blattidæ.

Psyche helix is well known to all entomologists as being one of those interesting species of which the males long remained unknown. From the time of Réaumur, naturalists have sought for it in vain. Von Siebold especially examined a hundred and fifty specimens, which all proved to be females. Latterly, indeed, one or two entomologists have described insects which they supposed to be the males of P. helix, but there has always been a certain amount of doubt about it. Prof. Clauss appears to have been more fortunate. The larval case of the male (Zeits. f. Wiss. Zool. vol. xvii. p. 470) is smaller than that of the female, and somewhat different in form. The larva itself is very similar in the two sexes, while, on the contrary, the pupæ differ considerably. Prof. Clauss gives a description and figure of the male, and whatever doubt may attach to the supposed discovery of this sex by other observers, we may now, I think, congratulate ourselves that the male of this curious species has been at last discovered.

The last number of the Zeitschrift f. Wiss. Zool.* contains a short paper by M. F. Ratzel on the egg of an Ephemera. He describes and figures two curious hemispherical appendages which are attached to their flat sides, one to each end of the egg. Leuckart, in his celebrated memoir, "Ueber die Micropyle und den feineren Bau der Schalenhaut bei den Insecteneiern," had already observed a somewhat similar appendage to the eggs of the Ephemeras examined by him, as indeed Swammerdam had also done long before; but he considered it to be a mass of spermatozoa, one end of which was engaged in the micropyle opening. M. Ratzel has, however, observed the formation of the appendages in the ovary, which proves that they belong to the egg itself. The eggs examined by M. Ratzel have another curious peculiarity. A number of fibrous cords, each ending in a circular disk, are attached to the egg along two zones, which divide it into three subequal parts. He suggests that the object of these curious structures is to prevent the eggs from being carried away by the current.

The 'Comptes Rendus' for June last contain an interesting paper by MM. Balbiani and Signoret, on Periphyllus testudinatus, which

* Vol. xviii. p. 99.

has been translated in the 'Annals and Magazine of Natural History' for August. This insect, known here as the leaf-insect or brown Aphis of the maple, was discovered by Mr. Thornton in 1852, and described under the name of Phyllophorus testudinatus. In 1858 Mr. Lane Clark changed the generic name to Chelymorpha, Phyllophorus having been already used. Chelymorpha, however, is in the same position, and M. Van der Hoeven therefore replaced it by Periphyllus. The insect is a minute form of Aphis, about one twenty-fifth of an inch in length, flat, and brown. It is characterised by "the extraordinary development and unusual appearance of the tegumentary system. Thus their surface is no longer furnished only with simple hairs, but also and principally with scaly transparent lamellæ, more or less rounded or oblong, and traversed by divergent and ramified nervures. These lamellæ occupy especially the anterior margin of the head, the first joint of the antennæ (which is very stout and protuberant), the outer edge of the tibiæ of the two anterior pairs of legs, and the lateral and posterior margins of the abdomen. Moreover the whole dorsal surface of the latter and of the last thoracic segment is covered with a design having the aspect of a mosaic, composed of hexagonal compartments, and which is not without analogy to the pattern formed by the scaly plates of the carapace of tortoises.". . . . "Another remarkable character of these abnormal individuals of Aphis Aceris is the rudimentary state of their generative apparatus. This is reduced to a few groups of small, pale, and scarcely visible cells, none of which arrives at maturity to become transformed into an embryo: and it retains this character as long as it is possible to observe the animal. The functions of nutrition, also, are performed in them in a very unenergetic manner; for from the moment of their birth until that at which we cease to observe them, they increase but little in size, attaining scarcely 1 millimètre. They undergo no change of skin, never acquire wings like the reproductive individuals, and their antennæ always retain the five joints which they present in all young Aphides before the first moult. Nevertheless they possess a well-developed rostrum and an intestinal canal, the peristaltic contractions of which we have distinctly observed."

This curious Aphis turns out to be, not, as was at first supposed, the larva of a new species, but a special form of the well-known Aphis aceris. MM. Balbiani and Signoret consider that they have placed this remarkable fact beyond the possibility of doubt.

The question naturally arose, What was the signification " of these abnormal individuals of the Aphis of the maple, and what part did they fulfil in the reproductive functions of the species to which they belong? They are evidently not males, since their generative apparatus retains the same rudimentary form at whatever epoch we examine them. Moreover, in no known species of Aphis are the males produced at the same time as the viviparous individuals, which are not the true females of the species. There is therefore no other alternative but to regard them as a modification of the specific type constantly reproduced, with the same characters, by the successive normal generations."

This, I confess, seems to me no satisfactory explanation of the constant production in a species of a form, very abnormal in appearance, which does not reproduce itself, which scarcely grows at all, is almost stationary, and, after living for several months, dies with the leaf on which it was born. This curious instance of Dimorphism seems to offer a very promising field for further study, and I would specially recommend it to the attention of the Members of our Society.

In conclusion, gentlemen, I cannot quit this chair without thanking you for the constant courtesy and support which I have met with from all during the two years that I have had the honour of presiding over you; more especially my thanks are due to the members of Council, and, above all, to my friend Mr. Dunning.

It is a great satisfaction to me to feel that I shall be succeeded by my friend Mr. Bates, of whom we are all proud, by whose labours our Science has been so much advanced, and under whose Presidency our Society is, I think, sure to prosper.

Mr. Pascoe proposed a vote of thanks to Sir John Lubbock for his conduct in the chair throughout his tenure of the Presidency, accompanied by a request that the admirable Address just delivered might be published in the Society's 'Journal of Proceedings.' This was seconded by Mr. Grut, and carried by acclamation.

Sir J. Lubbock returned thanks, and acceded to the request.

The thanks of the Society were also voted to the other Officers, the Auditors, and the Members of Council for 1867, and were acknowledged by Mr. S. Stevens, Mr. Dunning, Mr. Janson and Mr. J. Jenner Weir.

Abstract of the Treasurer's Accounts for 1867.

Receipts.

	£	s.	d.
By Balance in hand, 1st January, 1867	11	18	1
„ Arrears of Subscriptions	23	3	0
„ Subscriptions for 1867	154	7	0
„ Admission Fees	18	18	0
„ Sale of 'Transactions'	77	18	2
„ „ Furniture, &c.	6	7	3
„ Interest on £109 14*s.* 9*d.* Consols	3	5	10
„ Tea Subscriptions	11	6	0
„ Donation from W. Wilson Saunders, Esq.	5	5	0
„ „ J. W. Dunning, Esq.	105	0	0
	£416	18	4

Payments.

	£	s.	d.
To paid Arrears for 1866, Rent, one quarter	5	0	0
„ Fire Insurance to Lady Day, 1868	1	4	0
„ Librarian for Attendance	18	4	0
„ for Tea, 13 Meetings	13	13	0
„ Attendance, Coals, Candles, Postage, Stationery, &c.	20	12	9
„ Rent, to Christmas, 1867	20	0	0
„ Printing 'Transactions'	197	5	9
„ „ 'Proceedings,' Circulars, &c.	16	14	0
„ for Plates, engraving	11	14	0
„ „ printing	15	10	6
„ „ colouring	85	9	0
„ Books purchased	4	16	0
„ Prize for Essay on Economic Entomology	5	5	0
Balance in Treasurer's hands	1	10	4
	£416	18	4

Liabilities and Assets of the Society.

Liabilities.

	£	s.	d.
To Loan of Mr. Dunning	45	0	0
	£45	0	0

Assets.

	£	s.	d.
By Arrears of Subscriptions:—			
Good (say)	18	18	0
Doubtful £40 19*s.* 0*d.*			
„ £109 14*s.* 9*d.* Consols (cost)	100	0	0
„ Cash Balance in hand	1	10	4
	120	8	4
Less Liabilities	45	0	0
	£75	8	4

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GENERAL INDEX.

NOTE.—Where the name only of an Insect is mentioned, the description of the Insect will be found at the page referred to.

The Arabic figures refer to the pages of the Transactions; the Roman numerals to the pages of the Journal of Proceedings.

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GENERAL SUBJECTS—*continued.*

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COLEOPTERA.

COLEOPTERA—*continued.*

COLEOPTERA—*continued.*

DIPTERA.

HEMIPTERA.

LEPIDOPTERA—*continued.*

LEPIDOPTERA—*continued.*

LEPIDOPTERA—*continued.*

MYRIAPODA.

NEUROPTERA.

NEUROPTERA—*continued.*

NEUROPTERA—*continued.*

ORTHOPTERA.

STREPSIPTERA.

THYSANURA.

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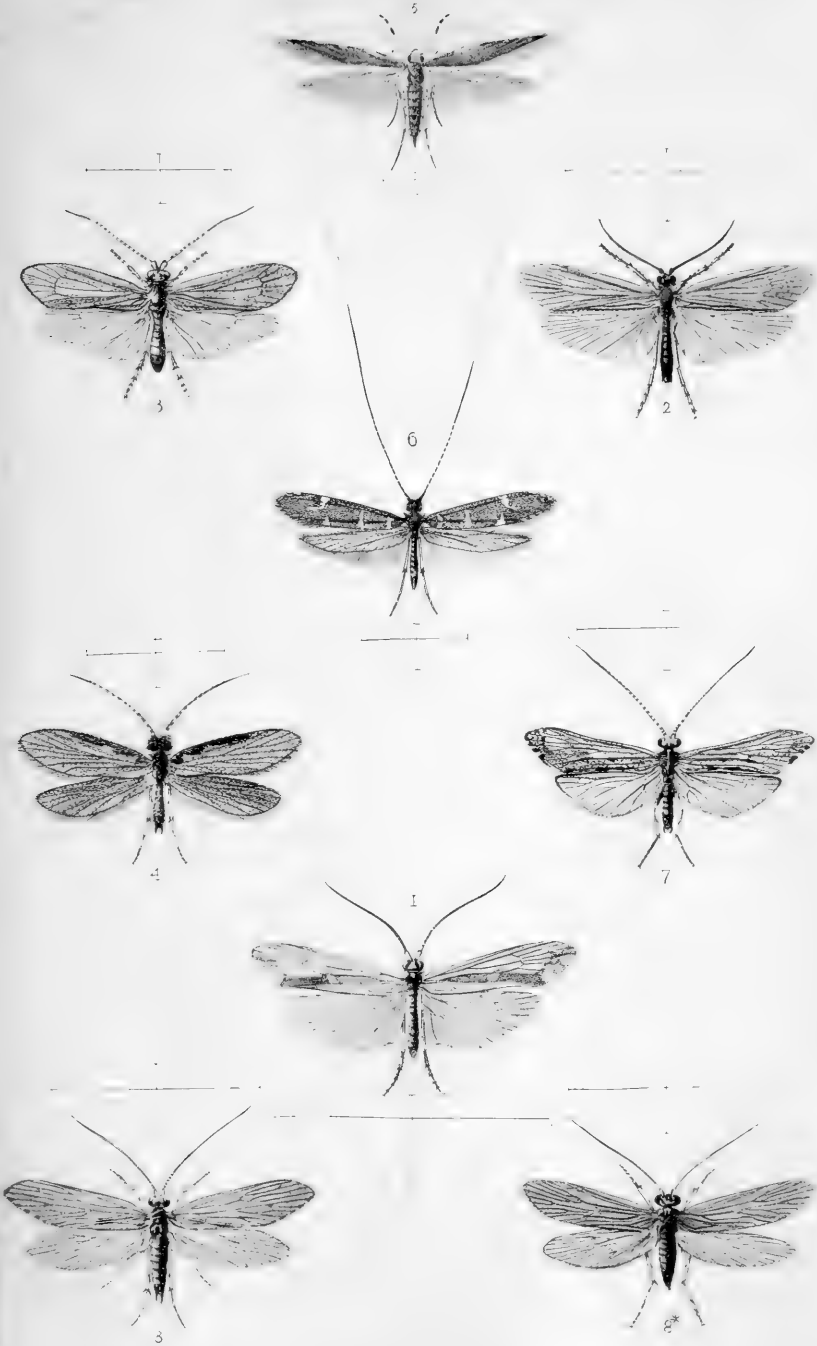

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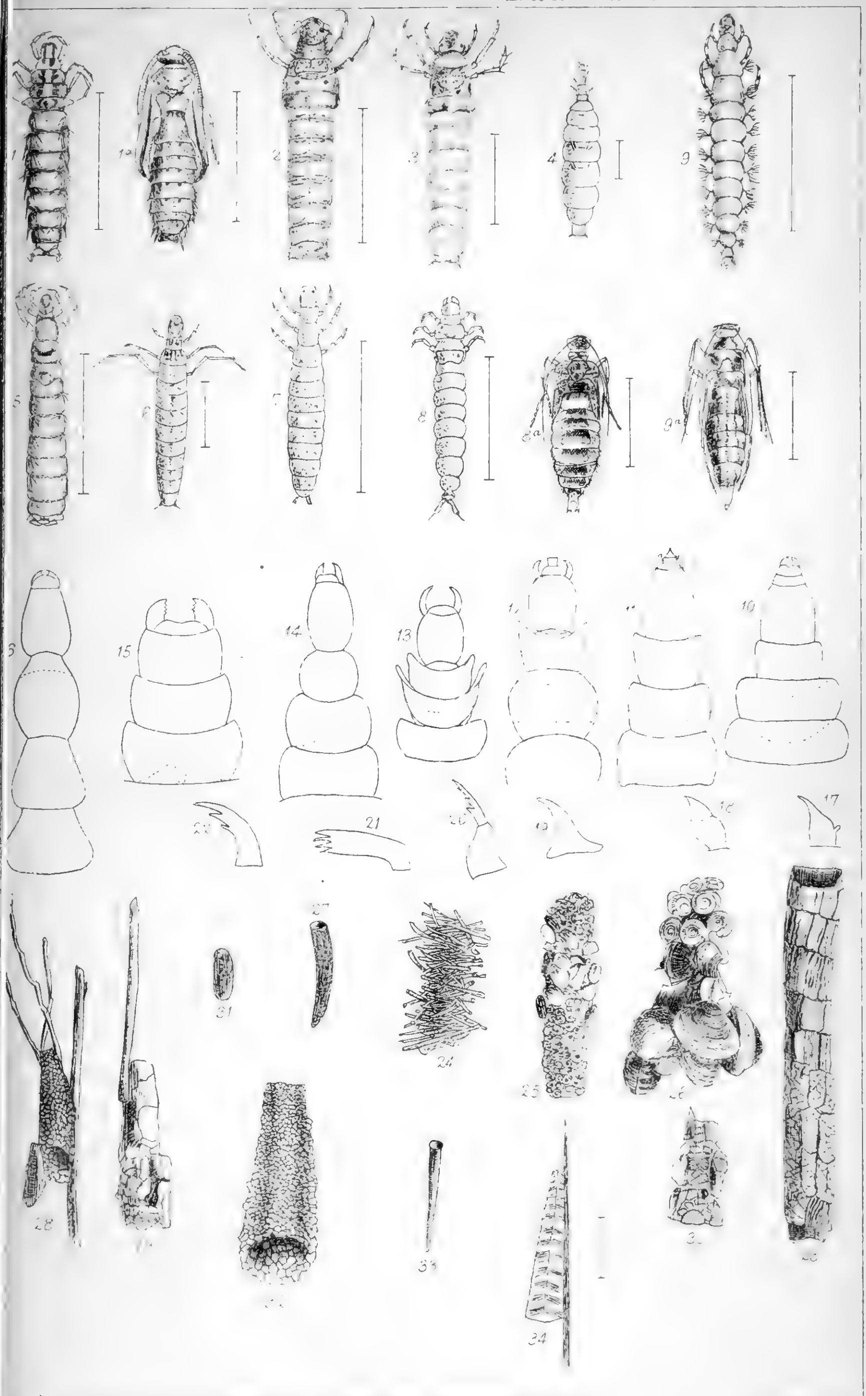

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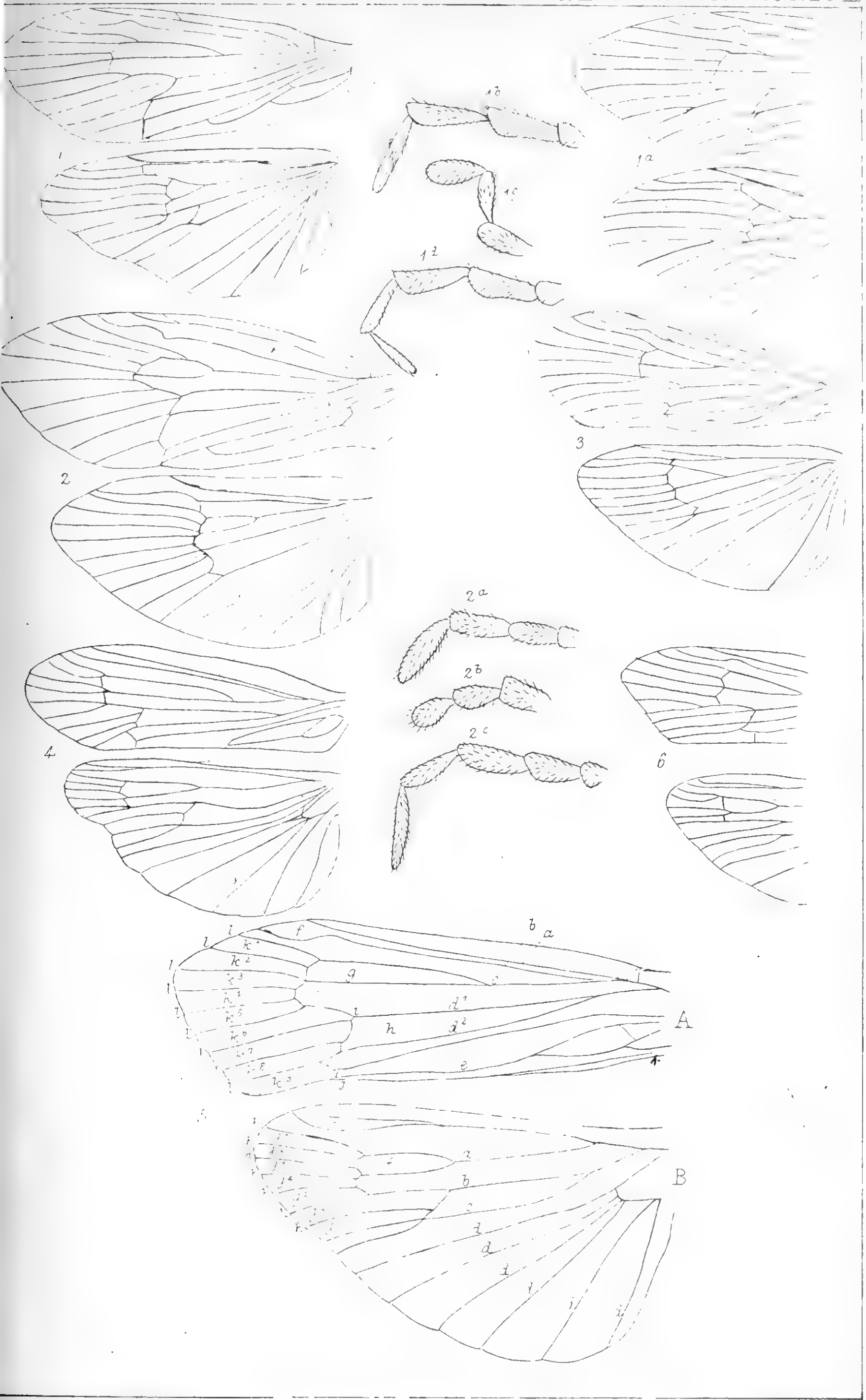

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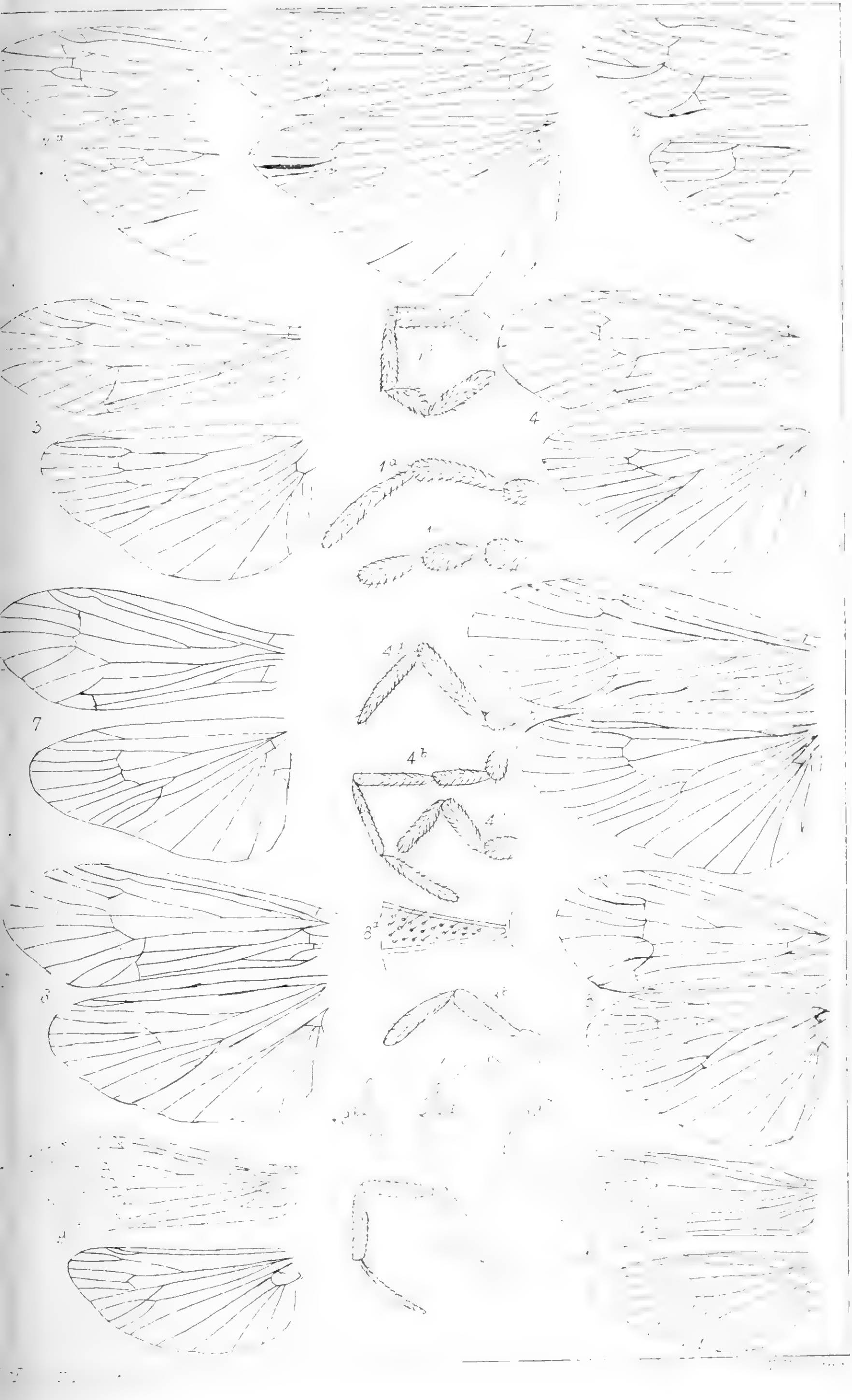
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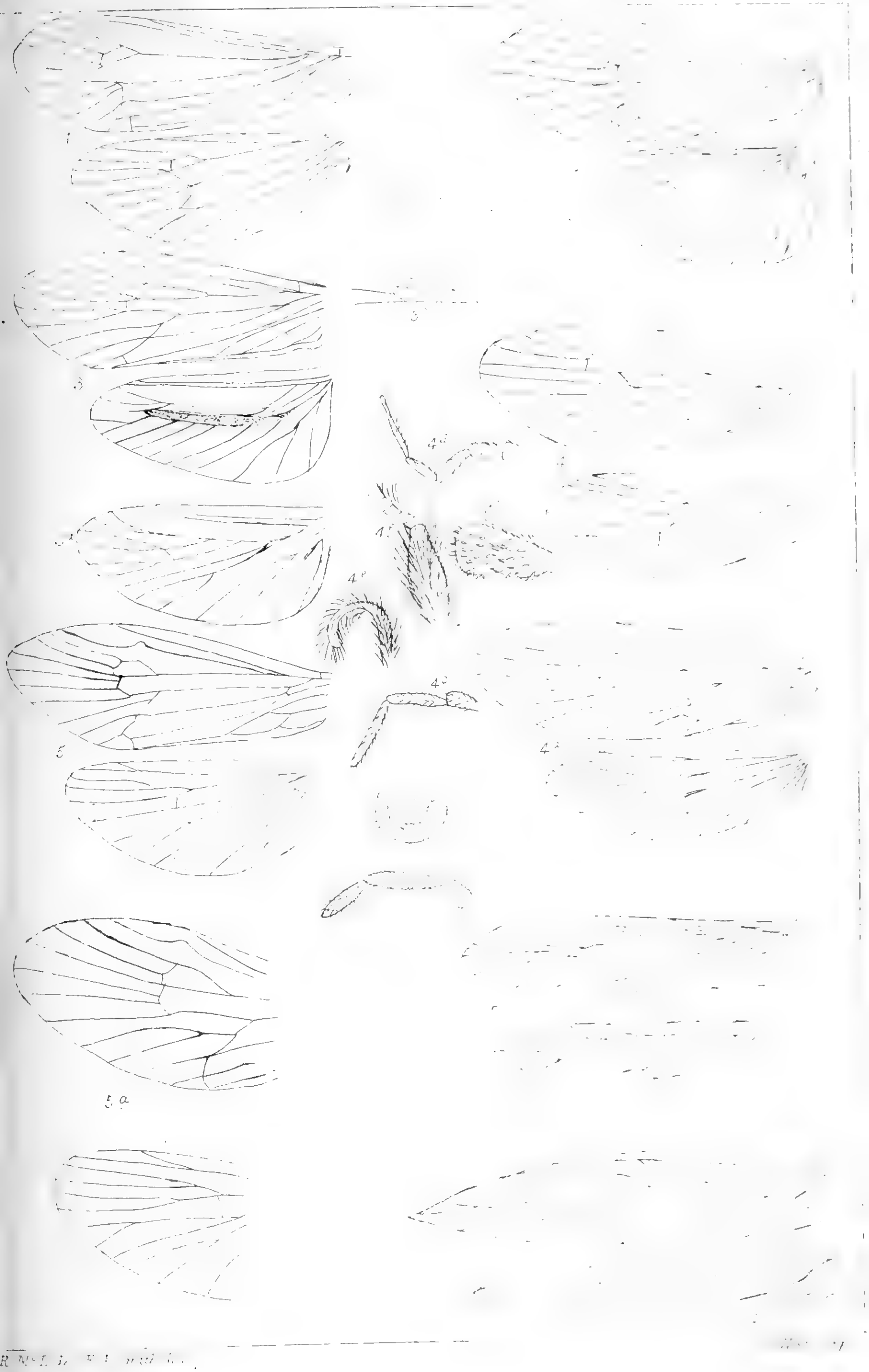

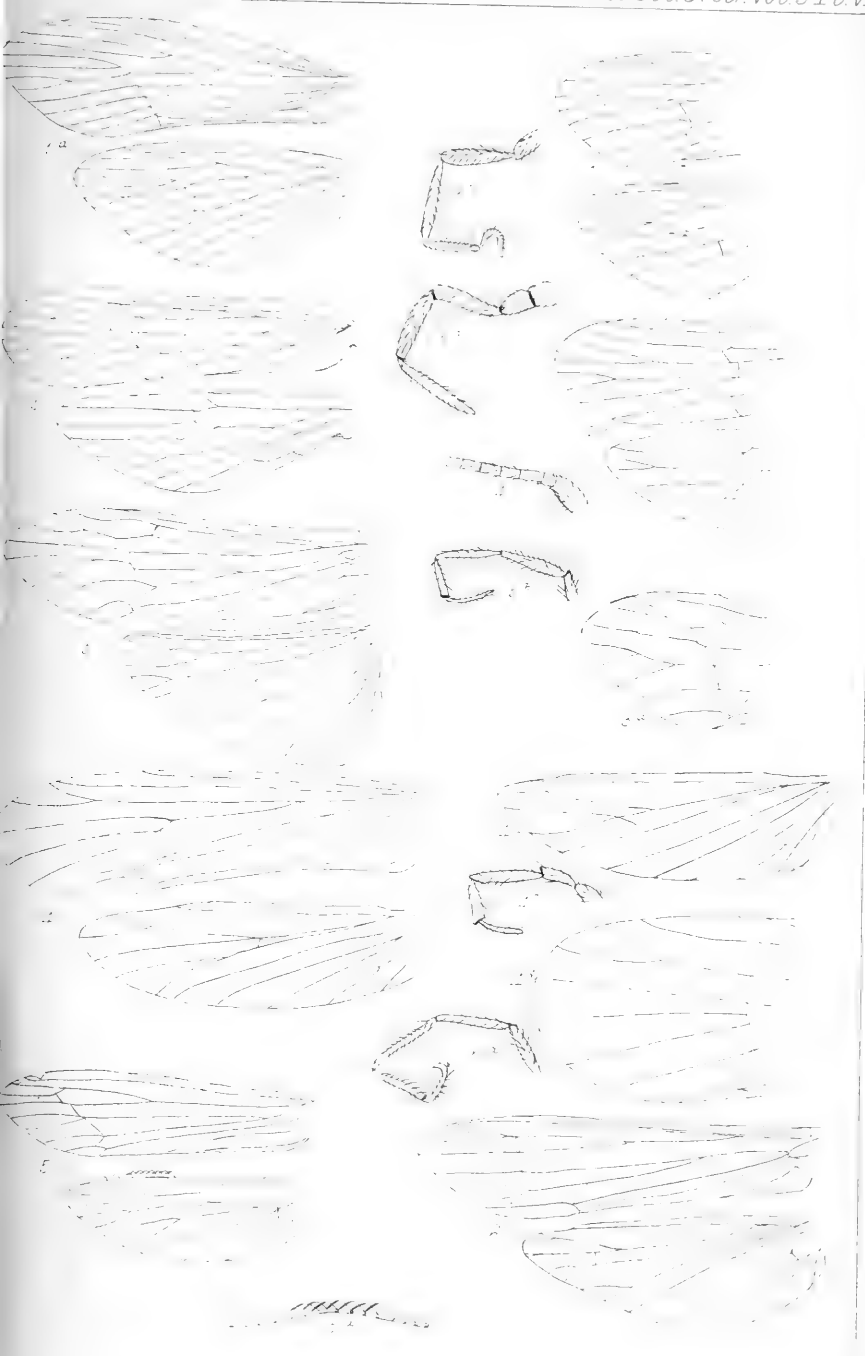

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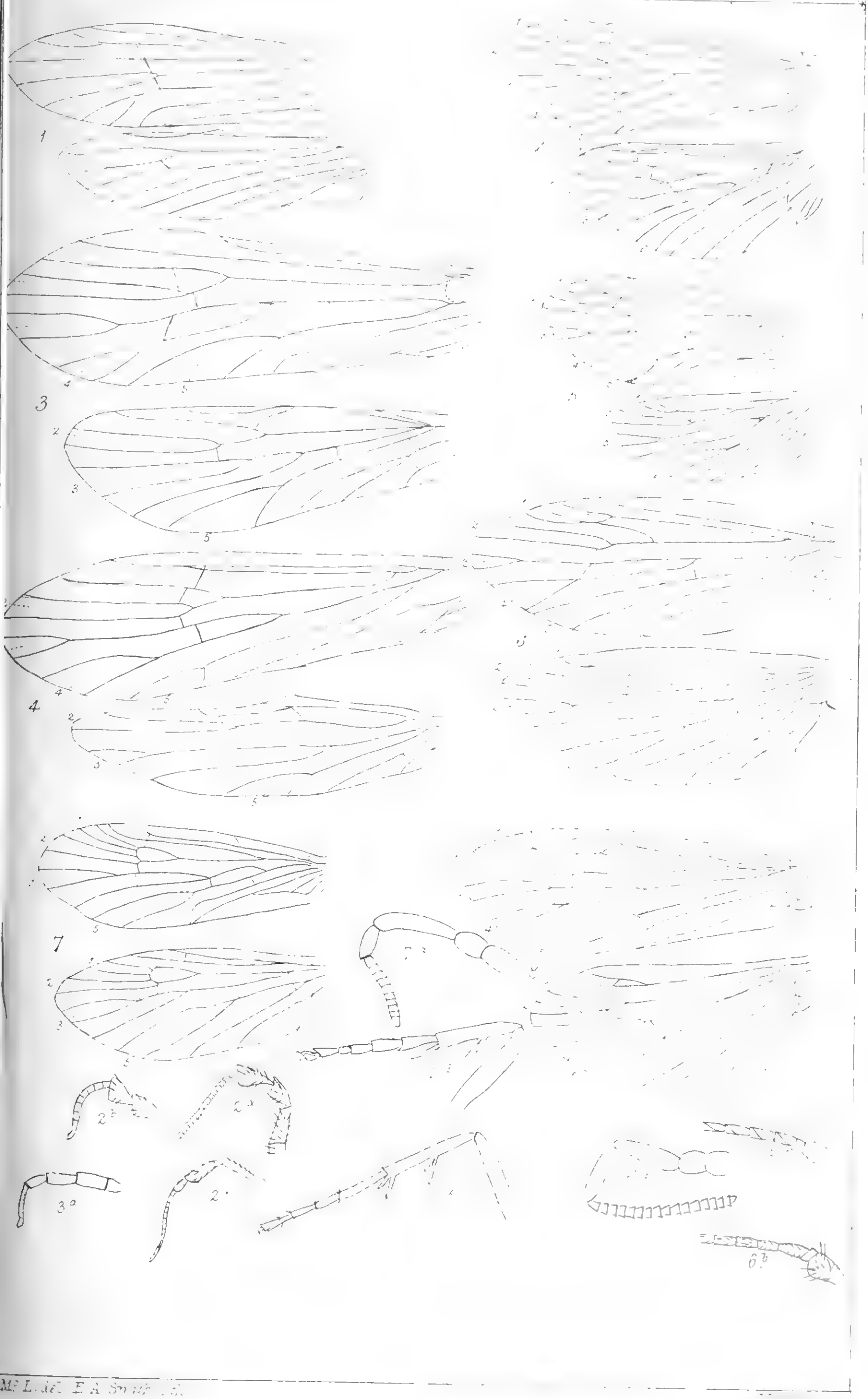

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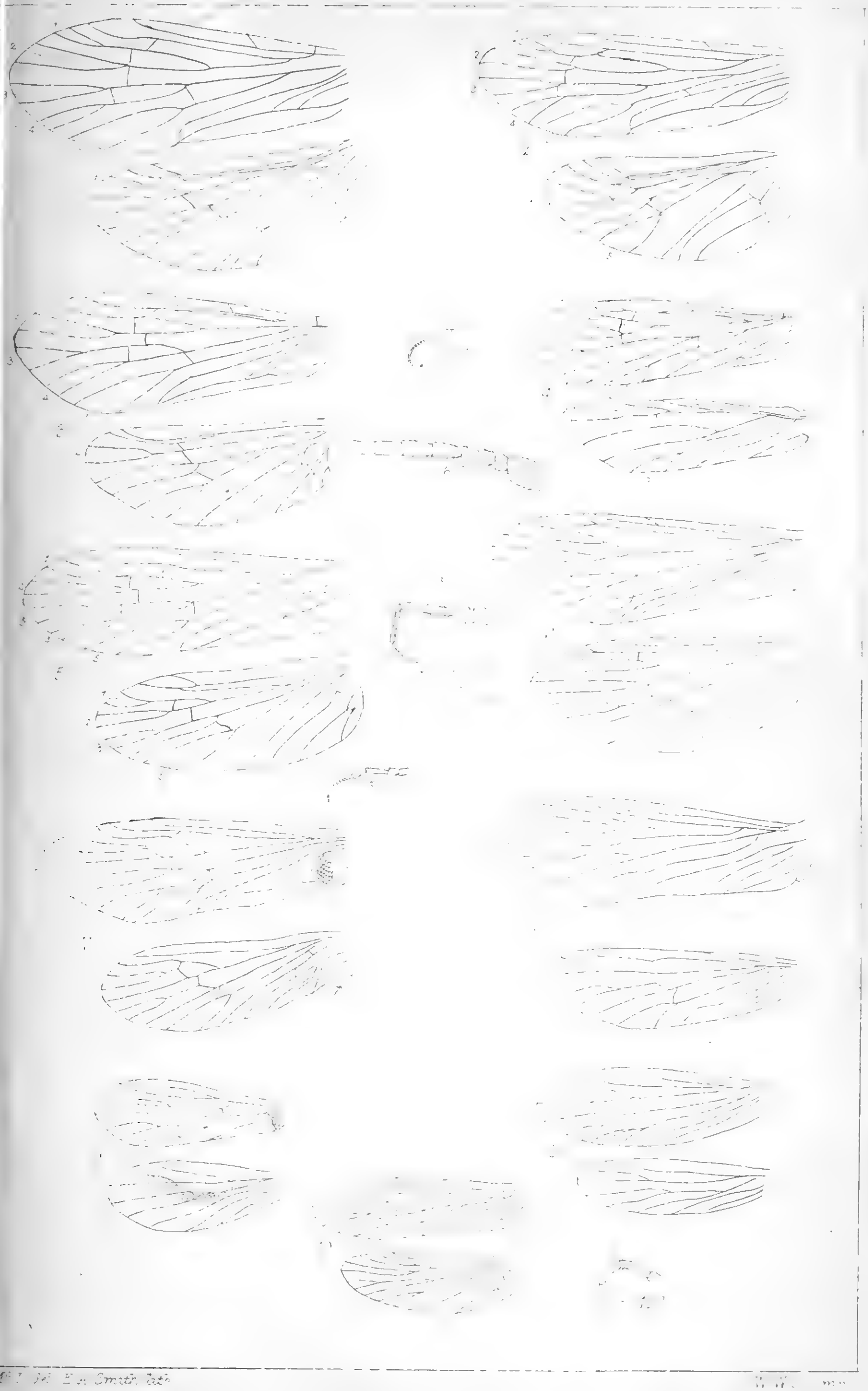

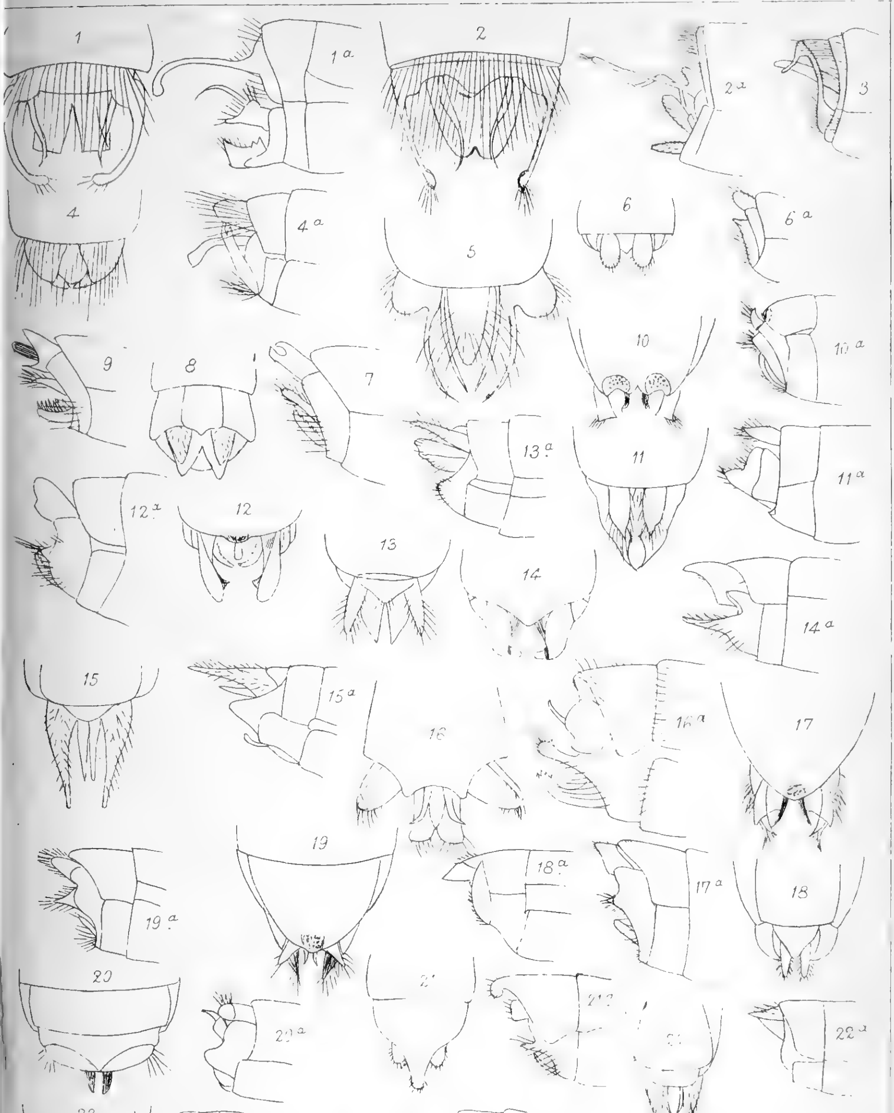

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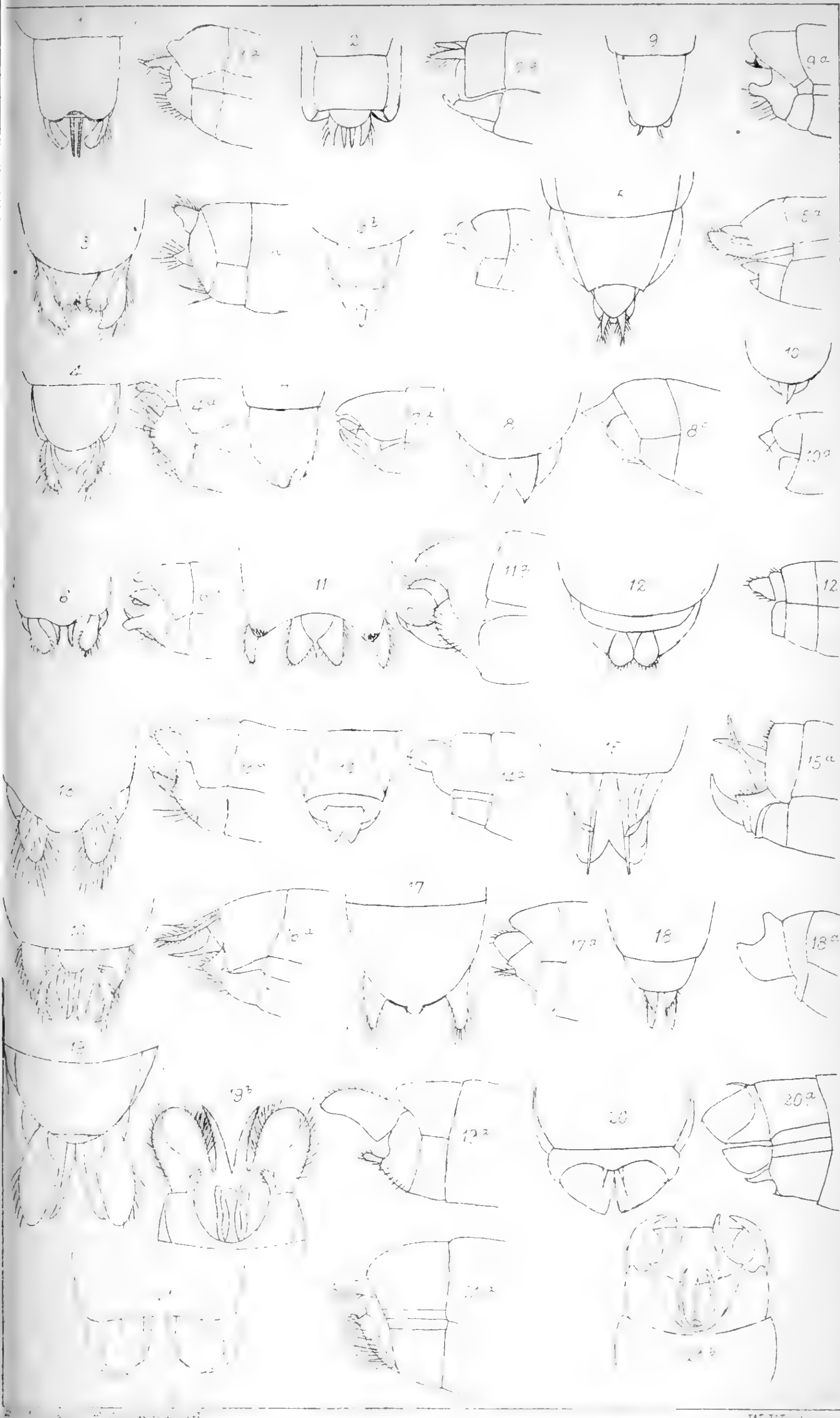

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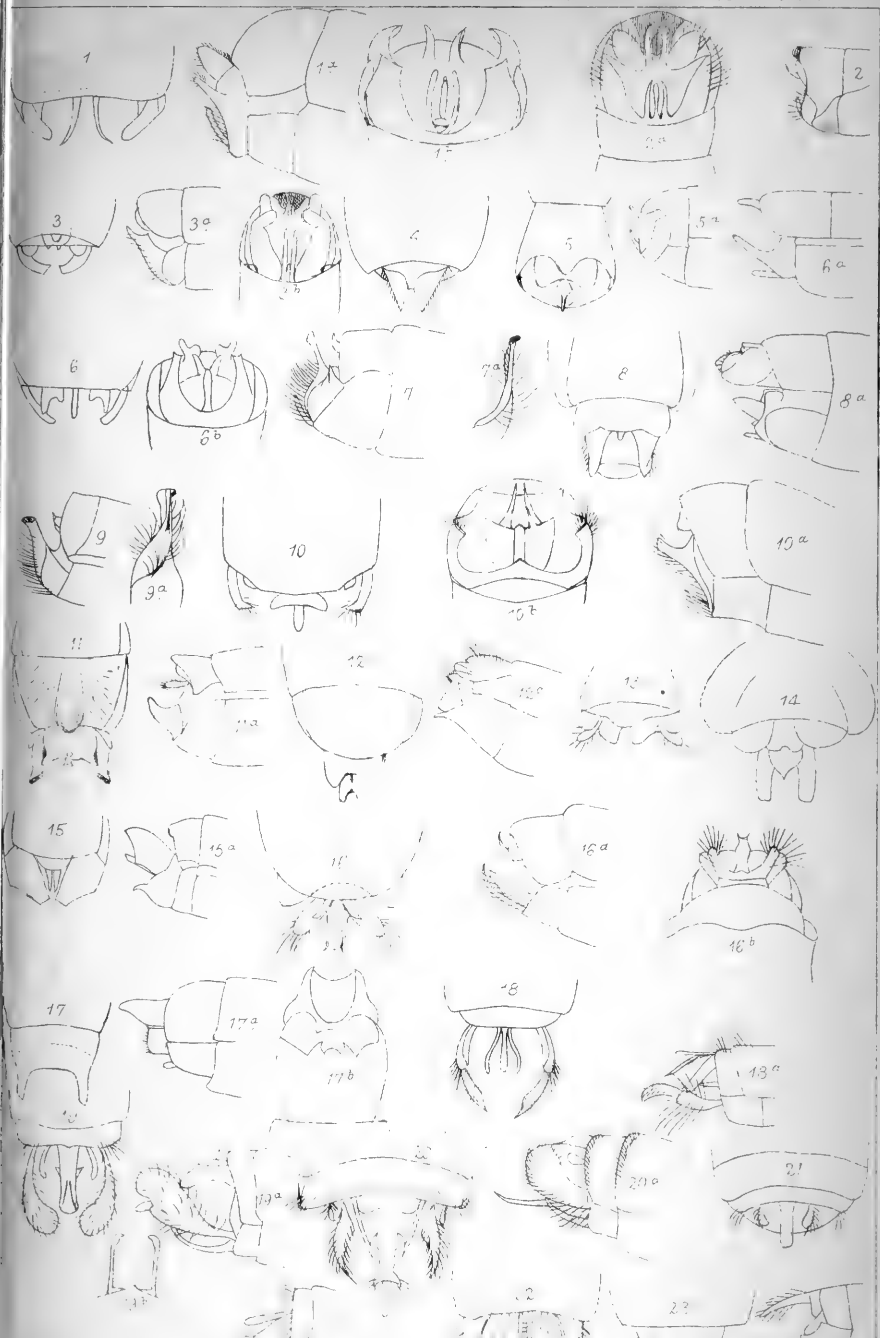

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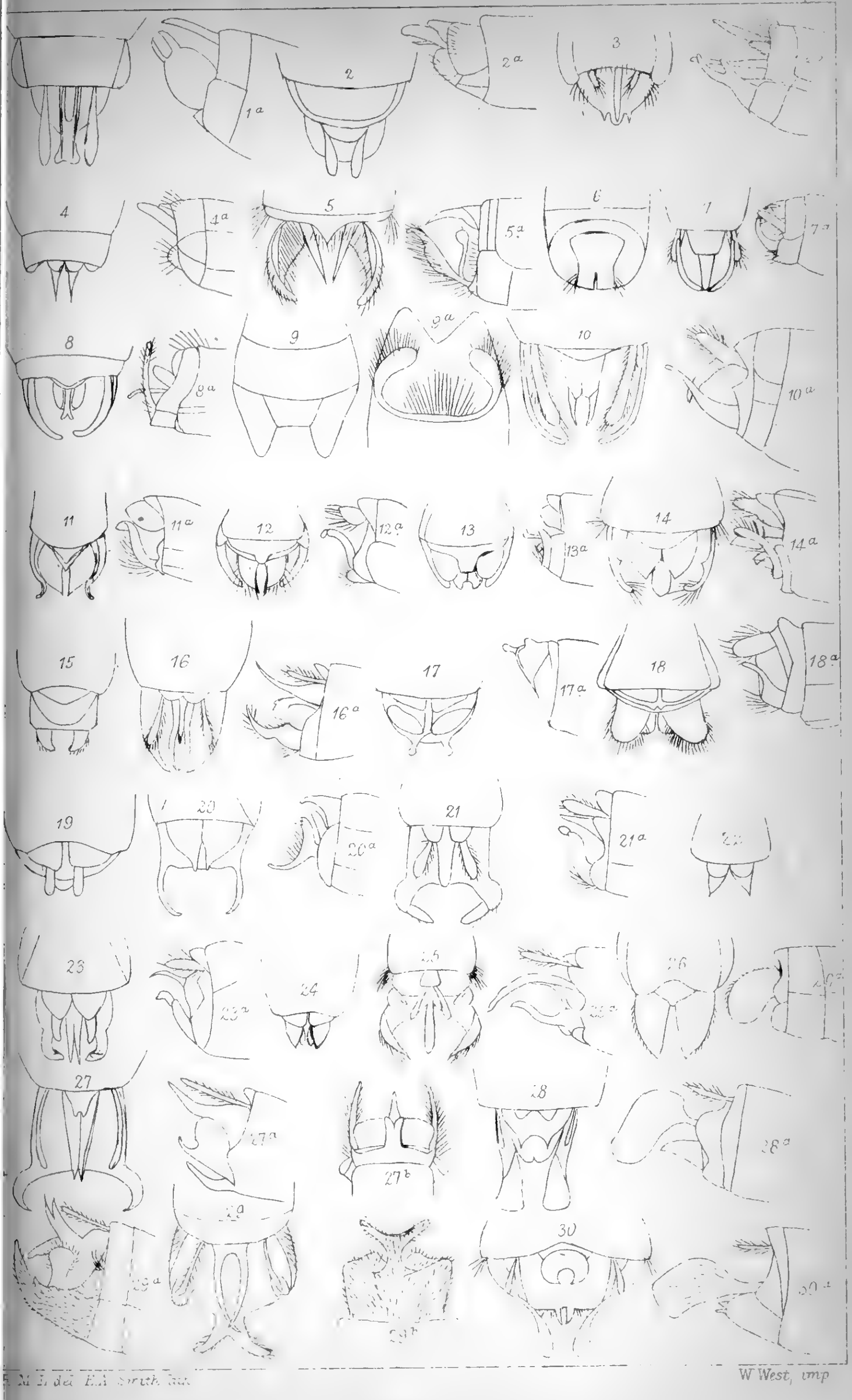

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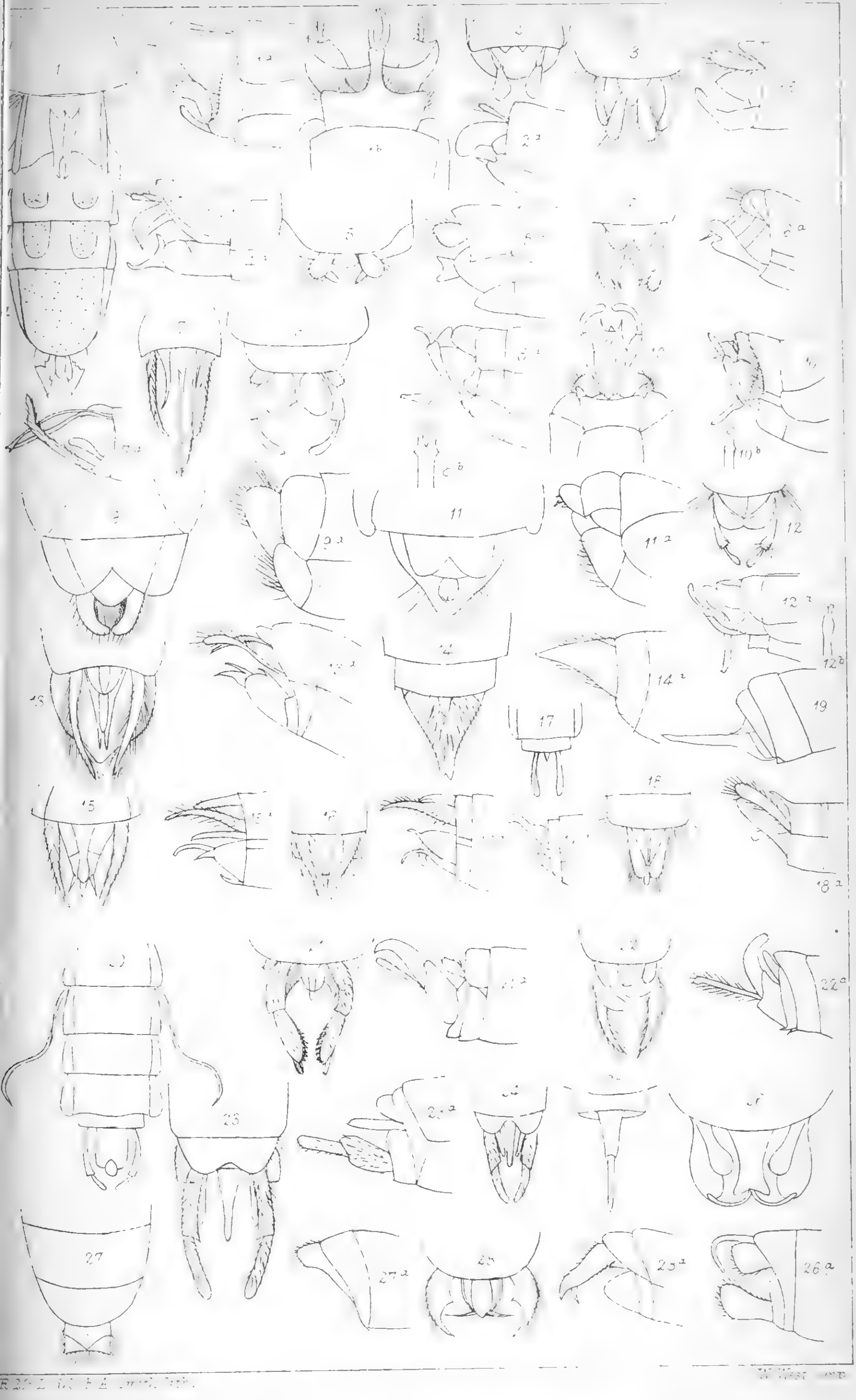

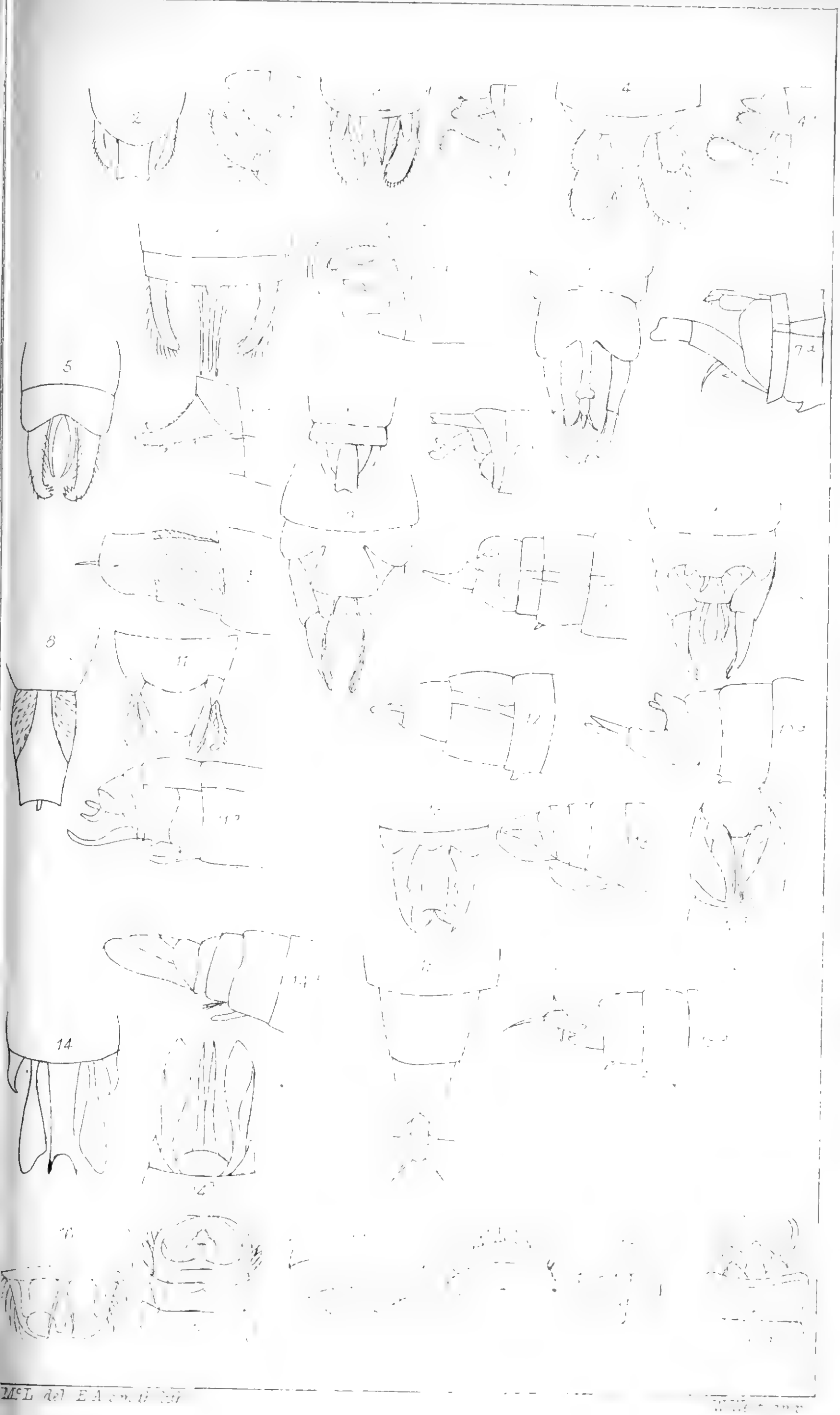

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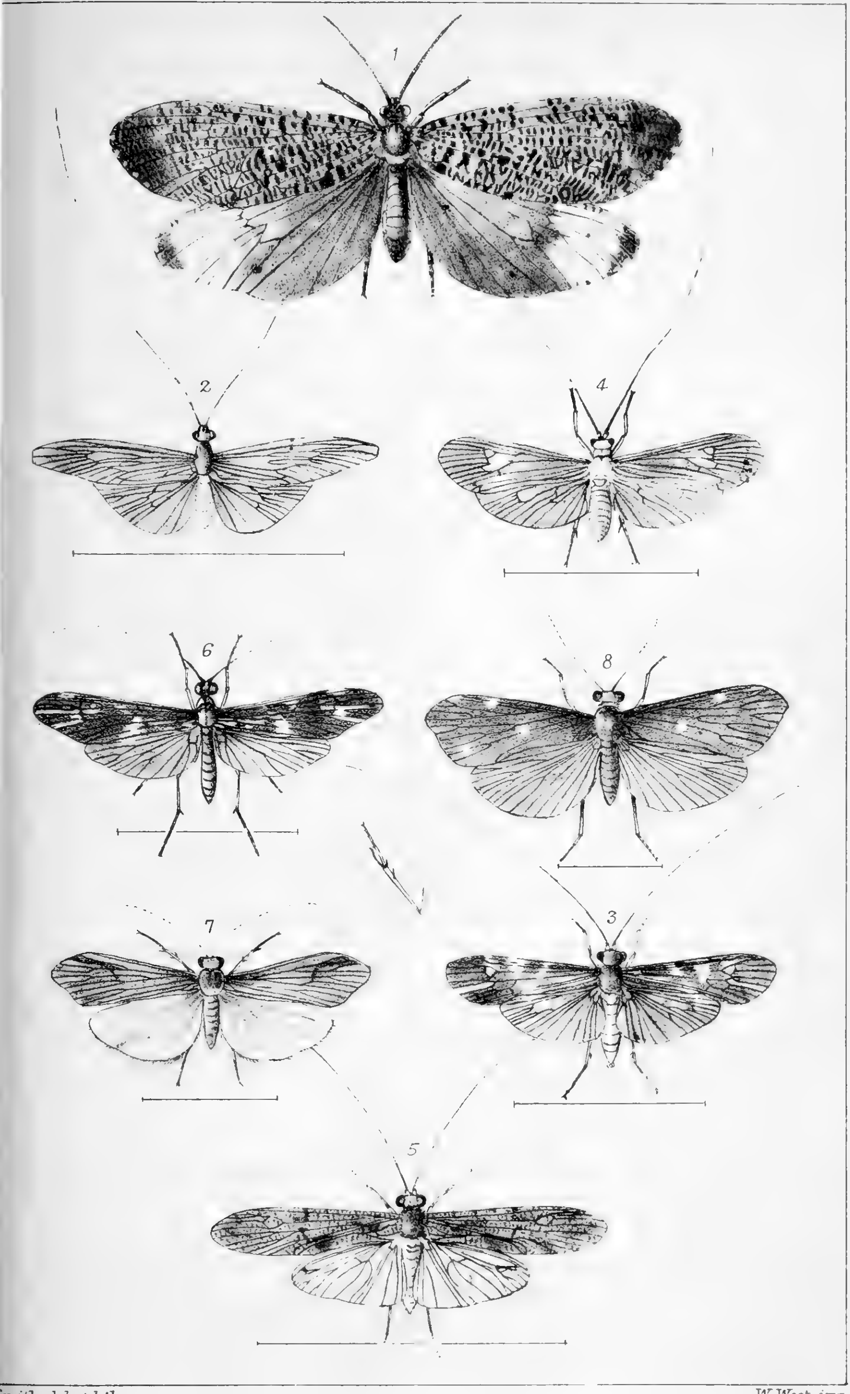

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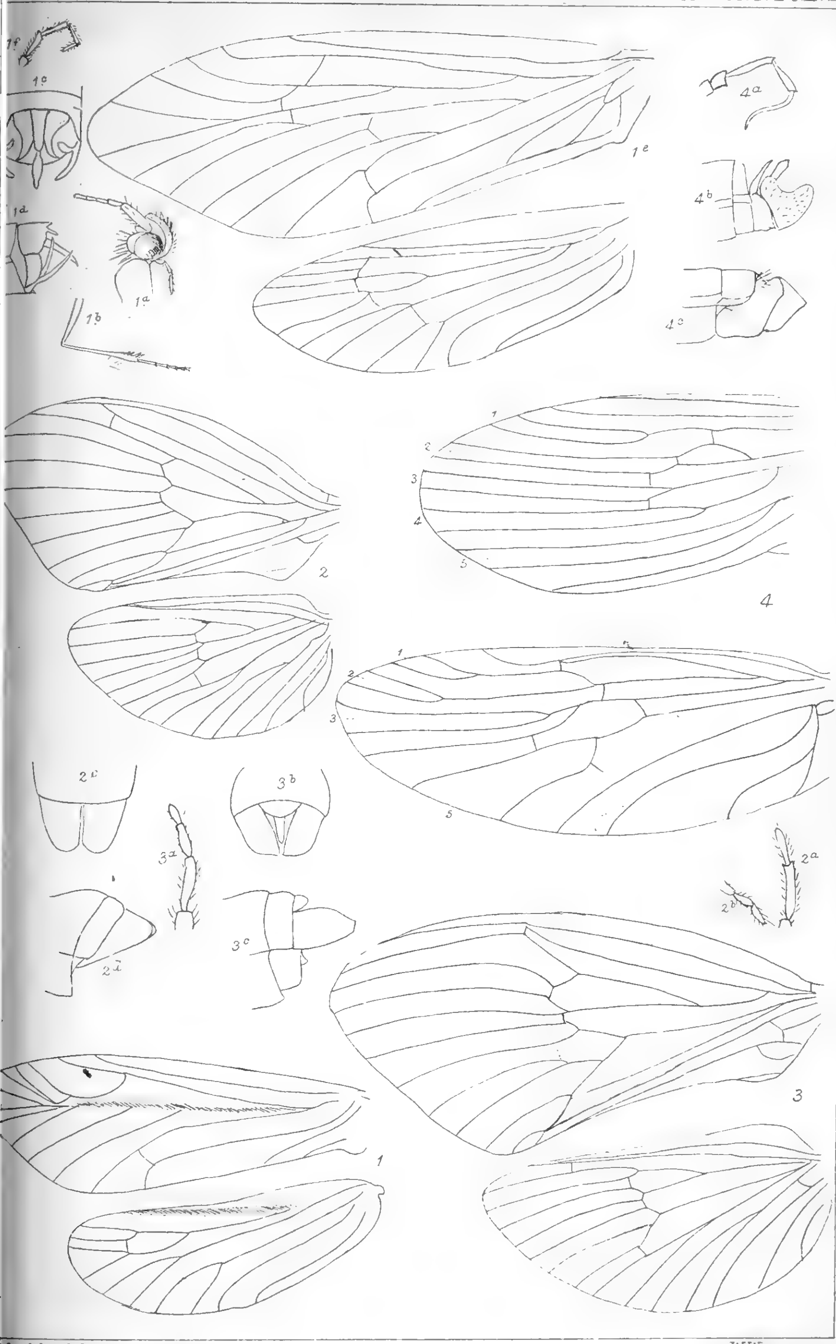

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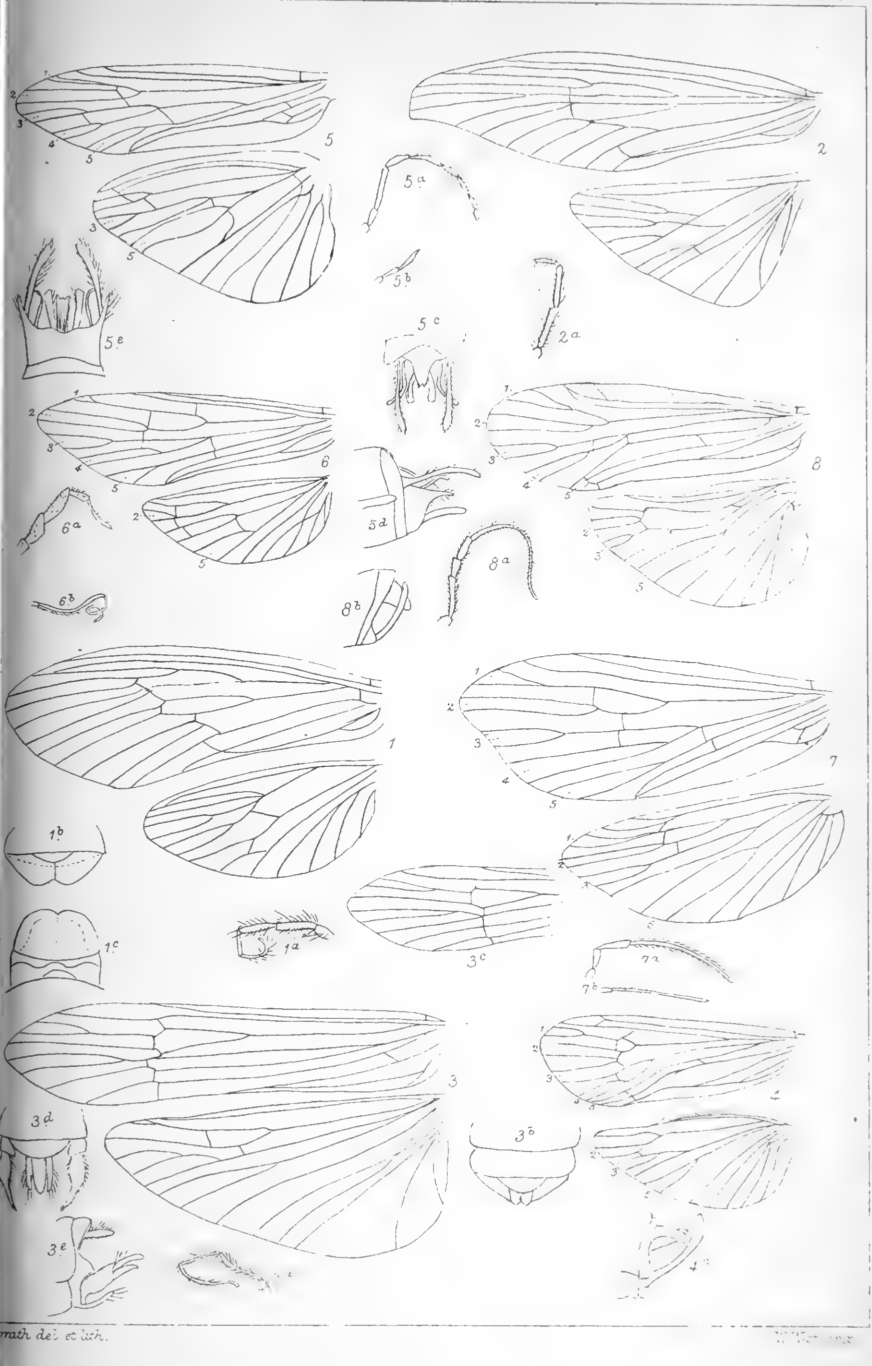

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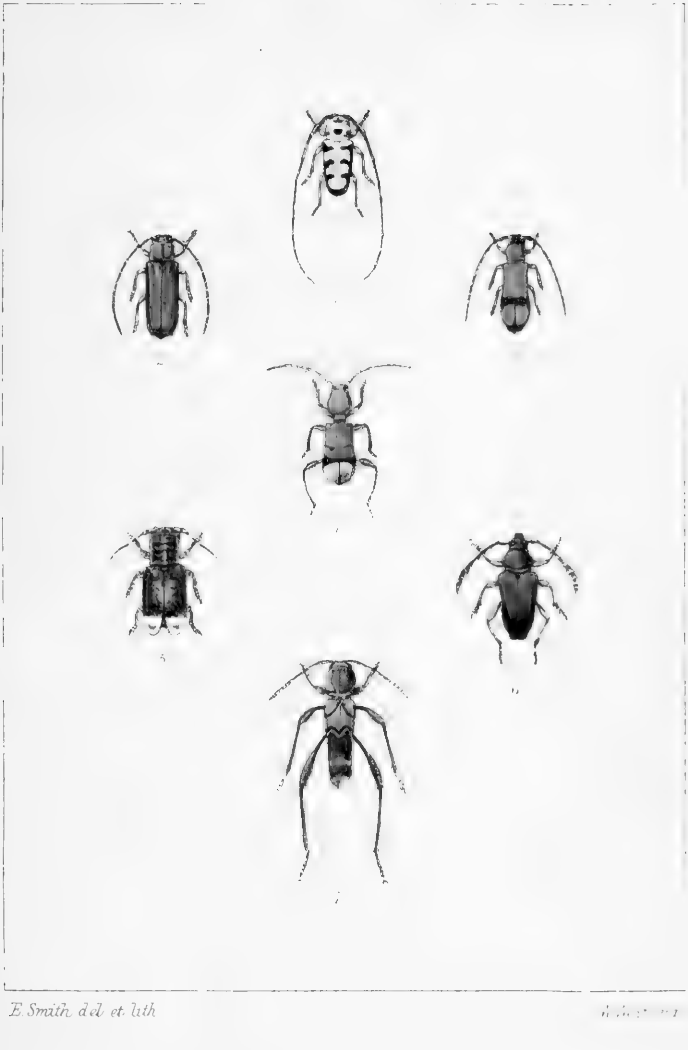

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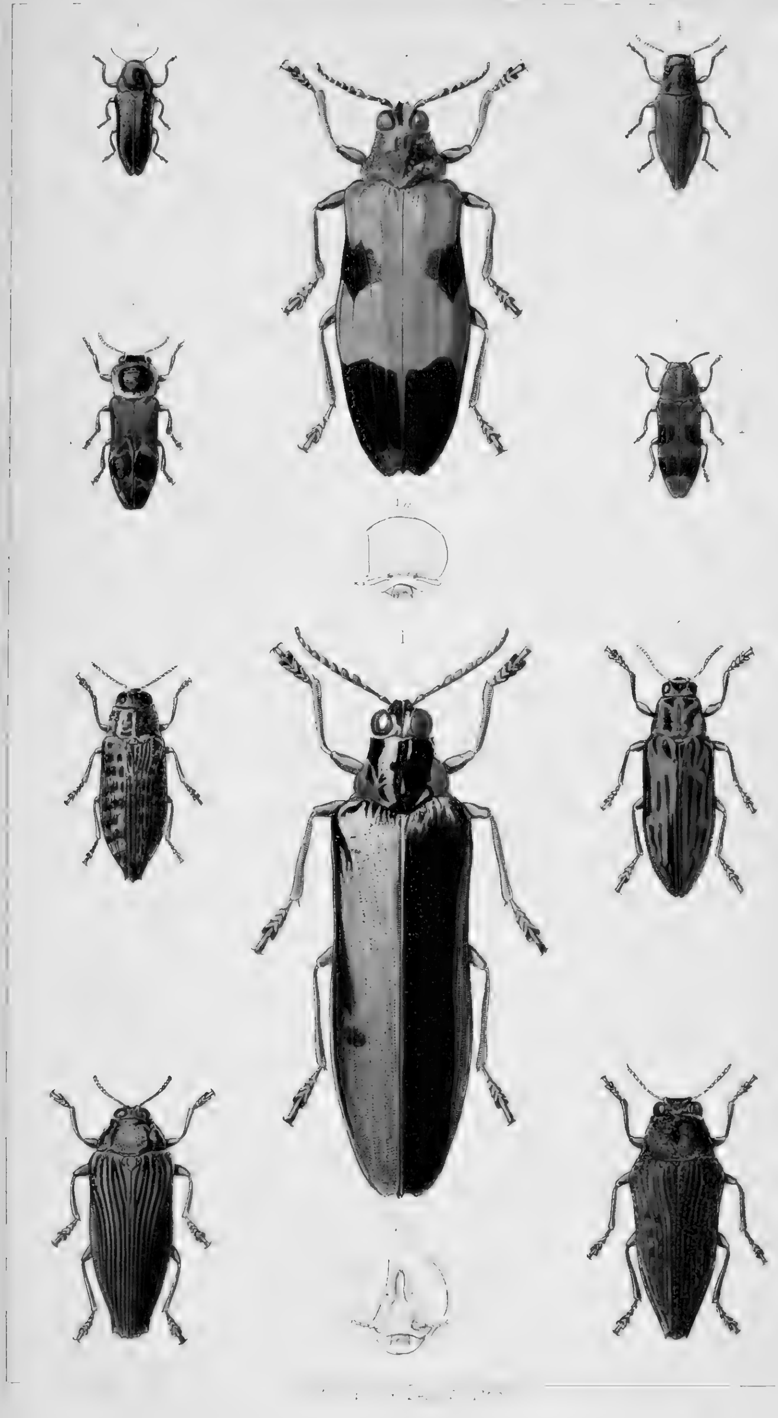

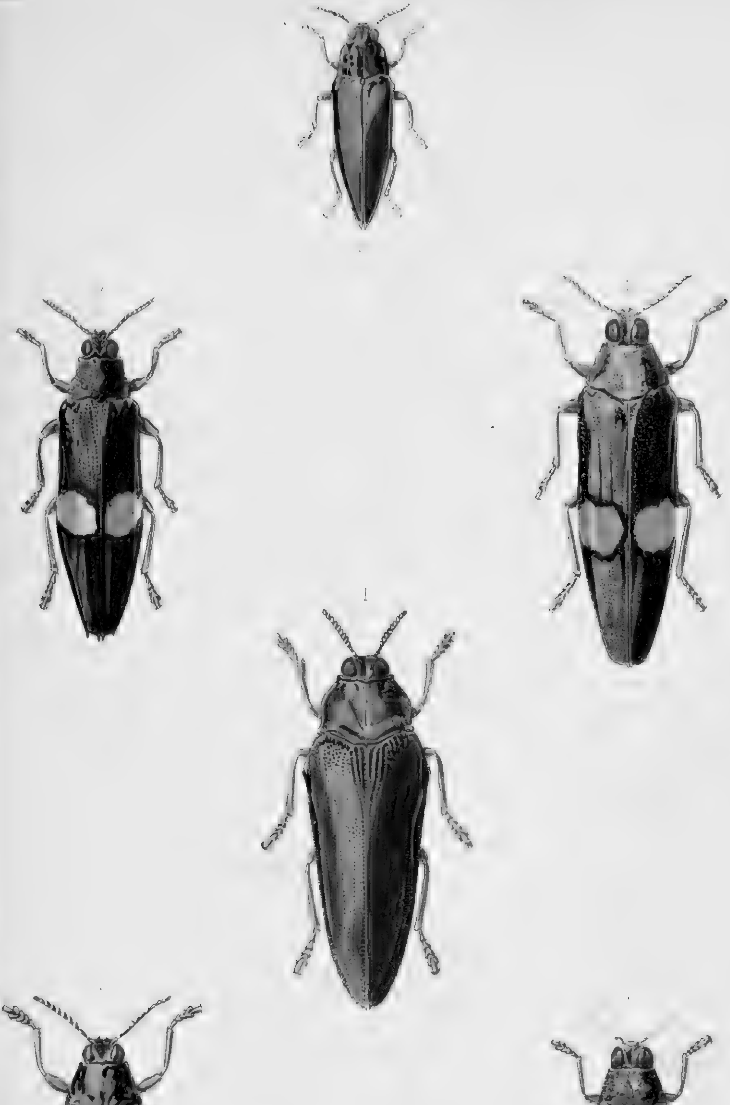

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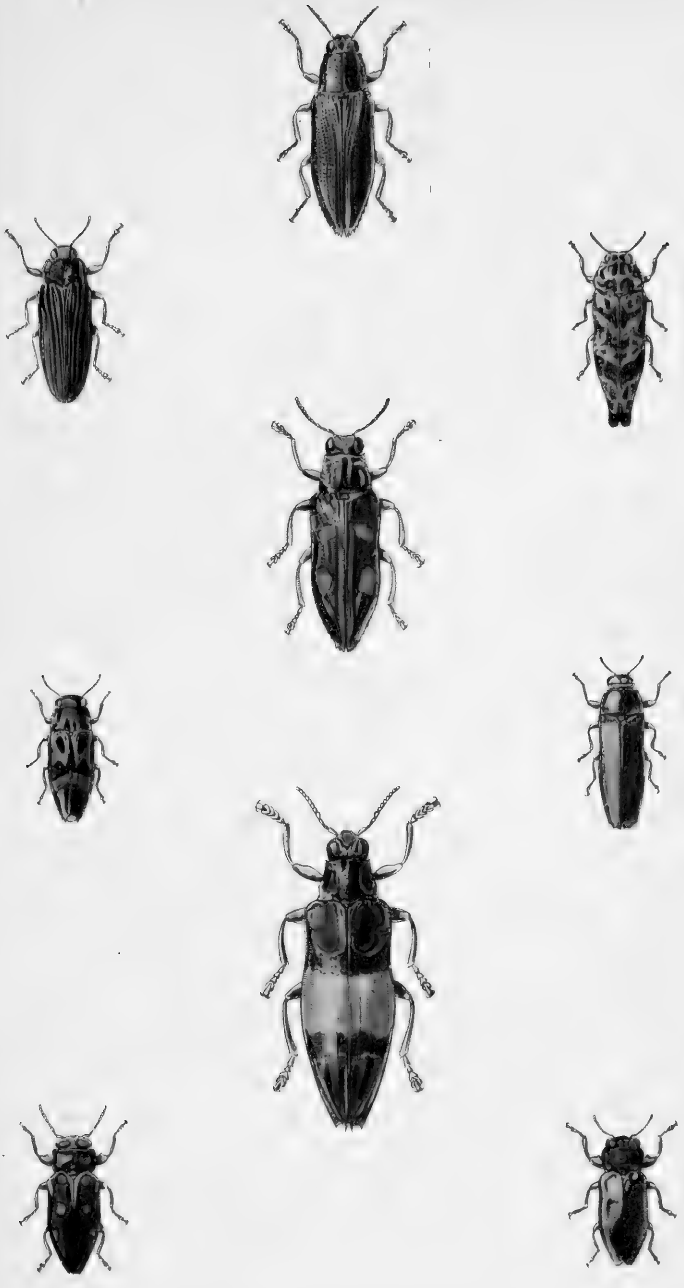

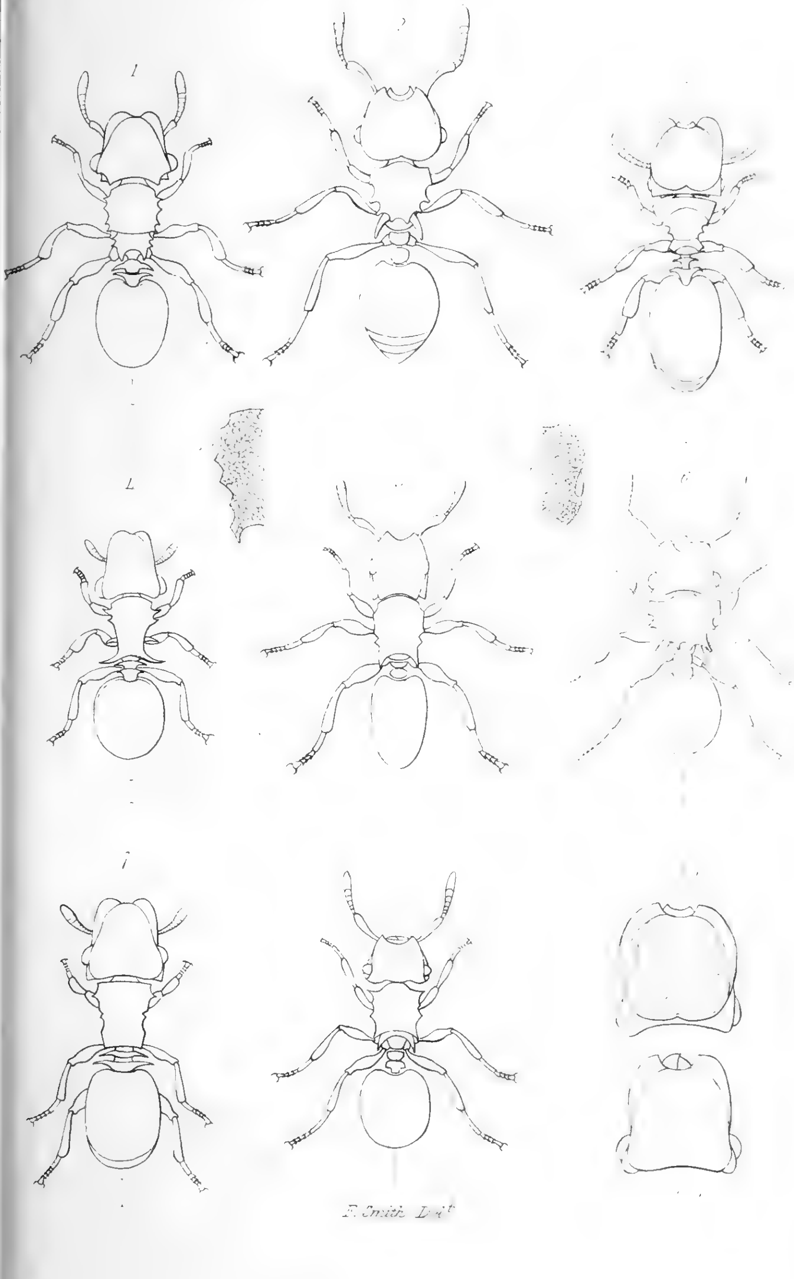

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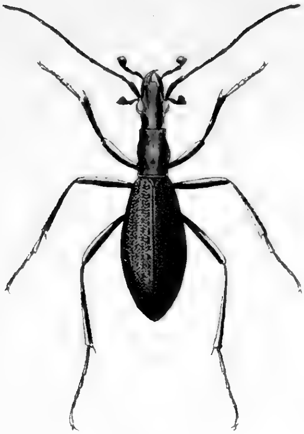

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OF

VOLUME V.—PART I.

Corrigenda.—Page 28, line 3 from bottom; *for* "figs. 11, 12," *read* "figs. 10, 11." Page 74, line 5 from bottom; *insert* "Expanse of fore-wings, 6–9 lines."

N.B.—Vols. II., III. and IV. are not yet complete.

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