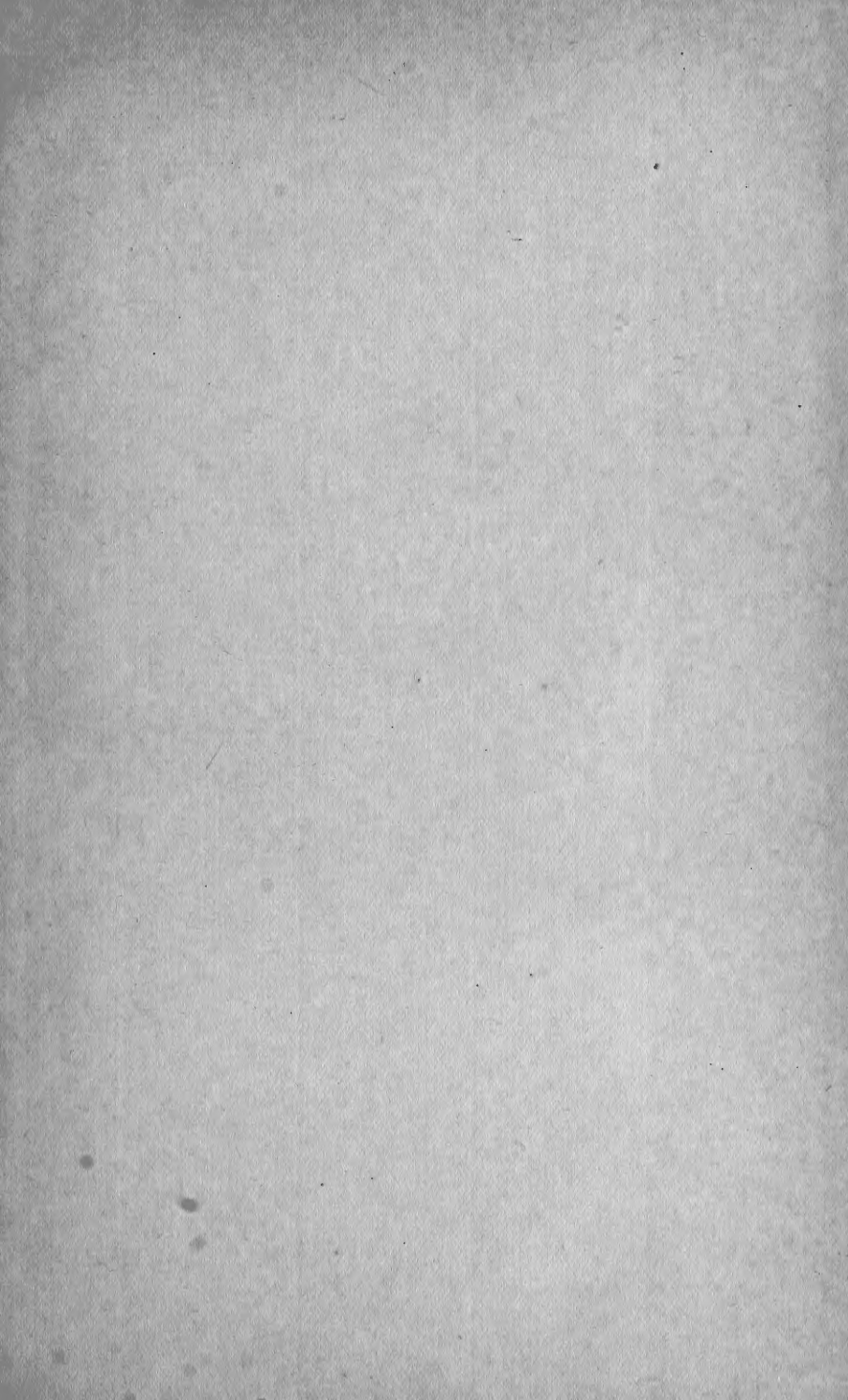
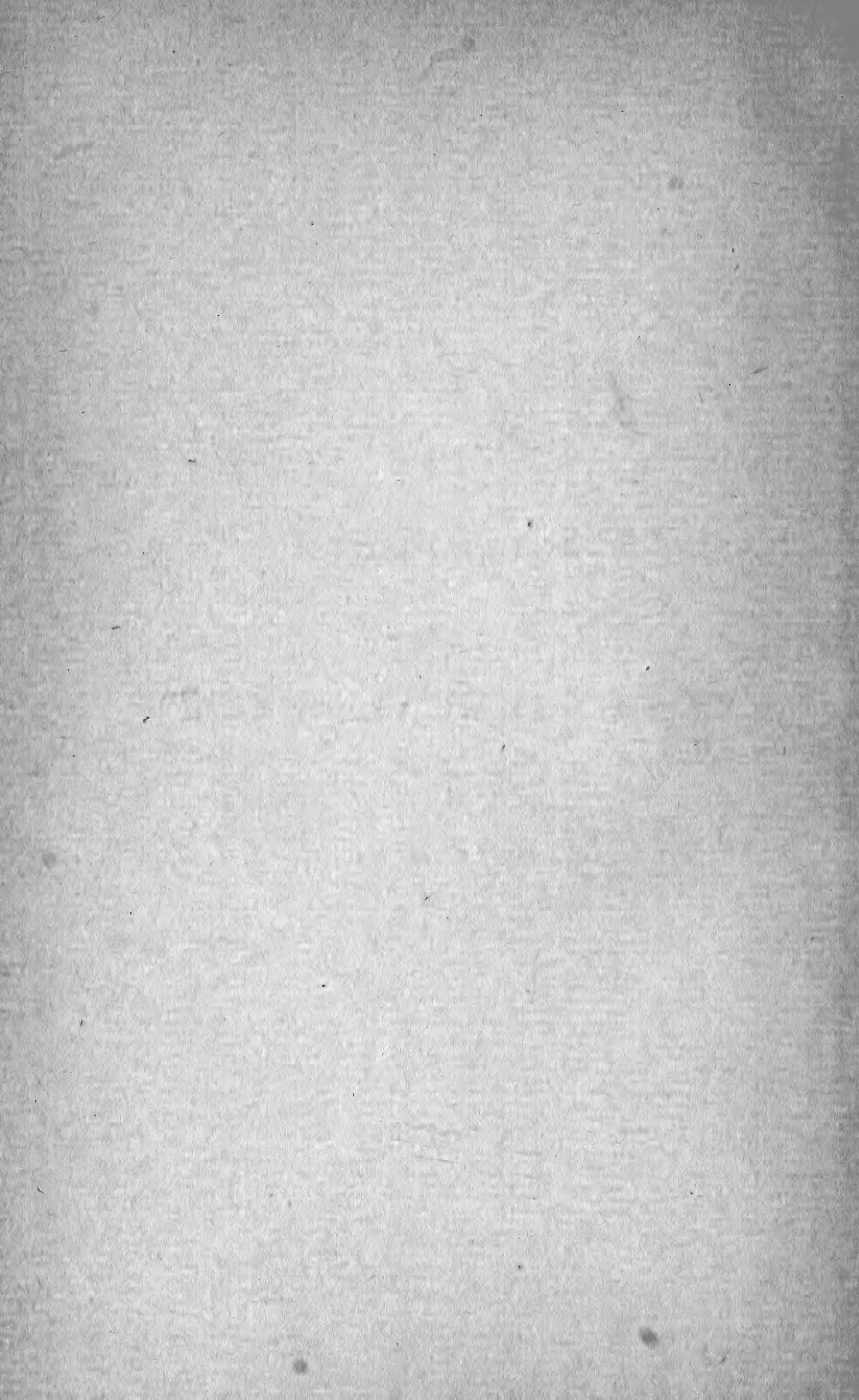


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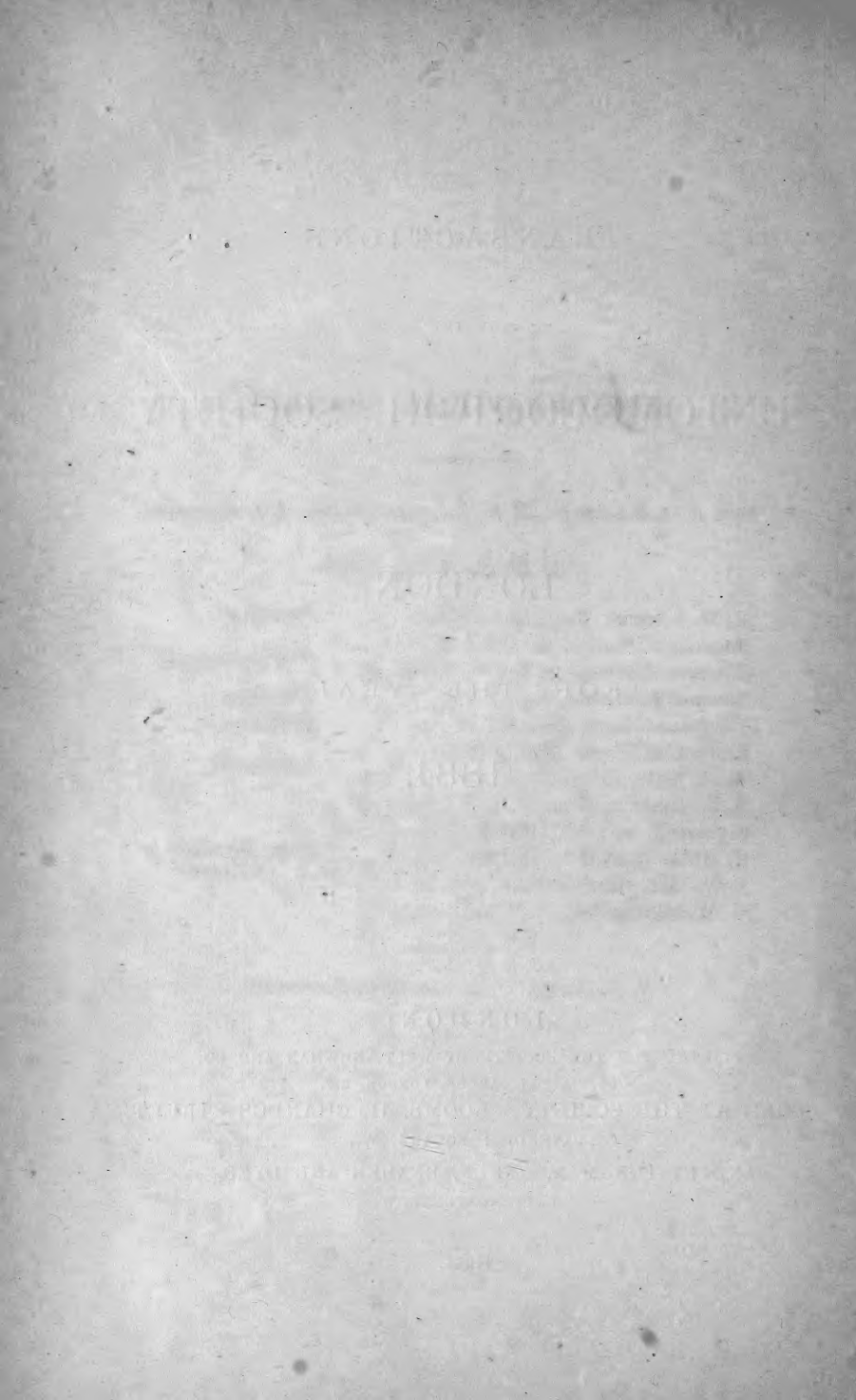
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ERRATA.

- Page 146, line 7 from bottom, for “male” read “female.”
- Page 363, line 9, for “*dissimilis*” read “*assimilis*.”
- Page 465, lines 10 and 16, for “*Tornus*” read “*Tormus*.”
- Page 498, line 14, for “arrangement” read “argument.”
- Page 500, line 7 from bottom, for “dumme” read “dummen.”
- Page 507, line 14 from bottom }
 Page 514, line 9 from bottom } for “plumose” read “stubble-shaped.”
- (N.B.—“Stubble-shaped” is the translation of the German “stoppel-förmig,” introduced by Loew for similar structures.)
- Page 517, line 19, for “p. 500” read “p. 502.”

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- 1877 Oberthür, René, *Rennes*.
- 1883 Oldfield, George W., M.A., F.L.S., F.Z.S., 30 *Ladbroke Gardens, Notting Hill, W.*

- 1873 Olivier, Ernest, *Ramillons, près Moulins (Allier), France.*
 1881 S. Olliff, A. S., *Australian Museum, Sydney, N. S. Wales.*
 1878 Ormerod, Miss Eleanor A., F.M.S., *Dunster Lodge, Spring-grove, Isleworth, W.*
 1880 Ormerod, Miss Georgiana, *Dunster Lodge, Spring-grove Isleworth, W.*
 1841 † Owen, Sir Richard, K.C.B., D.C.L., LL.D., M.D., F.R.S., &c., *Sheen Lodge, Mortlake, S.W.*
 1840 † Parry, Major Frederick John Sidney, F.L.S., *18 Onslow-square, S.W.*
 1854 Pascoe, Francis P., F.L.S., *1 Burlington-road, Westbourne Park, W.*
 1884 Patton, W. H., *Waterbury, Connecticut, U.S.A.*
 1883 Péringuey, Louis, *Rondebosch, Cape Colony.*
 1879 Perkins, Vincent Robt., *Wotton-under-Edge, Gloucestershire.*
 1872 Phipson, Arthur, *3 Gray's Inn-square, W.C.*
 1881 Pim, H. Bedford, *Leaside, Kingswood-road, Upper Norwood, S.E.*
 1870 Porritt, George T., F.L.S., *Greenfield House, Huddersfield.*
 1884 † Poulton, Edward B., M.A., *Wykeham House, Banbury-road, Oxford.*
 1851 Preston, Rev. Thomas Arthur, M.A., F.L.S., *The Green, Marlborough, Wilts.*
 1876 Preudhomme de Borre, Alfred (Sec., Ent. Soc. of Belgium), *19 Rue de Dublin, Ixelles, near Brussels.*
 1878 Price, David, *48 West-street, Horsham, Sussex.*
 1867 S. Pryer, H. J. S., *Yokohama, Japan.*
 1870 Puls, J. C., *Place de la Calandré, Ghent.*
 1882 † Ramsden, Hildebrand, M.A., F.L.S., *26 Upper Bedford-place, Russell-square, W.C.*
 1872 S. Ransom, Wm. Hy., M.D., F.R.S., *The Pavement, Nottingham.*
 1874 Reed, Edwyn C., F.L.S., *35 Calle San Ignacio, Valparaiso, Chili.*
 1871 Riley, C. V., State Entomologist, *United States Entomological Commission, Washington.*
 1853 Ripon, George Frederick Samuel Robinson, Marquis of, K.G., F.R.S., F.L.S., &c., *1 Carlton-gardens, S.W.*
 1880 Robinson, Frank Edward, *Madura, South India.*
 1869 Robinson-Douglas, William Douglas, F.L.S., F.R.G.S., *Orchardton, Castle Douglas, N.B.*
 1872 S. Rothera, G. B., *High-street Place, Nottingham.*
 1868 Rothney, G. A. J., *Calcutta.*
 1876 † Rye, Edward Caldwell, F.Z.S., *Somerset Villa, Upper Richmond-road, Putney, S.W.*
 1865 Rylands, Thomas Glazebrook, F.L.S., F.G.S., *Highfields, Thelwall, Warrington.*
 1875 Sallé, Auguste, *13 Rue Guy de la Brosse, Paris.*
 1866 † Salvin, Osbert, M.A., F.R.S., F.L.S., &c., *10 Chandos-street, Cavendish-sq., W.; and Hawksfold, Fernhurst, Haslemere.*
 1865 † Saunders, Edward, F.L.S., TREASURER, *St. Ann's, Mason's Hill, Bromley, Kent.*
 1861 † Saunders, G. S., *Cumberland House, Mount Sion, Tunbridge Wells.*
 1865 Schaufuss, L. W., Ph.D., M.Imp.L.C.Acad., &c., *Dresden.*
 1881 Scollick, A. J., *Albion Lodge, Putney, S.W.*
 1875 † Sealy, Alfred Forbes, *Cochin, South India.*

- 1864 Semper, George, *Altona*.
 1862 Sharp, David, M.B., *Bleckley, Shirley Warren, Southampton*.
 1883 Shaw, A. Eland, 13 *Lanhill-road, Paddington, W*.
 1883 † Shelley, Capt. George E., 13 *Rutland Gate, W*.
 1847 Shepherd, Edwin.
 1884 Shuttleworth, Edmund, 8 *Winckley-square, Preston*.
 1877 Slater, John Wm., 36 *Wray-crescent, Tollington Park, N*.
 1883 Smith, Frederick W., *Hollywood House, Dartmouth Point, Blackheath, Kent*.
 1869 Smith, Henley Grose, 20 *Finsbury Circus, E.C*.
 * † Spence, William Blundell, *Florence*.
 1848 † Stainton, Henry Tibbats, F.R.S., F.L.S., F.G.S., &c., *Mountsfield, Lewisham, S.E*.
 1862 Stevens, John S., 38 *King-street, Covent Garden, W.C*.
 1837 Stevens, Samuel, F.L.S., *Loanda, Beulah Hill, Upper Norwood, S.E*.
 1882 Swanzy, Francis, *Stanley House, Granville-road, Sevenoaks*.
 1884 Swinhoe, Lieut.-Col. Charles, *India*.
 1876 Swinton, A. H., *Binfield House, Waterden-road, Guildford*.
 1856 Thomson, Jas., 12 *Rue de Presbourg, Place de l'Etoile, Paris*.
 1882 Todd, Richard, 5 *Princes-terrace, Bayswater, W*.
 1859 † Trimen, Roland, F.R.S., F.L.S. (Curator of South African Museum), *Cape Town, Cape of Good Hope*.
 1869 Vaughan, Howard, 11 *Ospringe-road, Brecknock-road, N.W*.
 1866 Verrall, G. H., *Sussex Lodge, Newmarket*.
 1876 Wakefield, Charles Marcus, F.L.S., *Belmont, Uxbridge*.
 1870 Walker, Rev. Francis Augustus, D.D., F.L.S., 33 *Bassett-road, Notting Hill, W*.
 1878 Walker, J. J., R.N., 23 *Ranelagh-rd., Marine Town, Sheerness*.
 1863 † Wallace, Alfred Russel, F.L.S., F.Z.S., &c., *Nutwood Cottage, Frith Hill, Godalming*.
 1866 † Walsingham, Thomas de Grey, Lord, M.A., F.L.S., F.Z.S., &c., *Eaton House, Eaton-square, S.W*.
 1866 Ward, Christopher, F.L.S., *Savile-road, Halifax*.
 1869 Waterhouse, Charles O., *British Museum, South Kensington, S.W*.
 * Waterhouse, George R., F.Z.S., &c., *Curton Lodge, Werter-road, Putney, S.W*.
 1869 Websdale, C. G., 78 *High-street, Barnstaple*.
 1845 Weir, John Jenner, F.L.S., *Chirbury, Beckenham, Kent*.
 1876 Western, E. Young, 27 *Craven Hill Gardens, Bayswater, W*.
 * Westwood, John Obadiah, M.A., F.L.S., &c., HONORARY LIFE PRESIDENT, 67 *Woodstock-road, Oxford*.
 1882 Weymer, Gustav, 58 *Kleeblattstrasse, Elberfeld, Rhenish Prussia*.
 1868 † White, F. Buchanan, M.D., F.L.S., *Annat Lodge, Perth, N.B*.
 1865 White, Rev. W. Farren, *Stonehouse Vicarage, Gloucestershire*,
 1884 White, William, *Morden House, 55 Highbury Hill, N*.
 1882 Williams, W. J., *Zoological Society, Hanover-square, W*.
 1874 Wilson, Owen, *Cwmffrwd, Carmarthen*.
 1881 Wood, Theodore, *Freeman Lodge, St. Peter's, Thanet*.
 1874 Wood-Mason, James, F.G.S., F.L.S. (Curator of the Indian Museum), *Calcutta*.
 1862 Wormald, Percy C., 10 *Cromwell-avenue, Highgate, N*.
 1865 S. Young, Morris, *Free Museum, Paisley*.

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THE
TRANSACTIONS
OF THE
ENTOMOLOGICAL SOCIETY
OF
LONDON
FOR THE YEAR 1884.

I. *Additional notes on the genus Colias.* By H. J. ELWES,
F.L.S., F.Z.S.

[Read November 7th, 1883.]

THOUGH it is only three years since I read a memoir on the genus *Colias*, which was published in our 'Transactions' for 1880 (pp. 133—146), a great deal has since been added to our knowledge of the genus; and, as it appears to be one of extraordinary interest on account of its bearing on the development of species, I shall make no apology for adding some observations to my first paper.

At least three papers of importance have appeared since 1880 on this genus. One by Keferstein, in the 'Journal of the Zoological-Botanical Society of Vienna,' October, 1882; the second by Dr. Hagen, in 'Proceedings of Boston Natural History Society,' December, 1882; and the third by Alpheraky, in 'Stettiner Entomologische Zeitung,' 1883, p. 488.

Keferstein's paper seems to me to be based on very insufficient materials and knowledge of the genus. The

principal points on which he dwells are the variability of all the characters which have been relied on for the discrimination of the species. Among them he includes the patch of thicker and darker scales at the base of the hind wing in the male, which, however, in my opinion, is one of the most certain and constant characters by which the species may be classified. He arranges the species into four groups, defined in the same way as my groups, by the presence or absence of spots on the dark border of the wings in one or both sexes. He arranges the species, however, in an unnatural and incorrect manner, uniting some which are undoubtedly distinct, as *Myrmidone*, *Eogene*, and *Hecla*, and separating others which are certainly identical, as *Lesbia* and *Pyrrhothea*, describing one species, *C. Aurivillius*, in such a manner that it is impossible to say what it may be; and, as no plate, exact locality, or specific characters are given, I think the name should be ignored.

Alpheraky's paper is principally a criticism of Keferstein's, but also gives some valuable notes on the Russian and Siberian forms, and is a valuable contribution to the literature of the subject. He strongly denies most of Keferstein's conclusions, especially his statement that the basal patch on the hind wing is a variable character, and therefore not to be relied on as a certain guide in distinguishing the species. He states that, after a careful examination of very many specimens, he finds the patch constantly present in *C. Edusa*, *Electra*, *Olga*, and others, and that, though its colour may vary, and sometimes, when of the same shade as the rest of the hind wing, escape the notice of the careless observer, yet that its form remains ever the same. I exhibit to-day a series of specimens of several species in order to show how far Alpheraky's views on this question are correct. I agree with him for the most part, but it is necessary to set the specimens in an unnatural manner in order to show the patch clearly, and I must say that I find it much more variable in size and appearance, when closely examined, than he seems to have done.

Alpheraky's observations show that, though he may be perhaps rather too much inclined to the separation of species, yet he is only led to do so by observed facts, and in general he proves himself a careful and scientific observer.

If Keferstein had had sufficient or any specimens before him of many of those forms which he treats as species, I feel sure he would not have done so. In no case does he attempt to define any of his forms by their characters, geographical distribution, or otherwise, and the result is therefore anything but satisfactory.

Dr. Hagen, on the other hand, has given us a most excellent review of the forms occurring in North America, the whole of which he reduces to eight species, and, as he had of the last four of these only three specimens in all to study, it is clear that he also has, from want of material, treated them somewhat unequally. I must say, however, that his remarks on the genus are distinguished by a scientific breadth of view and a fearless, though temperate and well deserved, criticism of inaccuracies which cannot fail to have a most excellent effect in America and elsewhere; and I believe that Dr. Hagen is laying the foundation of a more reasonable nomenclature for the butterflies of North America than has hitherto been possible. Though Mr. W. H. Edwards' species are suppressed wholesale, I cannot doubt that in the main Dr. Hagen is perfectly right, and I hope his review of the other genera will follow those which have appeared on *Papilio*, *Pieris*, and *Colias*.

For my part, I will not hesitate to say that, notwithstanding the somewhat intolerant criticism of my first paper by Mr. Butler, all I have seen and learnt since has only strengthened and confirmed my views as to the impossibility of defining or recognising many of the *Colias* described by him, most of which, I believe, and with greater certainty than at first, cannot be classified even as constant varieties.

I am glad to find that Mr. H. Pryer, in a catalogue of the Lepidoptera of Japan, just published, supports me in this opinion, and says:—"I am led by the result of my own observations to regard 'species' in the widest acceptance of this much-abused term, and shall therefore probably excite the ire of those numerous gentlemen who devote their whole existence to describing 'new species,' and who, by their active, but, in my opinion, misdirected labour, obscure many most important and interesting facts."

The concurrence in such opinions as these, both by genuine field naturalists such as Mr. Pryer, and by men of world-wide entomological fame such as Dr. Hagen,

cannot be any longer ignored by the "species makers"; and I think it is quite time to ignore even the names of those so-called species which are published, as they too frequently are, with incomplete and misleading descriptions, without figures, and very often based on most scanty and imperfect materials.

But to return to our *Colias*. I have, since I last wrote, examined carefully the finest collections in Europe and England, namely, those of Dr. Staudinger, Felder, Mützell, Honrath, and the public collections of Vienna and Berlin, in Germany, also those of M. C. Oberthür at Rennes. I have seen thousands of *Colias* from all parts of the world, including many of the most extraordinary aberrations, varieties, and supposed hybrids, and have come to the conclusion that, though typical male specimens of the forms enumerated below may be recognised by any one having a thorough acquaintance with the genus without knowledge of their origin, yet in the case of females it is often impossible to do so, and males of almost all the species can be found which it would be impossible to name without knowing where they came from.

My own collection contains a good series of all the species except three or four, and there are only one or two doubtful ones, of which I have not seen many specimens in other collections. Notwithstanding this I think the time has not yet come when the genus *Colias* can be monographed in a satisfactory manner, and my remarks will only express present opinions, which are liable to be modified or changed as our knowledge increases.

I shall adhere, for convenience sake, to the division of the genus which I indicated in my first paper, though there are one or two species in which the spots on the border are not constant in one or both sexes.

Of the life-history of *Colias Edusa* we have an excellent account by Mr. Fitch in the 'Entomologist,' vol. xi., p. 49 (1878), in which he brings together the numerous observations made by English entomologists in the year 1877, when this species was extremely abundant, though I have not seen in England a single specimen since then. He states that the size varies from 1.25 in. to 2.4 in.; the shape varies very much, as well as the colour, some specimens having a purple or blue sheen, as in *Myrmidone*. The marginal band varies slightly in shape, much in width and colour. The discal spot is

sometimes almost absent. The band in the female has rarely only faint traces of spots (one figured).

He says that *Edusa* varieties are now known, resembling in almost all details *Myrmidone*, *Chrysotheme*, and *Erate*. This is correct as regards the first, but not as to the other two, and he thinks *Erate* is a connecting link between *Edusa* and *Hyale*; but here again he speaks without sufficient knowledge of *Erate*.

With regard to breeding, the following details are given:—A female caught on June 6th; laid upwards of 200 eggs June 8th; hatched June 14th; first larvæ turned to pupæ July 9th; imago appeared July 21st; 43 days being the shortest time from egg to imago, 68 days the longest.

The conclusions from a long series of notes by various persons are to the effect that *Edusa* is normally double-brooded, sometimes triple-brooded. It may pass the winter in either of its four stages of existence, according to the period at which the eggs are laid.

Notwithstanding its extraordinary abundance in the wet year 1877, it has been ever since, during six seasons, a very scarce species in England.

Group I. FEMALE SEX ONLY SPOTTED ON THE DARK BORDER OF THE FORE WING.

Section 1. *Having in the male sex a patch of thick scales at the base of the upper side of the hind wing.*

<i>C. Edusa</i> , Linn.	.. ..	Western, Central and Southern Europe; Azores; N. Africa; Syria.
<i>C. Myrmidone</i> , Esp.	.. ..	Central, Eastern and Southern Germany; S. Russia; Turkey; Transcaucasia.
<i>C. Electra</i> , Linn.	.. ..	Cape of Good Hope; Transvaal; Natal.
<i>C. Aurorina</i> , H.-S.	.. ..	Mountains of Armenia; Cilicia.
var. <i>Libanotica</i> ; Led.	.. ..	Mountains of Syria; N. Persia; Asia Minor.
var. <i>Heldreichii</i> , Stgr.	.. ..	Mountains of Greece.
<i>C. Aurora</i> , Esp.	.. ..	South-East Siberia and Amur Region.
var. <i>Olga</i> , Rom.	.. ..	Transcaucasia.
<i>C. Wiskotti</i> , Stgr.	.. ..	Mountains of Turkestan.
<i>C. Fieldii</i> , Men.	.. ..	Himalayas, from Bhotan to Kashmir, Western China.
<i>C. Meadii</i> , Edw.	.. ..	High mountains of Colorado.
<i>C. Lesbia</i> , Fabr.	.. ..	Argentine States; Patagonia; Andes, Ecuador; Bolivia?; Peru?
<i>C. Vautieri</i> , Guér.	.. ..	Chili; Straits of Magellan.
<i>C. dimera</i> , Doubl.	.. ..	Andes of Columbia and Ecuador.
?? = <i>Euxanthe</i> , Feld.	.. ..	High Andes of Ecuador; Upper Peru.

Section 2. *Without the basal patch in the male.*

<i>C. Chrysotheme</i> , Esp.	Austria, Hungary, and South-East Europe.
= <i>Keewaydin</i> , Edw.	Southern and Pacific States of North America.
var. gen. 1, <i>Ariadne</i> , Edw.	} Texas, California, Arizona, &c.
var. gen. 2, <i>Eurytheme</i> , Bdl.	
<i>C. Hecla</i> , Lef.	Lapland; Greenland.
var. <i>glacialis</i> , McLachlan.	Smith Sound, Grinnell Land.
var. <i>Hela</i> , Streck.	Hudson's Bay.
<i>C. Thisoa</i> , Mén.	High mountains of Central Asia; N. Persia.
<i>C. Eogene</i> , Feld.	High elevations of N.W. Himalaya.
var. ? <i>Stoliczkanus</i> , Moore.	High plateau of Ladak.
var. ? <i>C. Staudingeri</i> , Alph.	Thian-shan Mountains.
? <i>C. Viluensis</i> , Mén. (doubtful species).	} Northern Siberia; on Jenisei and Vilui rivers.
<i>C. Philodice</i> , Godt.	
var. <i>Eriphyle</i> , Edw.	Southern, Eastern and Northern United States.
var. <i>Chrysomelas</i> , Edw.	British Columbia; Washington Territory.
<i>C. imperialis</i> , Butl.	California.
	Straits of Magellan ?.

Group II. BOTH SEXES SPOTTED ON THE BORDER OF THE FORE WING.

<i>C. Hyale</i> , Linn.	Central, Western and Southern Europe.
	(For vars. and synonymy, see later.)
<i>C. Phicomone</i> , Esp.	Alps of Central Europe.
<i>C. Ladakensis</i> , Feld.	Ladak; N.W. Himalayas (alpine).
<i>C. Melinos</i> , Evers.	S.E. Siberia; Amurland.
<i>C. Sagartia</i> , Led.	Mountains of N. Persia.
<i>C. Alpherakii</i> , Stgr.	Mountains of Turkestan.
var. ? <i>Erschoffi</i> , Alph.	Thian-shan Mountains.
<i>C. Nastes</i> , Boisd.	Labrador; Nova Zembla.
var. <i>Werdandi</i> , Zett.	Fells of Lapland.
var. <i>Kokandica</i> , Ersch.	Alps of Turkestan.
var. ? <i>Rossii</i> , Guen.	Boothia Felix.
var. ? <i>Boothii</i> , Turt.	Do. do.
var. ? <i>Moina</i> , Streck.	Hudson's Bay.

Group III. BOTH SEXES UNSPOTTED, BUT THE FEMALE ABNORMALLY SPOTTED OR THE BORDER REPLACED BY FAINT MARKINGS.

<i>C. Paleno</i> , Linn.	Alps and bogs of Central Europe; Circumpolar Region; mountains of Japan.
	Subspecies or varieties. (For synonyms, see under <i>C. interior</i>).
<i>Pelidne</i> , Boisd.	Labrador and Arctic America.
<i>interior</i> , Scudd.	British America; Northern and Western, U.S.A.
<i>C. Behrii</i> , Edw.	High mountains of California.
	Doubtful species unknown to me:— <i>C. Ponteni</i> , Wallengren, Sandwich Islands; ? indigenous.

Colias Olga, Romanoff.

Romanoff, Hor. Ent. Ross., xiv., pl. i., figs. 1—4, 1882.

C. Myrmidone, var. Led., Ann. Soc. Ent. Belg., xiii., 20.

C. Myrmidone, var. *Caucasica*, Stgr., Cat. Lep. Eur., 1871, p. 6.

This fine form was originally considered by Lederer and Staudinger as a variety of *Myrmidone*, but the latter now looks on it as the Caucasian form of *C. Aurora*; and Alpheraky, who knows it well in life, says that it is nearer to *Aurora* than to either *Myrmidone* or *Aurorina*. For my own part I think it is an additional proof, if one was wanted, of the difficulty of defining any of these species. Judging from the figure, which represents a male and three forms of female, I see no reason to separate it from *Aurora*. The larva of both this species and *C. Aurorina* are said to feed on *Astragalus caucasicus*. *C. Olga* is found not uncommonly about Borjom, Achal-zich, Abbastuman, and other places in the mountains of Georgia at 2000—4000 feet elevation, and also at Achty, in Daghestan. It flies from the middle of May to the middle of June, and on into July. The females are more often of the white than the orange form, which, according to Lederer, is also the case with *C. Aurorina*, and to a great extent the case with *Aurora*.

Colias Fieldii, Mén.

I was at first disposed to think this species only a form of *Myrmidone*, but having received several hundred specimens from Sikkim, others from Nepal and all parts of the North-West Himalaya to Hazara, and, through the kindness of M. C. Oberthur, from Ta-t sien-lo in western Szchuen, I find that, though varying much in size and tint, it may be distinguished with almost absolute certainty from *Myrmidone* by the black band on the hind wings being continued right round the anterior margin, which is not the case in any of my fifteen males of *C. Myrmidone*.

Other though less important characters, which alone would not be of much weight, are the greater size and prominence of the black discal spot above, which on the under side is white-pupilled, and the series of black spots below. Some of the specimens from Kashmir are much smaller and paler in colour, and are probably the first generation. I should be curious to know whether

Fieldii and *Eogene* are ever found flying together, but am not aware that this is so; *Fieldii* inhabiting the warmer damper region of the Lower Himalaya, whilst *Eogene* seems to be confined to the dry barren region of Ladak, which is beyond the influence of the rains. The basal patch in *Fieldii* (male) appears constantly present though variable in extent and colour, and Alpheraky agrees with me in considering it a distinct species.

PS.—I have just received a valuable note on this species from Capt. Graham Young, whose local knowledge of the butterflies of the N.W. Himalaya is very extensive. He says—"This insect is very common in the Sialkot district in early spring, at about 900 feet elevation. I have taken it as high up as 14,800 feet on the top of the Humpta Pass, in Kulu, in September, when it was the only butterfly to be seen. In Kulu, at 3500—4000 feet, it comes out the first week in April, and swarms in the fields of vetches. It disappears by the middle of May from that zone of elevation, though a few may be seen in autumn; but comes out in profusion on the grassy hills from 6000—10,000 feet."

In the Chumbi Valley, on the Tibetan frontier of Sikkim, it is abundant at 10,000—12,000 feet in autumn, and in Kashmir and Hazara it occurs from June to August at 6000—10,000 feet. A few smaller paler specimens occur among numbers of the usual type, but I do not yet know that the spring and summer broods can be distinguished apart; and it seems somewhat doubtful if successive broods do occur in the same district, or whether the species may not rather be single-brooded, appearing earlier or later according to the climate of the locality.

Colias Meadii, Edwards.

Edwards, Butt. North Am., i., *Col.*, pl. 8, fig. 6—9, 1872; Zeller, Stett. Ent. Zeit., vol. 35, p. 437; Hagen, Proc. Boston Soc. Nat. Hist., 1882, p. 175.

This species I formerly placed as a variety of *Boothii*, but this was undoubtedly an error. Hagen considers it most nearly allied to, but distinct from, *Myrmidone*, and, with a good series of each form before me, I am inclined to agree with him, though, as it appears to be generally allowed that *Chrysotheme* in Europe and North America are identical, it would be less extraordinary if *Meadii* and *Myrmidone* should also represent the same species in the two continents.

If *Meadii* is a good species, it is probably more limited in its range than any other *Colias* known to me, except perhaps *C. imperialis*, being confined, as far as we know, to the mountains of Colorado, at and above 10,000 feet elevation, where it appears to be common. In this species the black discal spot of fore wing is reduced to a minimum, and in some cases appears only as a faint streak; this was considered by Zeller the only specific character in which it differed from *Myrmidone*.

Colias Vautieri, Guér.

- Colias Vautieri*, Guér., Voy. Coq., pl. xv., fig. 2, 1829, ♀; Blanch., Gay, Faun. Chil., vii., p. 18, 1852; Reed, Mariposas Chil., p. 15, 1877; Butler, Trans. Ent. Soc. Lond., 1881, p. 470.
- C. rutilans*, Boisd., Sp. Gen., i., p. 642, No. 9, pl. 19, fig. 3, 1836; Blanch., *l. c.*, pl. 1, fig. 7 *a, b*, ♂; Reed, *l. c.*, pl. 1, figs. 3, 4; Butler, *l. c.*, p. 470.
- C. minuscula*, Butler, *l. c.*, p. 470, pl. xxi., fig. 11, ? gen. 1.
- C. Cunninghamii*, Butler, *l. c.*, p. 471; (? var. *septentrionalis*).
- C. flareola*, Blanch., Gay, Faun. Chil., vii., p. 19, pl. 1, figs. 6 *a, b*.

I need have added nothing to what I said of this species in my first paper had not the subject been confused by the addition of fresh synonyms by Mr. Butler, who seems quite unable to pass by any specimen differing in the slightest from those in the British Museum collection without describing it as new.

I can say with tolerable certainty that his *C. minuscula* is nothing whatever but a smaller form, probably the spring brood or first generation of *Vautieri*. There is nothing whatever in the figure, description, type-specimens, or in the one which I possess labelled *C. minuscula* by Mr. Edmonds himself, which would give the least reason to doubt this; and Mr. Edmonds' statement that *minuscula* occurs in August and September, and the larger form, *Vautieri*, in October, would have been, I imagine, enough to convince any other lepidopterist of the necessity of at least advancing some evidence that it was a distinct species. Mr. Butler, however, settles the matter to his own satisfaction by a most concise footnote, "Undoubtedly another species."

Such an opinion as this would be excusable if given by one who had no opportunity of knowing the facts bearing on the question given by Mr. W. H. Edwards in 'Butterflies of North America,' when writing of the seasonal forms of *C. Chrysotheme* (*Keewaydin*), but, after such an ample proof of the identity of much more distinct forms of a nearly allied species under very similar climatic conditions, it seemed to me impossible to agree with it. I therefore wrote to Mr. Edmonds for further information, which I got in the letter quoted below, and which confirm me in my belief that Mr. Butler's views are entirely erroneous.

With regard to *C. Cunninghamii*, the case is even worse, as I had already (Trans. Ent. Soc. Lond., 1880, p. 142) remarked on the specimens which he describes under that name, that they appeared to be a form of *Vautieri*. In his description no allusion is made to this, and not a single character is given by which the insect may be distinguished from *C. Vautieri*. He does indeed compare it with *C. rutilans*; which is but a synonym of *Vautieri*; but this could only confuse those who have not the opportunity of seeing how trifling and ridiculous are the characters by which he attempts to split up the Chilian *Colias*, making four out of one, just as he did in the case of the Japan *Colias*, and in the case of *C. Hyale* from Afghanistan.

If every species is so treated the nomenclature of Lepidoptera will become a maze of synonyms, and I can therefore only say that in my opinion no doubtful species described in future by Mr. Butler should be noticed unless it is accompanied by a good coloured figure or a description comparing it with a well-known and undoubted species.

On a second examination of the types of *C. Cunninghami*, I see no reason to doubt that they are a form of *Vautieri* modified slightly by the colder climate of the Straits of Magellan; when it shall be shown that this variety is constant, and capable of definition in all cases, it will be time to give it a specific name. At present this is not the case.

Note.—To the above I must add some extracts from a letter afterwards received from Mr. Edmonds respecting *C. minuscula*. He says—"It occurs sparingly and locally in the neighbourhood of Valparaiso in August and September,

the male being much more plentiful than the female. I only obtained two of the latter, one of which I gave to the British Museum, the other I kept myself.

“Towards the end of September the examples become worn and scarce, and early in October their place is taken by *Vautieri*, which, however, appears in greater numbers; and instead of being confined to a few localities, is spread over the whole neighbourhood, and continues on the wing more or less abundantly till the following May. I took it in every month from October to May inclusive, and also found it abundant in the Cordillera of the Central Provinces in January, at Chillan in March, and in Valdivia in February; but I have never found *minuscula*, except in three places near Valparaiso.

“*Vautieri* varies slightly in size and in the breadth of the black margins of the male, and amount of clouding in the female, which in the mountains are much darker than in the lowlands; but I never saw one of either sex which could possibly be confounded with *minuscula*; the female of the latter is paler above, and darker and greener beneath, the markings on upper side of hind wings being confined to a single small dusky blotch. In the male the black margin is invariably much narrower than in *Vautieri*, and there is such a difference in the appearance of the two species or varieties that it would not be possible for anyone who was acquainted with both to confound them.

“It may be as you say, that one is the early brood of the other; but I fancy that, as *minuscula* is not out till the end of August, and *Vautieri* is plentiful by the second week in October, there is hardly time for the insect to pass through its various stages (*cf.* p. 5). If, however, this is the case, *Vautieri* must be triple-brooded, as there are certainly two broods on the wing between October and May.

“Mr. Butler is decidedly wrong in considering *Vautieri* and *rutilans* distinct. As I have said before, the species varies slightly; but I have examined a large number and found it impossible to separate them.”

After reading these remarks I again examined the specimens of *Vautieri* at the British Museum and in Mr. Godman's collection carefully, and found very great variation amongst them, though not more than I should expect;

one female from Concepcion, in North Chili, is as small and pale as the female type of *minuscula*. It then struck me that *flaveola*, Blanch., was probably the same insect, so I wrote to Prof. Blanchard to know if the type still existed. He replied that it is at Paris, and that he now considers it simply a small variety of *C. Vautieri*, of which the male was called *C. rutilans* by Boisduval. The distribution of the species will then very nearly coincide with the geographical limits of Chili.

? *Colias Euxanthe*, Feld.

Feld., Reise Nov., ii., p. 196 (an nova species).

C. Dinora, Kirby, Trans. Ent. Soc. Lond., 1881, p. 358, described from a single female from Chimborazo which I have seen in Mr. H. Grose Smith's collection, is probably a form of *dimera* or *Euxanthe*.

As I am unable to say with certainty what *C. Euxanthe* really is, I can only apply the name provisionally to the species now in question, which is a very puzzling one.

Mr. Whymper in his Andean journey took several specimens of both sexes of a small pale narrow-winged *Colias* at great elevations in the Andes of Ecuador, namely, Pichincha, 11,000—12,500 ft.; Cayembe, 13,000 ft.; Antisana, 16,000 ft. As far as I can judge from a hasty examination, it belongs to the same section as *Vautieri*, but differs markedly from that species, as well as from *Lesbia* and *dimera*, in their typical examples. There exist, however, several specimens in Mr. Godman's collection which seem intermediate between ? *Euxanthe* and others, namely, two from Poziuzu, on the Ucayalz River, collected by Whiteley; two from Chili, which connect it with *Vautieri*; one from Bolivia (Buckley); and one or two from the Sierra de Totoral, which are probably a form of *Lesbia*, though more like *Euxanthe* in general appearance. The material is certainly insufficient to decide anything, and I must therefore leave it a *species dubia* for the present, though I have little doubt that Whymper's specimens at any rate belong to a distinct alpine species. He found them in company with *dimera* at the upper limit of its vertical range, but going to a much higher elevation, and not nearly so abundant as that species. It resembles *Scalidoneura Hermina*, Butl., very closely in general appearance; but the venation of the single type-specimen of that species is certainly dis-

tinged, though not easy to make out; and I am still without further knowledge of this curious form.

Colias Lesbia, Fabr.

Since writing on this species I have gathered a good deal more information as to its distribution, which is much wider than I at first supposed.

Berg, in Bull. Mosc., 1876, p. 198, records it as common in Patagonia, from Rio Negro to Santa Cruz, and it is the commonest of butterflies in the Argentine States as far N.W. as Sierra de Potoral, Prov. Catamarca (White); occurs at Rio Grande do Sul, in South Brazil (Rogers); and at various localities in the Andes of Ecuador, where Mr. Whymper found it in some numbers at Otovalo and Machachi, 8000—12,000 ft., together with *C. dimera*, which was more numerous. These Andean specimens agree very well with those from Buenos Ayres, but the females do not seem to be dimorphic as in the south, where the pale form is common.

Darwin, in his 'Naturalist's Voyage,' mentions the occurrence of a flight of this species containing countless numbers which came on board his ship, ten miles from land, in the Bay of San Blas.

C. Eogene, Feld.

Feld., Reise Novara, p. 196, pl. 27, fig. 7.

C. Theia, Stgr., MSS. Cat., 1882.

Var. ? *C. Stoliczkana*, Moore, Ann. & Mag. Nat. Hist., 1878, p. 229; Yarkand Exp. Lep., pl. i., fig. 1, 1879.

When I first wrote on *Colias* I did not know this species so well as I now do, and placed it doubtfully as a variety of *Fieldii*. This it certainly is not; and having seen the types in the Felder collection, and several other specimens, of which four males and two females are now in my own collection, I believe it to be as good a species as any other in this group, and allied most nearly to *Thisoa*. It may be known by the extremely bright fiery orange tint of the upper side, which in the female is much overlaid with smoky black, especially on the hind wings; by the broad black border on both fore and hind wings; the large red blotch in centre of hind wings, especially in the female; and the peculiar shape of the costa of

fore wing, which seems more or less characteristic of *Thisoa* and *Meadii*. On the under side it resembles *Thisoa*, but has the veins distinctly yellowish, and the central white spot more surrounded with red.

It occurs on the Baralacha Pass, the Zogi-lah Pass, and other of the alpine passes which lead from the Himalayas into the dry climate of Ladak, from 11,000 feet upwards; and if I am right in uniting with it the form named *Theia* by Staudinger in his MS. Catalogue of 1882, which was collected by Haberhauer in the mountains near Osch, in Eastern Turkestan, extends considerably to the north and west.

The specimens from Osch, however, of which two are before me, are not nearly so brilliant or distinct in colour as those from the Himalayas; and appear to be a transition to the form named *Stoliczkana*, of which I have seen two specimens collected by Stoliczka himself, and which, though much smaller, paler in colour, and distinctly spotted on the under side, might be only a form of *Eogene*. As, however, no females of this supposed species are known, we must await further materials before deciding about it. It occurs at great elevations, 16,000—17,000 feet, at Changla and Pang-chong, in Ladak.

Capt. Graham Young wrote of *Eogene*—"I have only found this insect in July and August, in the Upper Chandra Valley, at 11,000 feet and upwards. It flies with great rapidity, and is very difficult to capture. It frequents the patches of flowers scattered amongst the boulders and glaciers of that inhospitable region."

Colias Staudingeri, Alph.

Alph., Hor. Ent. Ross., xvi., p. 35, pl. xiv., fig. 4; Stett. Ent. Zeit., 1883, p. 493.

This species is found in the high mountains of Kuldja, at 7000—12,000 ft., and, according to Alpheraky, is very distinct from *C. Thisoa*, both in the elevation of its habitat, its flight, which is very swift, like that of *Eogene*, and other points. The only two specimens I have seen of it in Mr. Godman's collection are, however, not sufficient to form an opinion; but Mr. Alpheraky sends me the following points of distinction:—

C. Thisoa, ♂, ♀.

Under side of hind wings not more velvety than in *Edusa*, *Myrmidone*, &c.

Pattern of the under side of hind wings distinct, the submarginal spots distinctly marked.

In the male the central black spot of the hind wings never mixed with scales of the ground colour.

In the male the black border always distinctly marked.

The wings of the male always very sharp at the apex, and the wings broader than in *Staudingeri*.

The wings of the male below with more lines.

C. Staudingeri, ♂, ♀.

Under side of hind wings more velvety even than *C. Hecla*.

Pattern of under side of hind wings very indistinct; the submarginal spots indistinct, or entirely lost in the ground colour.

The same black spot is always mixed with scales of the ground colour, and in some cases quite effaced by them.

The border not distinctly marked, but the colours shading into each other.

The wings longer and more rounded at the apex.

The wings covered with larger scales, giving a mealy appearance.

I expect that the nearest alliance of *C. Staudingeri* is with *C. Eogene*, Feld., from the northern form of which, *C. Theia*, Stgr., it is not very different; and agrees with both these in the great elevation of its range, and in the absence of the basal patch on the hind wing.

Colias Viluensis, Mén.

Mén., Schrenk's Reise, p. 18, pl. 1, fig. 7.

? *C. Edusa*, var., Trybom, Kon. Vet. Akad. Förh. Stockholm, 1877, No. 6, p. 38.

This very obscure form seems to be an arctic variety of *Chrysotheme*. It is placed by Staudinger with doubt next to *Chrysotheme*, and is considered by Trybom to be a form of *Edusa*, if, as he believes, the specimens examined by him which were taken at Dudinska, on the Yenesei River, in lat. 69° 25' N., are the same species as that described and figured by Ménétriès from the Vilui River, in E. Siberia. The female seems unknown, and no specimen exists in any collection I have seen. There is, however, nothing in the figure or description that I can see by which this form may be certainly distinguished.

Note.—Alpheraky states (Stett. Ent. Zeit., 1883, p. 493) that he has seen five males of this species in which the basal patch is absent. He considers it a distinct species on account of the entire absence of the row of black spots on the under side.

Colias Chrysotheme, Esp.

Esp., Schmett., 1, 2, t. 65 (1777).

Var. *Keewaydin*, W. H. Edw., Butt. N. Am., ii., *Col.*, pl. iv.

Gen. 1, *Ariadne*, W. H. Edw., *l. c.*

Gen. 2, *Eurythème*, Bdl., Ann. Soc. Ent. France, p. 286 (1852); Zeller, Stett. Ent. Zeit., 1874, p. 437; Boll, Berl. Ent. Zeit., 1880, p. 241; Hagen, Proc. Bost. Soc. Nat. Hist., 1882, pp. 151, 173.

The account published by Mr. W. H. Edwards in the 2nd vol. of his work on the various seasonal forms and geographical distribution of the species is so exhaustive that I need only refer to it, and hope that it may serve as a model to lepidopterists in other countries, and as a warning to species-mongers to be more careful. I would, however, observe that the distribution of this species is, as far as I know, quite unparalleled by that of any other species. We find the form *Chrysothème* in a limited district of Central and South-Eastern Europe, but never, as far as I know, with any marked variation. I have seen a female which resembled in colour *C. Ladakensis*, but nothing of the male sex which could be mistaken for any other European species.

In N. America, however, it occurs over a very wide range: in northern and mountainous districts, where the summer is short and there is but one annual brood, it takes the form of *Keewaydin*, which so closely resembles *Chrysothème* that it is not easy to tell European from American specimens. In California, Texas and other warm districts where the summer is very long, the form *Keewaydin* is only found as a variety; but there are other very distinct-looking forms which belong to different broods, *Ariadne* being the smallest, darkest, and earliest, and *Eurythème* the largest, brightest, and latest.

Colias Philodice, Godt.

Godt., Enc. Méth., ix., p. 100, 1819; W. H. Edwards, Butt. N. Am., ii., *Col.*, pl. ii. iii. (1876); Hagen, Proc. Bost. Soc. Nat. Hist., 1882, p. 174.

C. Anthyale, Hüb., Zutr. Ex. Schmett., ii., p. 21, figs. 307—8 (1823).

C. Eriphyle, W. H. Edw., Trans. Ent. Soc. Phil., v., p. 202 (1876).

C. Chrysomelas, W. H. Edw., Proc. Cal. Acad. Nat. Sci., Feb., 1877.

I follow Dr. Hagen in uniting these three forms; specimens of each of them in my collection fully bear out his opinion, and the figures in Edwards' plates show how variable *Philodice* is. As I have before mentioned, the name *Anthyale*, Hüb., which in Staudinger's Catalogue is used for *Pelidne*, Bdv., must without doubt be considered a synonym of *Philodice*.

Colias interior, Scud.

Scud., Proc. Bost. Soc. Nat. Hist., ix., p. 108 (1862);
? *Pelidne*, Bdv., Icones, t. 8 (1832); Hagen, *l. c.*, p. 147.

C. occidentalis, Scud., Proc. Bost. Soc. Nat. Hist., ix.,
p. 109 (1862); W. H. Edw., Butt. N. Am., i.,
Col., pl. vii.

C. Edwardsi, Behr, W. H. Edw., Trans. Ent. Soc.
Phil., iii., p. 11 (1870); Butt. N. Am., i., *Col.*,
pl. vi. (1870).

C. Christina, W. H. Edw., *l. c.*, ii., p. 79 (1863); *l. c.*,
Butt. N. Am., i., *Col.*, pl. ii., figs. 1—4 (1868).

C. Alexandra, W. H. Edw., *l. c.*, p. 15, t. 11; *l. c.*,
Col., pl. i., figs. 1—4 (1860).

C. Scudleri, Reak, Proc. Ent. Soc. Phil., iv., p. 217
(1865); W. H. Edw., Butt. N. Am., i., *Col.*, pl. viii.,
figs. 1—4.

C. Emilia, W. H. Edw., Trans. Am. Ent. Soc., iii.,
p. 12 (1870).

C. Astræa, W. H. Edw., *l. c.*, v., p. 202 (1876).

Var. *Harfordi*, H. Edw., Proc. Cal. Acad., vii., p. 79
(1877), ♂.

C. Keewaydin, W. H. Edw., Butt. N. Am., i., *Col.*,
pl. iv., fig. 7, ♂.

C. Barbara, H. Edw., *l. c.*, p. 7, ♀.

Var. *Laurentina*, Scud., Proc. Bost. Soc. Nat. Hist.,
p. 4, Oct. (1875).

I follow Dr. Hagen entirely in his views as to the synonymy of this species, and, as he has had access to most of the types, and has gone into the subject very carefully in a way which no European lepidopterist is in a position to do, am much indebted to him for interpreting the nomenclature of such a difficult species, some of the forms of which I was obliged to pass by with doubt in my first paper.

The next question, however, to be considered is whether, having gone so far, we must not go a step

farther and unite all the American forms with the European *Palæno*. I should certainly have hesitated to do this if it was not for the very able and well-reasoned remarks on the subject by Herr J. Schilde, in the *Stett. Ent. Zeit.*, 1873, p. 169, which will well repay a close study, as bearing not only on this case, but on many similar ones.

My own collection does not allow me to follow all Herr Schilde's points exactly, but, having seen his own collection at Bautzen, and also that of Herr Moeschler, which between them contain the ample materials on which Schilde's arguments are based, I am quite prepared to assent to the proposition that, though in its typical alpine and North German form *Palæno* is a very distinct-looking species from the Labradorian *Pelidne*, yet on the comparison of a large series, including many varieties from Lapland and Finland, the supposed differences become sensibly weakened.

Dr. Hagen at present does not seem to see his way to uniting *interior* with *Palæno*, and perhaps he is right to hesitate, for, when we consider how few specimens have hitherto been collected from widely distant points over the immense territory of British North America, and how little we know about them, it is clear that the time has not yet come when the question can be decided.

I have but little doubt that *Palæno*, in some form or other, does occur over the greater part of this region, and, considering that there are only differences of colour and size between it and *interior*, and, as far as we know, no structural difference, I fully expect to see them treated as one species before long.

The question which occurs to me is whether, having gone so far, he might not have gone a little farther and treated the whole of these forms as the descendants of *Pelidne*, which, indeed, has already been suggested by Moeschler, *Stett. Ent. Zeit.*, vol. 31, p. 114, as regards *interior* and *Labradorensis*, the latter of which Dr. Hagen considers to be *Palæno*.

As he goes on to say that *Pelidne* and *Palæno* are probably not distinct species in America, we seem to arrive at the conclusion that *Palæno*, with its form *Chippewa*, from Hudson's Bay, and *Pelidne*, are, together with all the above-named forms or varieties, to be considered as representing one and the same species.

Judging from the materials at my disposal, which, though pretty large, are by no means equal to those which Dr. Hagen had, I see no reason to doubt the truth of this, and I do not find any characters which are present in one or other of these species that are not sometimes to be found in the others.

The point, however, remains to be settled whether the *Pelidne* described by Boisduval, of which the type cannot be found, was the same as *interior*, Scudd., which Dr. Hagen seems to doubt.*

The geographical distribution of the species would, in case of the correctness of my views, be circumpolar; but, if *interior* and *Pelidne* are distinct, it has yet to be unravelled. The American forms range from Labrador, all over British North America to Alaska, and the Pacific and Rocky Mountain States, occurring, as it seems, wherever the climate is of an arctic character.

PS.—Since this paper was read I have seen, in the 6th number of 'Papilio,' 1883, which reached me in February, 1884, Mr. W. H. Edwards' reply to Dr. Hagen's paper, in which he laughs to scorn the notion of uniting any of these so-called species. I can only say that after reading it carefully, I fail to see that he has seriously shaken Dr. Hagen's position, and he certainly has failed to point out how these forms may be distinguished in all cases from each other, though picked specimens no doubt would afford slight distinctive characters. In the same number of 'Papilio' he describes another new species? under the name of *C. Hageni*. I have just had an opportunity of hastily looking over a number of specimens collected in the Saskatchewan District in 1883 by Capt. Geddes, in Mr. H. Smith's collection, and am more puzzled than ever. Some of the forms which Dr. Hagen considers to belong to *interior* certainly seem to have more affinity to *Philodice*, but Mr. Edwards denies stoutly that any example of *Philodice* was ever seen in the Rocky Mountains, in Oregon or within a thousand miles of it. The question must remain unsettled until much more is known about the forms occurring in British America.

* I have just heard from Dr. Staudinger that the type of *Pelidne* in Sommer's collection, which he now possesses, is the well-known form from Labrador.

C. Hyale, L.

C. Erate, Esp., t. 119, fig. 3.

I am quite unable to say how these two species can be in all cases distinguished from each other, and, though pages might be written on the subject of their varieties, yet I doubt whether anything certain could be made out except by breeding on a large scale and in different parts of the world.

What we do know is this, that in Europe, ranging from Belgium and England in the west, to Russia in the east, and to Andalusia, Sicily, and Algeria in the south, the species which we know as *Hyale* occurs. Typically, and, in fact, with rare exceptions, the males are of a deeper yellow than the females, and both sexes have the black band on the fore wing marked with blotches of the same colour as the rest of the wing. In the collection of Herr Mützell, of Berlin, I have seen (and doubtless they may be found in other collections) specimens of *Hyale* from the South Tyrol, and also from Berlin, which are of the same, or almost the same, colour in both sexes, and, as I noted at the time, agree well with the Himalayan specimens. These, I may say, have been selected during a long life from thousands which have come under Herr Mützell's eyes, and, as regards the sexes, I rely on his assurance, not having been able to verify them myself in the short time at my disposal.

In the South of Russia, at Sarepta, on the Volga, *Hyale* seems to mix with what is known as *Erate*, which differs from *Hyale* in the sexes being of the same tint of yellow, slightly deeper than the yellow of *Hyale* male; but male specimens of *Erate* occur at Sarepta which have the spots on the fore wing as in *Hyale*. Pale-coloured females also occur (ab. *pallida*, Stgr.) which do not differ from female *Hyale*, except that the black border of the fore wing is sometimes more produced towards the hind margin.

At Sarepta are also found forms (? hybrids or varieties) of *Hyale* (*Sareptensis*, Stgr.), which he characterises thus in his Catalogue of 1877, "Al. ant. marg. post. lato, nigro; ♂ satur, flavus."

As to the comparative abundance of these two forms at Sarepta I cannot speak positively, but it seems evident that they here begin to mix.

In Greece, however, Staudinger records neither species, and in Asia Minor only *Hyale*.

At Lepsa and Saisan, in Central Asia (cf. Staudinger in Stett. Ent. Zeit., 1881, pp. 260—279), both *Erate* with *pallida*, and *Hyale* with *Sareptensis*, are found, and it is said that the pale females of *Erate* cannot be surely distinguished from those of *Hyale*.

In Afghanistan (see Proc. Zool. Soc., 1880, p. 409) all these forms occur mixed together, and Major Roberts takes *Sareptensis* and *Erate* in copulâ, as is only natural that he should do, if, as I believe, they are merely one and the same species.

In North Persia also the two forms, *Erate* and *Hyale*, with their pale varieties, occur, according to Christoph Haberhauer and Bienert.

In the Himalayas we have them abundantly from Kashmir to Sikkim. Moore, in Proc. Zool. Soc., 1882, p. 254, in treating of Hocking's collection, includes "*Sareptensis*?, *Erate*?, *pallida*?" and a new species which he calls *lativitta*. I have all these specimens named by Mr. Moore himself, and can say with confidence that they differ in no respect from specimens which I have through Dr. Staudinger and others from Osch and Margilan, in Central Asia, and from *Sarepta*; neither would it be possible to say which specimens came from either locality, if the labels were removed.

As regards the forms of *Erate* and *Hyale* found in Southern Russia and in the Kuldja District, Alpheraky, in Horæ Soc. Ent. Ross., vol. xvi., gives some very interesting observations. The principal facts to be noted are, that in the environs of Taganrog and at Kuldja the form described as *Sareptensis* by Staudinger is found in both sexes, and is doubtless the product of crosses between *Erate* and *Hyale*, which are often found in copulâ; they are generally of the colour of *Erate*, but with spots on the black border.

Secondly, although, in South Russia and the Caucasus, Alpheraky finds *Hyale* almost agreeing with those of Central Europe in size and in the shape of the border, with innumerable intermediate forms between the two extremes, yet out of 2000 or 3000 specimens which he examined from Taganrog and the Caucasus none of the males are as pale coloured as in Central Europe. He therefore doubts whether the form known as *Sareptensis* is to be considered as a variety, an

aberration, or a hybrid, and to which form the name is to be applied.

With regard to what is known as *Chrysodona*, Kinderman = *Helictha*, Lederer, he says that amongst fifty or more specimens which he has examined there exist two forms, one of which, inconstant, he believes to be a hybrid between *Edusa* and *Erate*, which he declares he has several times taken *in copulâ*, and the other, which he believes to be an ochreous variety or aberration of *Erate*, found not uncommonly in the environs of Azoff, and also in the Thian-chian and near Kuldja, where *Edusa* does not occur.

I may add that in the Vienna Museum are three pairs of a variety of *Hyale* from Nubia and Egypt, collected by Marno, which, if correctly labelled, as I believe they are, extend the range of this species much farther than is generally known.

From Japan, Amur-land, Askold, and Shanghai I have numerous specimens representing several supposed species, none of which I can see the slightest reason for separating; and, after comparing about seventy specimens in my collection from various parts of Europe and Asia, can say only that, whilst I can usually distinguish typical European *Hyale* by the shade of colour in the male, and by the somewhat shorter and narrower black band on the fore wing and less conspicuous border on the hind wing in both sexes, I can find specimens from all parts of Asia which cannot, by the most ardent believer in the fixity of species, be defined by any constantly different characters.

I have not myself any specimens from N.E. Asia representing *Erate* male, but Bremer records it from Possiet Bay, and Murray from Japan, *cf.* Elwes, in Proc. Zool. Soc. 1881, p. 879.

Pryer, in his 'Catalogue of Japanese Lepidoptera,' says of *Hyale* "that it is an abundant and variable insect both on plains and mountains. It varies in size from $1\frac{3}{4}$ in. to $2\frac{1}{2}$ in.; appears first in February, when it is small and lightly coloured, the successive broods being larger and brighter. The female is dimorphic."

From the above facts I conclude that the two species, however distinct in their typical forms, do in the regions where they occur together interbreed and vary to such an extent that they are not certainly to be distinguished,

and that the various forms found in Asia must for the present be treated as at best local and not fixed varieties.

PS.—I must add that, after writing this, I observed that Schilde, in Stett. Ent. Zeit., 1873, p. 175, notices that *Erate* and *Hyale*, to use his own expression, "conglomerate," and that yellow spot-like markings are not unfrequently observed on the band of *Erate* male.

Supposing my views to be correct, the synonymy and geographical distribution of the forms would be as follows:—

- L. Hyale*, Linn. Western, Central, and Southern Europe ; Asia Minor ; Algeria.
- Hybrid ? and var. *Sareptensis*, Stgr., Cat. Lep. Eur., 1871, p. 5, in parte ; ? = *Neriene*, Fisch. (in part), Alpheraky, Hor. Soc. Ent. Ross., xvi., p. 365. Southern Russia ; Caucasus ; Persia.
- Var. *Erate*, Esp. South Russia ; Western and South-Western Asia ; in Himalaya and Eastern Asia as an aberration only. Syn. *lativitta*, Moore, Proc. Zool. Soc., 1882, p. 255.
- Hyb. ? et var. *Chrysodona*, Boisd., Gen. Ind. Meth., p. 7, 1840 ; *Helictha*, Led., Verh. Zool. Bot. Ges., ii., p. 33, 1853. South Russia ; Kuldja.
- Forma orientalis *Neriene*, Fisch. de Wald., Ent. Russ., ii., t. ii., 3, 4, 1822 ; ♀ ab. et var. *pallida*, Stgr., Cat. Lep. Eur., p. 3, 1861. Afghanistan ; Central Asia ; Himalaya ; China ; Japan ; Amur-land.
- ? var. *poliographus*, Motsch., Et. Ent., ix., p. 29, 1860. Japan.
- Simoda*, De L'Orza, Lep. Jap., p. 16, 1869. Japan.
- subaurata*, Butl., Ann. Mag. Nat. Hist., ser. 5, vii., p. 138, 1881. Japan.
- Elwesii*, Butl., l. c., p. 135. Japan.
- Var. *Nilgherriensis*, Feld., Wien. Ent. Mon., iii., p. 395 (1859). Nilghiri mts., S. India.

Colias Alpherakii, Stgr.

Stgr., Berl. Ent. Zeit., 1882, p. 164.

Of this species I can say nothing more than is said by Staudinger, but, judging from three specimens received from him, it is fairly well distinguished from *Phicomone*

and *Sagartia* by characters which, though in this genus not so satisfactory as one might wish, yet, if constant, would enable one to recognise it with certainty. It was found in the Alai and Hazret Sultan Mountains of Turkestan by Haberhauer.

The principal characters by which it may be known are the white spots on the middle of the under side of hind wing, which are never surrounded by a ring of brown or yellowish (this seems to be also the case in *C. Wiskotti*), the colour of the antennæ, and the hair of the head and thorax, which have none of the pink colouring found in the other species of this group.

My specimen from the Hazret Sultan has, however, the antennæ, as in *Sagartia*, unlike the other two from the Alai. Before deciding as to whether this is really a good species, it would be desirable to see if specimens of *Sagartia* occur in the as yet unexplored mountains of the Perso-Turcoman frontier to the eastward of its hitherto only known habitat, as, if they do, they may possibly present intermediate forms.

Colias Ladakensis, Feld.

Feld., Reise Nov. Lep., ii., p. 197, t. 27, figs. 8, 9, 1865.

C. Shipkee, Moore, Proc. Zool. Soc., 1865, p. 492, t. xxxi., fig. 13.

Since writing on this species I have seen the types of *Ladakensis*, which is undoubtedly the same as *Shipkee*, and, though there is still some doubt as to the priority of the names, Felder's is so much the best that I think it should be adopted. It appears to me, after the examination of a number of specimens, to be so well distinguished from all allied forms, both by the colour of the upper and under side, and by the peculiar shape and colour of the central spot on under side of the hind wing, that it may very well stand as a good species.

The females appear to be distinguished by the slight orange tint of both wings on the upper side.

Colias Erschoffi, Alph.

Alph., Hor. Soc. Ent. Ross., xvi., t. xiv., figs. 1, 2, p. 362, 1881; Stett. Ent. Zeit. 1883, p. 494.

Of this species I know nothing beyond the description and figure cited. Judging from these alone I should have said that there were no good characters by which it might be separated; but Alpheraky later speaks of it as a "remarkable species which can be thus taken for no other," and says "that the figures, especially that of the females, are bad, and do not represent it properly"; he says further "that it is nearest to *C. Sagartia*, and has no resemblance to *C. poliographus*, as Erschoff supposed." He does not, however, give any special points of distinction, and for the present I should class *C. Erschoffi* with the doubtful species.

Colias Boothii, Curt.

Curt., Ross., 2nd Voy., App., p. 65, t. A, figs. 3—5 (1835); Guenée, Ann. Ent. Soc. France, 1864, p. 198.

After a re-examination of the specimens of this species, and the numerous ones of *C. Hecla* from various parts of Arctic America, which exist in the British Museum, I am disposed to think that they are distinct species, and that the typical *C. Boothii* is perhaps only a form of *C. Nastes*. I can hardly believe that a peculiar species should be confined to so small an area in the Arctic Regions as *C. Boothii* at present seems to be, and there is so much variation amongst the specimens themselves that it is not always possible to define them.

Dr. Staudinger tells me that the only two *C. Boothii* he has seen are more like some varieties of *C. Werdandi*, Zett., from Lapland, which is allowed by all entomologists to be a form of *Nastes*. An additional argument in favour of this theory is that the forms described as *Chione* and *Rossii*, which connect *Boothii* with *Nastes*, were taken in the same localities, and that no typical *Boothii* have, as far as I know, been found in other parts of Arctic America, though *Nastes* occurs both in N.E. Labrador and at Hudson's Bay.

PS.—I see that Holmgren, in Af. Vet. Acad. Förh. Stockholm, xxix., pt. 6, p. 105, mentions *C. Boothii* as

having been brought from N. Greenland by Nordenskiöld, but I should imagine this to have been the same as some brought from Grinnell Land by Capt. Nares' expedition, var. *glacialis*, M'Lachl., of which I remarked that they resembled the figure of *Boothii*, the veins on the fore wing being so conspicuously marked that the band is divided into blotches.

II. *Notes upon, or suggested by, the colours, markings, and protective attitudes of certain lepidopterous larvæ and pupæ, and of a phytophagous hymenopterous larva.* By EDWARD B. POULTON, M.A.

[Read November 7th, 1883.]

PLATE I.

IN the following notes I have numbered the segments of larvæ according to the general custom of English entomologists. The head is considered as the 1st segment, and the others are counted (antero-posteriorly) from two to twelve. In adopting this plan I simply wish to be intelligible, and do not stand committed to any theory. I wish to express my sincere thanks to Prof. Westwood for his kind help and advice in this as well as in all other work that I have done in Entomology.

THE MARKINGS OF SOME LARVÆ OF THE GENERA SMERINTHUS AND SPHINX.—The following notes were made after reading Professor Weismann's most interesting and suggestive Essay on 'The Origin of the Markings of Caterpillars,' together with Mr. Meldola's important additions to the English translation. Some observations I have to record were made during the past summer (1883). In other cases (which will be indicated) I have been obliged to rely on my memory for facts of which I did not see the significance at the time when they were noticed, and to which therefore I did not direct very careful attention. This will explain some deficiency of detail in certain observations, although in such cases the main facts have been firmly impressed upon my recollection.

1. *The red spots that sometimes occur on Smerinthus larvæ.*—Weismann considers that this well-known variation represents a step in the origin of coloured borders to the oblique stripes such as are met with in *Sphinx*. I have never been fortunate enough to find these spots in *S. tiliæ*, although the larva is well known to me. This is all the more unfortunate, because Weismann's conclusions have

been chiefly formed from the study of this species. But I have been long familiar with the coloured spots upon larvæ of *S. ocellatus* and *S. populi*, and I am perfectly convinced that, in these species at any rate, they have nothing to do with coloured borders to the oblique stripes. It is quite possible that they afford protection by resembling galls:—seen irregularly, as they are, between the leaves and upon a ground colour very much like the under side of the leaves (see the Editor's notes to the translation of Weismann's book). But I do not think that we can yet speak of their significance with any certainty. The spots are excessively variable in size, in the number found in each row, and in the number of the rows themselves. In these facts we do not seem to recognise the slow but sure accumulation of favourable variations by natural selection. I think it is probable that we see the decline of an old rather than the establishment of a new character. In fact the extreme variability of the spots, when present, seems to be best explained by reversion, which is often unequal and irregular in its action. It should also be remembered that a decided majority of the larvæ of *S. populi*, and an immense majority of *S. ocellatus*, have no trace of these markings.

Shortly after reading Weismann's Essay I was fortunate enough to find a spotted variety of *S. ocellatus* (August 18th, 1883). The larva was feeding on *Salix cinerea* by the banks of the River Cherwell. It had the bright yellowish green ground colour, and each of the spiracles was, as usual, encircled by a fine red line. The following is an account of the number and arrangement of the spots (see Pl. I., fig. 1):—Each of the spiracles of segments 5 to 11 (inclusive) was upon or near a red patch, very slightly indicated on segments 5 and 11, and not greatly developed on the others. Except in the smallest instances, each spot was made up of two patches, one anterior and the other posterior to the spiracle, with its encircling red line. There was also a row of spots above and below that just described, and the spots of both were approximately alternate with those of the latter, and therefore each spot of the highest row was situated vertically over one of the lowest, as far as the two rows corresponded. There are only four spots in the lowest row (on each side of the body), one upon each of the first four claspers; while in the highest row there are distinct spots on the 7th,

8th, 9th, and 10th segments, and a very slight one on the 6th segment, and on the 11th of the right side only.

Thus the spiracular row contains the greatest number of spots, but I believe that the highest row is generally best developed, especially in the size of the spots.

It seems perfectly obvious that we have (here at least) markings which bear no relation to the coloured borders of the oblique stripes. We have a system of three rows whose spots form alternating series, and only the spots of the highest row are placed in front of the oblique white stripes, in the position of the coloured borders found in the genus *Sphinx*. And the highest spots show no tendency to become drawn out into oblique lines. One spot only, and that belonging to the spiracular row, communicates a faint tinge of red (not shown in the figure) to the last white oblique stripe; but this tinge shows no tendency to separate as an anterior coloured border, and the spot which communicates it is placed *behind* the oblique stripe. These observations and conclusions are also entirely in accordance with what I remember of the spotted varieties of these two larvæ. At the same time a darker shade of the ground colour forms a very distinct border to the anterior edge of each oblique white stripe, and greatly increases the efficiency of the protective resemblance to leaf-veining.

I shall presently show reasons for the belief that the coloured borders of *Sphinx* correspond to these green edges, which are distinct in all larvæ of *Smerinthus ocellatus*, whatever be the shade of the ground colour.

Since writing the above I have seen figures of the spotted variety of *S. tiliæ*. The spots certainly show a great tendency to become drawn out into stripes in this species, but such a tendency does not seem to be general in this form of marking, for it is not exhibited in *S. populi*, in which the spots are often developed to an extent never reached by *S. tiliæ*.

Through the kindness of Mr. G. C. Bignell, who has lent me his original painting for the purpose, I am now enabled to add a figure of an extreme variety of *S. populi*. This is shown in Pl. I., fig. 2, and the specimen is remarkable for its very light ground colour, as well as for the unusual development of the spots. Although the spots are developed to a greater extent, especially anteriorly, than in any specimen I have found, yet

varieties approaching fig. 2 are not uncommon. The alternate arrangement is not marked to the same extent as in fig. 1, and the spots are not greatly developed upon the claspers. Anteriorly the spots are not distributed regularly upon the segments, since the former exceed the latter in number. This fact brings out very clearly the want of relation to the oblique stripes, for these are not developed at all anteriorly, and the remnant of the subdorsal, which follows the oblique line system (as will be shown) in the chief protective attitude, sweeps over the contracted anterior segments as a whole without any suggestion of a separate development upon each of them. In fact, a development of oblique lines on each small anterior segment, approaching the development of the spots, would destroy the symmetry and protective value of the whole system. In fig. 2 there is no tendency towards a drawing out of the spots into lines, except perhaps to some extent in connection with the 7th stripe, as was also shown in fig. 1; and this slight tendency does not appear to be in the direction of forming anterior coloured borders. It seems possible that in *S. tiliæ* there is a further intensification of the tendency shown in the 7th stripe of *S. ocellatus* and *populi*, and that there is no relation to coloured borders such as are met with in *Sphinx*.

If *S. tiliæ* is developing after the manner suggested by Prof. Weismann, and *Sphinx ligustri* has lost the spot-stage in its ontogeny, it must nevertheless remain true that *S. ocellatus* and *populi* have progressed in quite another direction. But, considering the above facts and those which follow, it seems more probable that *S. tiliæ* occasionally presents us with a modification which renders its own oblique striping more distinct by a suffusion with the colour of the spots, but that this has no significance for the coloured borders invariably present in *Sphinx ligustri*, &c., which arise directly from the darkened ground colour anterior to the light stripes. Such an extreme instance of this variety as is shown in fig. 2, coexisting with a vast majority of larvæ (of the same species) without a trace of the marking, seems to be greatly in favour of the view that the whole character is due to occasional reversion to a form of marking which is disadvantageous to larvæ protected by their resemblance to leaves. The theory of protection by resemblance to galls is not supported by such a complete

system of spots as is shown in fig. 2, and it is further rendered unlikely by the fact that *S. populi* presents the variety far more commonly and to a far greater extent than *S. ocellatus* (considering the relative abundance and arrangement of galls upon the leaves of their respective food-plants). The spotted varieties are certainly more conspicuous than the others, and such a variety as fig. 2 is very much more conspicuous. Not only is this true, but the modification of the spots, suggested by Professor Weismann, would also be disadvantageous in rendering the larva conspicuous, and *Sphinx ligustri* is far more easily detected than the *Smerinthus* larvæ. The protective resemblances, in fact, belong to two different classes (as will be pointed out), for *S. ocellatus* resembles a rolled-up leaf (at any rate when feeding upon apple), while *S. ligustri* is protected by a general harmony with its surroundings. Hence the coloured borders would be disadvantageous in the former case, as they would destroy the special resemblance; while they may be beneficial in the latter case, where the resemblance is to a general effect caused by complex combinations of light and shade falling upon a large and heterogeneous object. And so also with *S. tiliæ* and *populi*, which are protected by a special resemblance to leaves or parts of leaves.

2. *The origin of the white stripes in Smerinthus.*—If the shagreen dots be carefully observed they will be found to possess an annular arrangement. There are generally eight rings in the largest segments. As each ring intersects a white stripe (either belonging to the oblique or subdorsal system), the dot that is placed upon the stripe is much larger than others near it in the same ring. The largest oblique stripe—the last—has more than one row of dots. When the full-fed larva has ceased to feed, and is lying quiescent in a contracted state before pupation, the colours are much changed. The white striping disappears, and the ordinary shagreen dots become very inconspicuous, but the enlarged dots remain distinct, and thus the whole system of lines can at once be recognised. It is thus seen how large these dots really are, for under other conditions they are hard to detect, being placed on a white ground. In addition to their arrangement upon the usual stripes there is a line of enlarged dots on each side of the dark pulsating dorsal line formed by the dorsal vessel. In this case the ground colour has not become white along the line

of dots. These facts seem to indicate that the white lines of the larva first arose as enlargements of the shagreen dots, and that the effect has been increased by the ground colour becoming gradually lighter along the same lines. The extreme anterior end of the subdorsal seems to be made up of a row of dots only, without any whitening of the ground colour. The dots on each side of the dorsal line doubtless serve to render the latter more distinct. The importance of the dorsal line is very great for protective purposes, as it represents the midrib of a leaf. It is possible that the ground colour may now be in process of change along these two lines. At the same time the changes of colour before pupation afford evidence that the dark anterior borders to the oblique stripes have risen to the position of distinct and independent markings, and are not merely local deepening of the ground colour. At the time I speak of, the ground colour fades and is replaced by dirty brown, but the green borders appear more distinct than ever (in some specimens at least, and in none do they share the fate of the ground colour). It is very probable that the origin of the white markings from the shagreen dots can be proved in the ontogeny.

3. *The use of the remains of the subdorsal in the last stage of Smerinthus.*—At this stage the subdorsal line remains distinct (as Weismann points out) in front of the oblique stripes, and also intersects the first two or three of these, gradually disappearing posteriorly. I believe that it is not generally known that there is the beginning of an 8th oblique stripe, slightly marked, on the 5th segment (see figs. 1, 3, and 4). This stripe (which possesses a dark coloured anterior border remaining after the changes before pupation) begins superiorly at almost the same level as the others; inferiorly it reaches, but does not cross, the subdorsal. If the oblique stripes were repeated anteriorly, with the same relation to the segments that they bear to those where they are present, they would entirely mar the effect of a series, because the anterior segments are so much smaller than the others, and are, further, much contracted when the larva most needs the protective resemblance, *i. e.*, when it is at rest and assuming the *Sphinx* attitude. But, if a larva be watched in this position, it will be seen that the subdorsal line, following the curved anterior segments, becomes approximately parallel to the oblique stripes

(Pl. I., fig. 4). The effect is heightened by the slight oblique stripe on the 5th segment, for the eye naturally regards this as the true continuation of the subdorsal. The curving and contraction of the anterior segments do not produce perfect parallelism, but quite enough for the eye to accept the subdorsal as part of the series of oblique stripes. It is an instance of an imperfect suggestion being sufficient to continue a series of markings, and to be efficient in protection. I have no doubt that this is the cause of the retention of the anterior part of the subdorsal and of its gradual disappearance posteriorly. When the larva is at rest the contraction of the anterior segments is so great that the spiracle on the 2nd segment is always partially and sometimes completely hidden. Fig. 4 shows the attitude of rest, but the same larva as that drawn in fig. 3 has been here given, and the subdorsal is in consequence less subordinated to the oblique stripes than is usually the case.

The same adaptation of an older system of markings to a more recent oblique line system is seen in other larvæ, as well as in the *Sphingidæ*. Thus, in the larva of *Endromis versicolor*, as depicted on page 203 of Newman's 'British Moths,' a distinct dorsal line is drawn, and another line, which appears to be spiracular in the 2nd segment and subspiracular in the 6th. There is also the oblique line system consisting of eight stripes (which slope in the opposite direction to those of *Sphingidæ*) upon segments 4—11 inclusive. The spiracular line is distinguished by a longitudinal row of dots, as well as by its position. It appears to be normal in segments 2—6, but on the 7th segment it becomes oblique, and forms a continuation of the true oblique stripe on the 6th segment. This is also the case upon all the segments up to and including the 12th. In each case the true oblique line upon one segment is continued posteriorly on to the next segment by a modification in position of the subspiracular line upon the latter. Although modified, the subspiracular oblique lines retain their characteristic dots, and it is thus easy to recognise this portion of the stripe as belonging to a different system, which is retained unchanged anteriorly. This is therefore an extremely interesting adaptation of an older to a newer form of marking, which has taken place where the latter is chiefly developed (after the 6th segment).

The larva thus represented is certainly adult, and I

have tried, but without success, to find figures of the younger stages. I have no doubt that in the early stages the horizontal system is alone present, and that later these lines coexist with an oblique system, while in the highest stage the former becomes part of the latter. In fig. 5 a copy is given of the larva represented upon page 203 of Newman's 'British Moths.'

4. *The comparatively recent replacement of the subdorsal by the oblique lines in Smerinthus.*—Weismann proves this fact from the ontogeny of the larvæ.

After the formation of the oblique line system it seems likely that the subdorsal somewhat rapidly disappeared from all but the anterior segments of the adult larva, because (as Weismann points out) it would interfere with the protection from the oblique lines, and also because it would spoil the effect of its anterior part, which, as above shown, lends itself to the newer system of markings. But these changes must have been very recent, for traces of the subdorsal can generally be made out by careful observation upon all the usual segments in adult larvæ.

In the gradual deepening of the ground colour to form the borders to the oblique white lines the point of intersection of the former with the white subdorsal must have been lighter than the ground colour, and has therefore taken longer to darken. Hence in each segment, at the level of the posterior part of the subdorsal remnant, a light linear interruption of the green border can generally be detected. In one adult larva, with the bluish green ground colour (found on *Salix viminalis* by the River Cherwell, Sept. 8th, 1883), these light short lines were connected together into a faint representation of a complete subdorsal line, ending posteriorly in the last white stripe (see fig. 3). The line was here most distinct and linear where it crossed the dark borders, but was fairly well-defined inferiorly through its whole length. The upper limits gradually shaded off into the ground colour, and the line seemed to spread upwards in the anterior part of each segment, so that it was of considerable thickness where it joined the white oblique line. But this appearance can be detected in the posterior part of the subdorsal remnant in most larvæ. The larva which thus retained the subdorsal was full-fed and of large size. This observation shows (together with the traces which can often be detected) that the

subdorsal has been retained very late in the phylogeny of the genus *Smerinthus*.

5. *The probable phytophagic character of the ground colour in S. ocellatus.*—This conclusion is suggested by Mr. Meldola in the notes to his translation of Weismann's book. I have no doubt that experiment will settle the question in the affirmative. In the meantime I give a list of the trees upon which I have found *S. ocellatus* during the past summer, with the colour of the leaves (under sides) and the larvæ. The invariable resemblance of the latter to the former in many species of plants is much in favour of the cause being phytophagic, unless we imagine that the larvæ are truly dimorphic, and that the moths of each variety lay their eggs on the appropriate trees only. I have found the bright yellowish green variety on *Salix cinerea* and *S. rubra*, and formerly, I believe, on a crab-apple tree at Reading. The under side of the leaves of the crab are whitish, but brighter in appearance than those of other apples, which have a peculiarly "dead" colour very characteristic of the whitish green larva. I have found the latter upon *Salix viminalis* and commonly upon apple (see Mr. Meldola's note on the subject).

6. *Protection sometimes gained by the changes in colour before pupation.*—The adult larva of *S. tiliæ* turns a dark purplish brown before pupation, and has usually assumed this tint by the time that it has come down from the tree upon which it was feeding. The same is true of *Sphinx ligustri*, which becomes quite brown on the back, and in this condition may often be found hurrying along a road or garden path in search of a suitable place to bury itself. I have found a larva of *S. ligustri*, still upon its food-plant, with distinct indications of the brown colour.

In these two species the dark coloration before the final change is very marked in amount and very early in appearance. Conversely the larvæ of *Smerinthus ocellatus* and *S. populi* show but a slight tinge of brown when they have left the trees and are wandering about before burying themselves. In all these cases I am speaking of the change of colour in the full-fed larva when it ceases to feed and makes preparation for the final change: I do not refer to the colours (already described in *S. ocellatus*) assumed in the quiescent condition immediately preceding pupation.

Contrasting the conditions of these larvæ, which behave so differently before pupation, we observe that the chief food-plants of *S. ocellatus* and *S. populi* are sallow and poplar respectively, and that these almost invariably grow in damp situations, and are surrounded by grass or other green vegetation. Thus the original ground colour of the larvæ is the best protection under such circumstances, and, in fact, it is very slightly altered. But the food-plants of the other two larvæ (elm and lime for *S. tiliæ*, many plants for *Sphinx ligustri*, e. g., privet, lilac, laurustinus, syringa, ash, holly, &c.) do not grow in damp places, and are generally surrounded by the bare ground or short turf. Hence, I believe, the importance of the darkening in these instances. In the case of a very large brightly coloured larva like *Sphinx ligustri*, which would show up as an extremely conspicuous object against the ground, this time of moving rapidly about before burying would indeed be fatal.

It is probable that the brown or dark shades so often met with before pupation are due to changes taking place in the larval colours, and are merely incidental to their destruction. Natural selection would then in certain cases seize upon the slight incidental darkening, and would give it such determinate direction as we see in *Sphinx ligustri*, &c. It is probable, too, that the same agency would diminish and retard the darkening in cases where it is unfavourable.

This explanation is probably correct, if we grant the extreme danger of this period to larvæ when they descend from their food-plant and come within the reach of new foes as well as old.

7. *The relation of the markings of Sphinx to those of Smerinthus.*—There is one fact in the ontogeny of *S. ligustri* which I think is not recorded by Weismann, that the larva is covered with white shagreen dots, until (I believe) the last ecdysis. I am almost certain that the shagreening is retained up to this point, although I have not seen it for many years. The shagreen is exactly like that on *Smerinthus* larvæ, and the retention of this character in the earlier stages of *Sphinx* is a very strong argument for the later origin of the latter, and from a form possessing likeness to *Smerinthus*. I believe that in the younger stages the oblique stripes also resemble those of *Smerinthus* in the character of

the white lines, and in the presence of borders formed by a deepening of the ground colour. The pure white stripes only appear when the skin becomes smooth, but before this the purple borders can be seen, although narrow and not conspicuous. I do not remember any indications of spots which gave rise to the borders by coalescence, but I believe that the latter took the place of the dark green edges.

The above statements are from memory: I can now speak with certainty as to the last stage, for I have carefully examined several specimens after reading Weismann's book. The beautiful delicate white stripes still retain indications of the shagreen covering in their anterior inferior extremities, which are made up of scattered white points. Superiorly and posteriorly they still show traces of their origin from stripes, resembling those of *Smerinthus*, for, continued on to the segment behind that in which most of its course lies, the white stripe becomes of a pale yellowish green, and can be followed nearly up to the dorsal line (formed by the dorsal vessel). The recognition of this superior continuation needs close observation, but it will be readily seen now that attention is directed to it. At the same limit the purple border to the white stripe changes superiorly and posteriorly into a dark green border to the yellowish stripe. This also continues nearly up to the dorsal line, and can be recognised with a little attention (see fig. 7). These observations seem to prove that the purple border has been modified from a dark green border (like that of *Smerinthus*) at the sides, but not above, where the latter faintly persists. In the same manner the pure white stripes have arisen from lines, like those of *Smerinthus*, which still remain above. The relation between the bright colouring of *Sphinx* and the obscure colouring of *Smerinthus* is very well seen by looking carefully at an adult *Sphinx ligustri* from above (see fig. 6).

These last facts, together with the marking of earlier stages and the long retention of shagreen, prove that the beautiful colours of *Sphinx ligustri* have been acquired very late in the phylogeny.

8. *Further notes on the adult larva of Sphinx ligustri.*—The anterior spiracle (on the 2nd segment) is not hidden during rest, although the *Sphinx* attitude is so marked in this genus. I found one specimen of *S. ligustri* (at Wootton, near Oxford, Sept. 14th, 1883)

which showed some interesting facts in connection with the oblique stripes. In the first place the tendency towards the repetition of markings in segmented animals had shown itself in the appearance of a slight oblique stripe on the 12th segment. This was very nearly parallel with the others, and consisted of an interrupted purple line, with the white stripe only indicated by a few isolated points at the lower end of the purple line (see fig. 7). This imperfect repetition of the oblique stripes occurred on both right and left sides, but without complete symmetry.

Another interesting fact was that the purple borders of the seven usual stripes became darker at about the middle, and this gradually increased until the lower end was very nearly black. The dark colour was repeated on the other side of the white stripe as an irregular patch opposite to the inferior end of the purple border. The darkening of the border began at the anterior edge and gradually extended posteriorly until in the lower quarter of the purple stripe it had affected its whole thickness (see fig. 7, in which the darkening is not sufficiently indicated). The dark patch behind the lower end of the white stripe was almost or completely hidden when the segments were at all contracted.

PROTECTIVE ATTITUDES IN THE LARVÆ OF GEOMETRÆ.—During the present year (1883) I have reared from the egg, larvæ of the three less-known species of *Ephyridæ*, *Ephyra pendularia*, *E. orbicularia*, and *E. omicronaria*. Although the perfect insects are well known, I infer that the larvæ are seldom seen, from the meagre descriptions in text-books, and from the fact that the food-plants are quoted from Guenée by both Stainton and Newman. My object was to experiment upon the pupæ in order to investigate the causes of seasonal dimorphism in this group of moths, using Prof. Weismann's methods (see the translation of his book on this subject by Meldola). I therefore directed no especial attention to the larvæ, being very busy with other work at the time; but upon one occasion I found the larvæ of *E. pendularia* assuming a remarkable spiral attitude which I had never before observed. This caused me to observe more closely, and ultimately led to the following notes.

The larvæ of *Geometræ* are especially protected, as is well known, by their resemblance to twigs and thorns which stand out straight from a stem, generally making

an acute angle with it. Accordingly the larvæ in nearly all cases tend to assume this position when at rest, and the resemblance is often carried further by the presence of roughnesses and tubercles on the larvæ exactly like those on a twig. The usual brown colour of the caterpillar may even have a slight green dusting in places (*R. crategata*) indistinguishable in appearance from the lichenous growth with which bark is generally covered in damp situations. A practised entomologist has often to touch a larva before he is sure that he is not looking at a twig; and he may often at the first glance mistake the one for the other, when the larva is shaken from its hold and falls, still perfectly rigid, into the beating-tray or umbrella. And the protection is far more complete when the larva clings to a branch of its food-plant. These facts are well known to every collector of insects: it is their limitation which I believe has been less noticed. This characteristic protective attitude is especially applicable to larvæ feeding on the leaves of trees, and would not be nearly so effective for those feeding on low-growing plants of which only a tuft of leaves is apparent above the ground. It may be safely assumed that the usual attitude would even be dangerously conspicuous for any fair-sized Geometer larva (unless green) which rested by day on the leaves of its food-plant. Thus the larvæ of *Aspilates citraria* and *A. gilvaria* have the habit of coiling up the anterior part of the body vertically into a flat spiral, with the head in the centre. If shaken from the food-plant the attitude is maintained. In this case the resemblance to a small bleached snail-shell is very striking, both in shape and colour. The situation which the larva frequents is exactly that where small empty shells are found in abundance, and all the localities I know of in which these moths are common are upon limestone, which is also favourable to the presence of these mollusca.

Two points about this protective attitude are of great interest, firstly, that the position when assumed upon the food-plant is just as dependent upon the normal structure of a Geometer larva as the more usual attitude of resemblance to twigs, &c. Secondly, that the object resembled is a dead and bleached shell; for it is very likely that many enemies of the larva (birds, &c.), would not object to a living snail, and the resemblance might thus be no protection if the pale colour did not coexist with the spiral posture.

There is also a period in which the usual attitude must be dangerous to Geometer larvæ feeding upon trees. I refer to the time when the young larva feeds and rests upon the leaf and does not retire to the stem. At this time the rigid position and the attenuated body attached by the posterior end to the surface or edge of a leaf would tend to attract attention. At the same time it is likely that larvæ have, as a rule, most to fear, in these early stages of growth, from their deadliest enemies, hymenopterous and dipterous parasites. These parasites appear on the wing, as far as I have observed, at the same time as the lepidopterous imago, and therefore it is probable that the larvæ in which their eggs are laid must be very young. Further, when larvæ possess a special apparatus for driving away Ichneumons, &c., the protective structures are well developed in early stages.

Indeed, in *Dicranura vinula* the protrusible flagella are of the greatest relative size in the young larva, and gradually become of less importance during growth, until it is rare to find the structures of any functional value in a larva much more than half-grown. In nearly all cases the flagella have ceased to be protrusible before the larva is full-grown. This follows from natural causes, and holds good when the structures have not been injured by other larvæ of the same species.

Of course the need of protection from birds remains through life, and is doubtless more necessary as the size of the larva increases and renders it more conspicuous. But in early stages there is the additional need of protection from parasites.

The objects usually met with upon leaves have an irregular shape, with a frequent tendency towards the spiral form. Such are, parts of the leaf accidentally injured and curled up, spiral or imperfectly cylindrical cases formed by many larvæ, the excrement of birds and snails. Nothing could be more unlike the usual attitude of a Geometer larva. As to colour, the leaf-fragments and larval cases are brown, the excrement of snails dark, while that of birds is rendered conspicuous by irregular white patches on a dark ground. Of course the usual attitude can be retained by larvæ of a green colour, for these would be almost invisible against the background of the leaf. It was very interesting therefore to find the green larvæ of *E. omicronaria* in the normal position whenever I observed them. I cannot be sure that they

never rested in another posture, but I am certain that this was not commonly the case. Next year I hope to be able to settle the point by further and more extended observations.

When the larvæ of *E. pendularia* were about half the full size, and brown in colour, I observed that they were, with hardly an exception, hanging from the under side or edges of the leaves, and that the body was thrown into a spiral of from one to one and a half turns. The head was nearly always downwards, and the caterpillar greatly resembled a brown spiral larva-case hanging from a leaf,—in fact, I thought for a moment that some of these must have been accidentally introduced with the food. I afterwards found that this was a common attitude during rest, and that it was especially maintained during the long period of quiescence that precedes ecdysis. It was so continuous on this latter occasion, and occurred in so many larvæ (I did not notice a single exception), that I thought for a long time that it must be important in producing tension in the old skin. But the attitude occurs at other times, and further, I have never noticed it in other larvæ before ecdysis, where the same tension would be as beneficial as in this case. If the object of the spiral attitude be to split the old skin we should expect to see it assumed just before ecdysis, and not maintained for the long period during which the larva ceases to feed. If further observations show that this position is of assistance to ecdysis it will still be true that the larva derives other benefits, in the same way that the usual darkening of colours before pupation is also of protective importance when larvæ wander over the ground in search of a spot to bury in. But, as far as my observations have gone at present, I am inclined to think that this attitude is especially maintained on such occasions, because the larvæ are then necessarily quiet, and have no reason to give up the protective position. These periods are the only long rests of larval life during which protection of attitude (as apart from colour) can be uninterruptedly kept up, for at all other times there is the constant necessity of feeding and of moving to fresh food, although the danger is frequently averted by such movements being nocturnal.

The larvæ of *E. pendularia* assume the normal attitude of *Geometræ* after the last ecdysis, and then usually

cling to the branches. They are at this stage dimorphic, the more numerous being green, while the others are brown. The latter are protected by their resemblance to twigs, the former by their likeness to young green shoots, and by being invisible against the background of leaves.

The larvæ of *E. pendularia* emerged from the eggs before those of the other two species, and fed up far more rapidly. I was therefore able to watch the other larvæ during the whole period in which protective attitudes are assumed; for the chief protection at the earliest stage (I mean before the first ecdysis) must be the extremely small size and the absence of conspicuous colours or markings. I have already mentioned that I never observed the green larvæ of *E. omicronaria* in any other than the normal attitude. After the last change of skin these larvæ also become dimorphic, but the brown variety forms a very small proportion in this case (one out of twelve larvæ). Before the last stage all these larvæ were green.

The larvæ of *E. orbicularia* were dark-coloured when young, and very early took up a position in which they exactly resembled snail's excrement. The body was twisted into a very irregular spiral (far more irregular than in the case of *E. pendularia* when observed). The illusion was all the more complete, because at this stage the leaf was eaten from the surface and not from the edge, and thus the chief strands of the fibro-vascular framework were left, exactly as they are when a snail has been at work. When the larva becomes larger it presents, when at rest, a striking resemblance to the excrement of birds. It is still dark-coloured, but possesses a series of white markings along the sides, which are shown irregularly in the twists and curves of the attitude assumed. A common position at this stage (when about half-grown) is a spiral twist of about one turn, from the posterior end as far as the last pair of true legs, and then at this point a sudden bend backwards of the anterior segments and head to a right angle with the proximal posterior segments. The effect is highly irregular. From some points of view the appearance is that of another smaller turn added to the first.

In larvæ which habitually assume an apparently angular position it is very common for the bends to be marked by a tubercle or prominence on their convex side. Thus the bends, pointed in this way, appear to be much sharper than they really are,—in fact they look

like angles, but are really bends. This effect is produced in the larva of *E. orbicularia* by thrusting out the posterior pair of true legs, which are situated on the convex side of the bend I have described. The spiral attitude is also chiefly maintained during the long rests before ecdysis, and is usually abandoned when the larva is nearly full-grown, although tendencies towards the habit are then occasionally observed.

When the larvæ are disturbed they resort to other methods of protection; first letting themselves down by a thread, and, if further irritated, falling to the ground and wriggling with great rapidity for some time. This habit is also followed by *E. pendularia* and *E. omicronaria*, and it is common in many larvæ. The rapid movements seem obviously directed towards escape from insect-parasites, but it might also be useful in working the larva down among the roots of grass, &c. But the remarkable thing about the two species of larvæ mentioned above is that these bilaterally symmetrical animals should sometimes assume an asymmetrical position when at rest. The best instance of such attitudes that I have seen was pointed out to me by Professor Westwood, *i. e.*, some of the *Phasmidæ*, which, resembling branches with lateral twigs, hold their limbs asymmetricaly, thus increasing the protective likeness. But I have not before observed any departure from bilateral symmetry in the various protective attitudes of lepidopterous larvæ. It seems very likely that this habit will be found during young stages of other Geometer larvæ, unless protected by a green colour, or in some other special way. It is possible, however, that the habit is confined to the *Ephyridæ*, or specially manifested by them, as this family in some respects stands alone among *Geometræ*. Since writing the above I have been told of other instances, and have also found some myself. In all cases the asymmetrical attitude appears in Geometer larvæ which feed on plants or parts of plants in which the usual protective attitude would not avail.

THE PROTECTIVE ATTITUDE OF NOTODONTA ZICZAC AS AN INSTANCE OF SIMULATED ANGULARITY.—Truly angular attitudes are entirely impossible during prolonged rest for such soft-bodied, semicylindrical, organisms as caterpillars (with the necessity for the constant circulation of air and blood through their respective systems). Therefore the appearance of a very angular attitude is a protection, as

affording a great unlikeness to organic form as assumed in this division of the animal kingdom.

(There is often the additional protection of distinct likeness to some object which could be of no interest to the enemies of the larva).

Hence the not infrequent position of some structure on the convex side of a bend producing the effect of an angle. A most remarkable instance of this is seen in the attitude of *N. ziczac*, the name of which indicates that entomologists have been deceived as to the true position of the larva when at rest. This caterpillar throws itself into a series of undulations in the vertical plane, of which the bends are perfectly round and even, and yet by a structure to point each curve the appearance of an angular *zigzag* is produced.

The following is an account of the series of bends with the structures situated upon each:—The head and two succeeding segments are thrown backwards, producing a curve with the proximal part of the body. The 4th segment is in the centre of this curve, of which the convex side is, of course, situated ventrally, and it is distinctly pointed by the 3rd pair of true legs, which are held out straight in the protective position, and at once attract attention. The centre of the next bend (in the opposite direction) is the 6th segment, and its convex dorsal side is rendered very prominent by a large hump, which in this attitude completely dwarfs that on the 7th segment. The convex side of the next bend (in the 10th segment) is pointed by the 4th pair of claspers, which are held so as to be very conspicuous, and further attract notice by their strongly contrasted colours. The 2nd and 3rd pair of claspers have slight traces of a light longitudinal stripe, but the 4th has so large a stripe as to convey the impression that the lateral (spiracular) line is turned aside into it. Careful examination, however, shows that this is not the case, for the line can just be detected posteriorly to this point. The wide light stripe on the 4th pair of claspers also gains in prominence by the presence of another dark marking sharply contrasted with it, the two opposite shades of colour meeting in an abrupt line of demarcation, which traverses the external side of the clasper longitudinally. The dark stripe does not occur on the other claspers, and it is continued on to the posterior part of the 4th pair from the clouded orange-colour upon the 11th and 12th segments, of which colour it shows the deepest shade. It

cannot be doubted that the object of this striking effect and peculiarly prominent method of holding the claspers is to attract attention to the convex side of the bend, and to convey the notion of angularity. After this bend there is a very marked hump on the dorsal side of the 12th segment which suggests another bend, only represented, in fact, by a very slight downward curve; while the last pair of claspers aids the delusion by being directed downwards and backwards. (It may be noteworthy that these claspers still retain some slight functional value in this species). This last curve is also intensified to the observer in another way. After contemplating a series of curves the mind is ready to continue the series upon a very slight suggestion. This principle is frequently made use of in the markings of insects, and I have had occasion to allude to it in describing the markings of the genus *Smerinthus*. Thus in *N. ziczac* the eye is directed to the convex sides of all the curves, and the impression is conveyed that they are sharp and angular, that they follow the outline of the structures on the convex sides instead of the true outline of the larva. All the four curves are, in fact, quite smooth and gentle, and the last one hardly exists.

When the larva is crawling it is seen that very much of the effect is due to the prominent way in which the structures are held, for they are then hardly noticeable (except the humps on the 6th and 12th segments, and the former appears now on much more equal terms with that on the 7th segment).

On October 15th of the present year (1883) I found a full-fed larva of *N. ziczac* (feeding on *Salix rubra* near Oxford) which presented some differences from the normal form. It was much darker than usual; the spiracular line—really a little below the spiracles—was distinct on the 2nd and 3rd segments, then absent, reappearing faintly on the 6th segment, and increasing in distinctness on succeeding segments to the 10th. On the clasper of the 10th segment it formed a very prominent bright yellow stripe, bordered posteriorly by the dark colour of the posterior segments, here also darker than elsewhere. The spiracular line was completely turned aside into the clasper, and there was no trace of it posteriorly to this point. Dorsally the dark longitudinal patch on the 2nd, 3rd, and 4th segments is seen to be part of a regular dorsal line traceable up to and over the hump on the 12th segment, even down to the anal flap. The dorsal

line is bordered by lateral light lines. There is a slight subdorsal on segments 2, 3, and 4. On segments 5—10 inclusive there are oblique light stripes bordered anteriorly with a darkened ground colour, just as in *Smerinthus* larvæ, and sloping the same way.

NOTE UPON THE USE AND NATURE OF THE MARKINGS OF A NEMATUS LARVA (TENTHREDINIDÆ).—On October 14th of the present year (1883) I found a nearly full-grown larva of *Nematus curtispina* feeding upon sallow in the Oxford University parks, close to the Cherwell. The markings were all longitudinal and very simple, and are shown from above in Pl. I., fig. 8. There was a very dark green (almost black) dorsal line extending from the 2nd segment to within (apparently) two segments of the posterior end of the body. The posterior end of the dorsal line showed a slight dilatation, and the line was interrupted at the intersegmental rings. This dorsal line lay in the midst of a very distinct narrow white stripe stretching the whole length of the body (excluding the head). On each side of this the general green colour of the larva was shaded with black. There was a very fine but distinct white spiracular line, and there was a white ventral line. The head was yellowish brown, with a black curved line on each side. These were all the markings visible on the larva, and the ground colour was a transparent and yet dusky yellowish green. The larva, when found, was clinging closely to the edge of a semicircular notch in the leaf, due to its own exertions. Looked at from the side the larva was very inconspicuous, as the green colour resembled that of the leaf, and the longitudinal dorsal stripes were barely visible in profile, and what was seen of them rather aided the protection. If the larva habitually clung to the uninjured edge of the leaf it would be easily recognisable in profile, because it would stand out beyond the natural edge, and also would interrupt the serrations or other natural features. But, as far as I observed, the larva attached itself to the edge which it had been eating away, and this, too, was the most natural position, for it was thus quite close to the leaf and the part of the leaf upon which it was actually feeding; and in such a position the body of the larva did not attract any attention, for it was merely added to an artificial edge, and did not render the latter conspicuous. But the larva was protected by its colours and position, when seen from above, as well as in profile.

In the former case the white dorsal stripe (with its narrow dark central line) was not distinguishable from the edge of the leaf, except on a close inspection. The effect of the dark shading on each side of the white stripe was to produce an appearance of lateral compression, so that the thickness of the larva did not attract attention. The fine white spiracular line could not be seen from above, and was only visible from the side when it was carefully searched for. It seems to take no part in protection. At first I thought that this was merely an interesting case of protective marking, but a little investigation led me to suspect that the nature of the colouring was peculiar.

The fine dark dorsal line was certainly the dorsal vessel, and its pulsations were distinctly visible to the naked eye. It formed a darker line than I have seen (similarly caused) in other larvæ, and evidently in this case the skin was especially transparent. Carefully examining the white stripe with a lens I found that it had the peculiar lobed appearance of the fat body, and that it was moved by the pulsations of the dorsal vessel. Thus it was certain that the white stripe was also due to some internal part of the larva shining through the skin. Similarly, with the simple lens, I could distinctly see the tracheæ radiating from each spiracle, and I was led to believe that the fine spiracular line was merely due to the main longitudinal tracheal tube on each side. Dissection entirely confirmed all these suspicions, and showed that the only true coloration of the skin—caused by a pigment deposited in its own cells—was the black shading on each side of the white stripe. The general green colour is chiefly due to the fluids of the body, the contents of the digestive tract and the green colour of many of the tissues, notably those cells in which the deposition of fat is taking place.

We have here a remarkable instance of protective colouring due to internal organs. The case of the fat body is especially interesting. Apparently the first cells to become filled with fat globules, and to gain a white appearance, are arranged in two rows, one on each side of the dorsal vessel. But this process cannot be carried on indefinitely, or the white band would become too wide for protective purposes; and the massing of mature cells elsewhere would cause white colours to be seen through the transparent skin, if the massing took place

in any position except one. This one position is the median ventral line, and this was the only other place where mature fat-cells could be found. Here they were collected round the ventral gangliated nerve-chain, and formed the white ventral line. In this position they are, of course, completely invisible in all natural positions of the larva.

Cells partially filled with fat are very common in other parts of the body, but none of these appeared white by reflected light, and I have no doubt that such cells are only found along the dorsal and ventral line. This was certainly the case in the specimen I dissected, which was probably full-grown, as I had noticed some slight changes of colour indicating the nearness of pupation. The spiracular line is merely the result of an extremely transparent skin important in producing other markings, and the former is thus incidental to the latter. It seems very probable that in many other cases also natural selection has taken advantage of the ready-formed colours of internal organs to produce the markings of larvæ. Indeed, the effect of the dorsal vessel in this direction, and the intensification of a general green colour from internal causes, are already well known in many lepidopterous larvæ. I was able to name the hymenopterous larva described above from Cameron's monograph on the British phytophagous Hymenoptera (Ray Society, 1882). Mr. Cameron draws attention to the attitude of the larva at rest, when it clings close to the curved surface which it has eaten out of the leaf.

TWO KINDS OF PROTECTION BY RESEMBLANCE TO SURROUNDINGS, SPECIAL AND GENERAL.—In the well-known cases of protective mimicry the organism resembles more or less exactly some portion of its environment. Thus the larva of *S. ocellatus* is protected by resembling the under side of a curled apple leaf (when it feeds on this plant). Holding the larva in one hand and the twig in the other the resemblance is marked, and the observer is led to wonder at the protection afforded. This is *special protective mimicry*, and to the same class belong the numberless beautiful instances of protection familiar to us from our own observation or that of others. But there is another kind of protective resemblance to which less attention has been directed, which is less apparent although not less real. Holding the larva of *Sphinx*

ligustri in one hand and a twig of its food-plant in the other, the wonder we feel is not at the resemblance, but at the difference; we are surprised at the difficulty experienced in detecting so conspicuous an object. And yet the protection is very real, for the larvæ will be passed over by those who are not accustomed to their appearance, although the searcher may be told of the presence of a large caterpillar. An experienced entomologist also may fail to find the larvæ until after a considerable search. This is *general protective mimicry*, and it depends upon a general harmony between the appearance of the organism and its whole environment, so that the former does not attract attention. It is impossible to understand the force of this protection for any larva, without seeing it on its food-plant and in an entirely normal condition. The artistic effect of green foliage is more complex than we often imagine; numberless modifications are wrought by varied lights and shadows upon colours which are in themselves far from uniform. We are unable to appreciate the significance of larval colours apart from the food-plant, because we do not comprehend all the factors that combine to form the whole appearance of the latter. General protective mimicry is such an appearance in an organism that the artistic effect of its surroundings is sufficiently reproduced in it to prevent attention from being attracted when the one is seen in the midst of the other. A better instance of this general protection is seen in the larva of *Papilio Machaon*. Here the protection is very real when the larva is on the plant, and can hardly be appreciated at all when the two are apart. The terms I propose seem to express the difference between these two forms of resemblance, protection being gained in the one case by the production of a general effect, in the other by the acquisition of a special appearance. I am aware that general protective resemblances have been already appreciated, especially by Weismann, in the work to which I have alluded. I believe that this is the first attempt to separate the two, and to confer distinctive names upon them. As might be expected, the two classes are connected by intervening forms—by organisms that are protected in both ways. Thus the larva of *S. ligustri* has doubtless *some* special resemblance to a series of leaves, each leaf being represented by the green colour between two of the purple and white stripes.

But this is very different from the special resemblance of *S. ocellatus*, and the former larva would be very imperfectly protected were it not for the additional general resemblance.

The number of larvæ protected by general resemblance is very large. A very small class (comparatively) is protected by taste or smell, a still smaller class by the possession of terrifying markings, structures, attitudes, or movements. Those specially protected form a large class, and I imagine that all larvæ unprotected in one or more of these three ways are protected by general resemblance. The latter will, I believe, prove to include by far the largest number of instances. In many cases a larva may be *specially* protected upon one food-plant, and *generally* upon others. So also a larva may have been very specially protected upon its original food-plant, which may be now unknown.

These same terms also apply to other cases of protection, such as the mimicry of distasteful forms, or of forms otherwise protected (special protective mimicry). The same terms also apply to all organisms which avail themselves of protective shapes, colours, attitudes, &c.

THE SIGNIFICANCE OF LARVAL (AND PUPAL) DIMORPHISM.—Professor Weismann has proved that in many cases dimorphism is simply a phase of transition into monomorphism of a different kind from that which the species assumed before the commencement of changes which led to dimorphism. The whole transition from the first *monomorphism* is, he says, first *variability*; then *polymorphism*, produced by the comparative permanence of the favourable varieties; then *dimorphism*, by the predominance of the two most favourable forms; finally *monomorphism*, by the ultimate permanence of the one most favourable form. One of the forms in the stage of dimorphism is the old monomorphism, and the other is that which will become the new monomorphism. This theory is proved for many larvæ, but I believe that there are instances in which such an explanation does not hold. It is indeed probable that there are several explanations for as many forms of dimorphism. I will now allude to one instance, and will show some grounds for not accepting the above explanation of its cause, afterwards attempting to account for it in another way. The larvæ of some of the *Ephyridæ*, after the last ecdysis, are dimorphic, appearing in the two usual

colours, green and brown. (*E. orbicularia* is variable, *E. pendularia* regularly dimorphic, *E. omicronaria* dimorphic, with a great difference in the relative numbers of the two forms. Some, if not all, of the other species are also dimorphic, but I have not had the opportunity of observing them closely).

The interesting, and, as far as I know, unique, point about this dimorphism is that it extends into the pupal state, and thus seems to prove a permanence of the condition which is irreconcilable with Prof. Weismann's view. The brown larvæ always become brown pupæ, and the green larvæ green pupæ. I have never known an exception to this (see figs. 9 and 10 for the green and brown pupæ of *E. omicronaria*, figs. 11 and 12 for those of *E. pendularia*). There is, however, no extension of this pupal dimorphism into the imago stage. It has nothing to do with sex. This is shown by the following figures:—I possessed 43 pupæ of *E. pendularia* of the first summer brood of 1883. Of these 30 were green (producing 17 males and 13 females), while 13 were brown (producing 5 males and 8 females). Many of the next generation of pupæ also emerged, forming a second summer brood. Of these (40 in number) 27 were green (13 males and 14 females), while 13 were brown (7 males and 6 females). Furthermore, there is no distinctive mark by which it is possible to identify the imagines from either set of pupæ. Hence it appears certain that the larval and pupal dimorphism is of advantage in these stages only, and has no further significance in the ultimate stage.

This seems to be true of *nearly* all cases of dimorphism (although in some few instances it is sexual: see note to pages 308, 309 of Prof. Weismann's book). This advantage I believe to be a *direct* result of dimorphism. It is of value to a larva and pupa (if exposed) to be divided into two groups, coloured respectively with the two most protective tints. It is certainly a protection to the species against the keen sight of entomologists. It is well known by every collector of larvæ that it is often difficult to find a larva for the first time, but that after this it is comparatively easy to find more. In colloquial phraseology the eye "gets in" for that particular species. And I believe that this is true (although to a much smaller extent) for each day's work at larva-hunting. I think that everyone who has tried to find a larva, which he only knows by book description, upon its

food-plant, and, having succeeded, has gone on to find many more, will appreciate the great amount of truth that there is in the popular notion of the eye "getting in." The true explanation for this kind of work is, of course, that we can never appreciate the true relation of a larva (protected by colour, &c.) to its surroundings until we have had actual experience of it. This is especially true of the larvæ which depend upon general protective resemblance. And, having become once accustomed to the disguise in a particular instance (the reality of which is shown by the difficulty in getting accustomed to it) it is comparatively easy to detect other similarly protected instances. The reason why description can never take the place of experience has been shown in the discussion of "general protective resemblances"; it is because the harmony is so subtle that it cannot be understood without most careful observation of the perfectly normal and undisturbed larva on its food-plant. Even then, as was pointed out, although the disguise may fail before an experienced observer, the complex conditions which render it generally successful—in fact the disguise itself—may not be understood in the least. If this be true it is obviously an advantage to a larva to appear under two forms possessing respectively the colours which are most (generally) protective: an especial advantage if the colours are added to a form with much special protective resemblance. There is, in fact, a special protection for both forms, the yellowish-green larvæ resembling young green birch twigs, the brown larvæ resembling older twigs.

It is very likely that an entomologist who had never seen either form would continue finding the form which he first discovered, and would fail to see the others (after searching a tree twig by twig in the manner of the enemies of the larvæ). Or, if he found both forms, he would find one more easily and frequently than the other, that, namely, to which he was more accustomed, and he could not become as accustomed to either as he would have been to the larva if monomorphic. There might often be exceptions to this, but if it *ever* happened the species would gain by larval dimorphism. There is every reason to believe that the natural enemies of the larvæ are similar to man in the respect above-mentioned.

In other kinds of protection we argue from the effect produced by certain colours, forms, or attitudes upon

ourselves, to the effect that must be produced upon other animals, and by observation we can often prove that the inference is correct. I have before shown that if a marking be repeated so as to form a regular series the latter can be carried on by a mere suggestion of the further repetition of the same marking without producing any suspicion of imperfection. In this case we cannot doubt that the advantage gained is by bringing about a similar absence of suspicion in those animals which are the natural enemies of the organism. But in granting this we are committed to the belief that the mental organisation of animals is similar to that of man in this respect; that both are equally deceived by the suggested marking, because in both there is the same subjective readiness (so to speak) to continue the series. In the same way it is most probable that animals, in searching after a prey that is protected by colour, &c., are likely to continue finding those that they first come across in any particular hunt. And this fact would be of especial value as against those enemies that seem to systematically work over a whole tree.

To put the argument perfectly plainly, I think all will admit that the larvæ upon a tree stand a better chance against their various enemies if they belong to two differently coloured species (both well protected) than if they are all the same. So dimorphism is an advantage when the divergence in colour is quite complete. Again, a large number of larvæ of one colour attracts attention and multiplies the chances of detection, and increases the danger for all. This is especially true of the larvæ of small moths laying their eggs upon isolated trees, for there are likely to be a great many larvæ upon one tree under these conditions. Without pressing the analogy too far between man and the natural enemies of larvæ, I think we may admit that larval dimorphism may be of direct value to a species in the manner indicated above. If this is the case the dimorphism will continue as a permanent condition unless there is a great difference between the protective values of the two forms.

I obtained twenty-eight pupæ from eggs from a female bred from the brown form and fertilised by a male similarly bred. Of these twenty-eight exactly half were brown and half green. In this case the number of brown forms is much above the average, and it is probable that the proportion could be increased

by again breeding from the brown forms. If in any district the green forms were especially attacked the greater proportion of brown ones left would increase the number of larvæ whose parents were both brown,—in other words, would greatly increase the proportion of brown larvæ in the next generation. But this would bring the brown larvæ into prominence, and would render it more probable that they would be especially attacked, and so the disproportion would right itself. According to this argument there should be a tendency (apart from the effect of enemies) for the more abundant form to predominate, owing to the greater chance of eggs being fertilised and laid by individuals of the same form. It is possible that there is such a tendency, and that such a result is coming about (in this case the gradual predominance of the green), but I think that this is hardly likely, and there are indications that the problem is very complex. There is no doubt that green is the better protective colour for summer and brown for autumn and winter. In the first summer brood there were 30 green and 13 brown; in the second there emerged 27 from green pupæ and 13 from brown (and these numbers include 5 brown and 5 green, from the lot of which both parents were brown, hence unduly raising the average of the latter).

There remained 34 pupæ of the second brood, of which 15 died, while 19 will (probably all) emerge in the spring. The 15 belong to the group which emerged last summer, for they died just before emergence, with the colours of the wings plainly visible through the pupal covering. Of these 15 pupæ 10 were green and 5 brown (including 5 green and 3 brown from the lot with brown parents). Of the remaining 19, which form the true winter brood, 12 are brown and only 7 green (including 4 green and 6 brown from the lot with brown parents). Hence in the last case only, the proportions are reversed, and there are nearly twice as many brown pupæ as there are green, while there were more than twice as many green pupæ in both summer broods. I hope to make further observations upon this point, but there seems to be much reason (from these statistics) for believing that the brown forms predominate when brown is the best protection, and green forms when green is the best protection. It is noteworthy that the colours appear first in the larvæ (always corresponding with those of the

pupæ) which all feed up together, those namely which will emerge the same summer, forming the beginning of a second summer brood, and those which will emerge next spring and belonging to the old winter brood.

I made some observations upon the situations selected for pupation, thinking that these might show some relation to the colours of the pupæ. Of those I observed 11 brown pupæ and 20 green were fixed to leaves; 4 brown pupæ and 6 green were fixed to twigs; 10 brown pupæ and 8 green were fixed to the case in which the larvæ had been kept (the latter having wandered from their food-plants). The wandering larvæ are more likely to represent those which would have been normally fixed to twigs. The statistics seem to point towards some possible relation, but they are not convincing; and, in fact, the protection of a (yellowish) brown pupa upon a leaf and of a green one upon a young twig is very considerable. Again, some leaves bearing pupæ would fall off and turn brown. I hope to make further observations upon this interesting question, and to investigate the phenomenon in other species of *Ephyridæ*. I should have added that I can draw no conclusions as to *E. omicronaria* for want of sufficient material. I had 12 pupæ (11 green and 1 brown), and it is probable that the above conclusions have applied here, but that the brown form has almost disappeared. There is not the same reason for an alternate predominance of the two colours at different seasons (in the pupæ) because *E. omicronaria* was, at any rate in 1883, very slightly double-brooded. Only one of the 12 pupæ emerged. This less marked tendency to double broods may render it more likely that the green forms should predominate. Thus, in *E. pendularia* the dimorphism is of direct value to the species in two ways, by giving an extra chance of escaping detection, and in the fact that the more protective colour predominates at the appropriate season of the year. It may be suggested that the latter gain is so palpable that it is probable that the larva is progressing in that direction, *i. e.*, towards a true seasonal dimorphism. But I believe that a certain proportion of brown (larvæ and pupæ) in the summer, and a certain proportion of green (pupæ) in the winter, add to the safety of the species; and further, the larvæ which produce the winter pupæ feed in the late summer, when green is an obvious protection. Hence the predominance of brown must be

entirely for the protection of the exposed winter pupæ, and, as has been shown, the predominance is only manifested by that proportion of the second generation of larvæ (in the year), which will form the winter pupæ. It is strange that the imagines of *E. omicronaria* should show distinct seasonal dimorphism, and yet that only a small proportion should emerge as the summer form. On the other hand *E. pendularia* (imago) shows indistinct seasonal dimorphism, and has two summer broods. It is probable that there is a considerable summer brood of *E. omicronaria* in more favourable years.

PHYLETIC PARALLELISM IN METAMORPHIC SPECIES.—Prof. Weismann's valuable essay on this subject (in the work previously referred to) proves that the different stages of two great groups may not show an equal divergence or affinity. He shows that the grouping would in many cases be entirely different according to the stage which is selected as the criterion of divergence, and further, that this varying divergence depends upon a corresponding difference or agreement in conditions. He proves these propositions from Diptera, Hymenoptera, and Lepidoptera. With regard to the latter he shows that the division into butterflies and moths depends upon imaginal characters, while the larvæ do not manifest an equal divergence. It is not possible to arrange the larvæ of Rhopalocera together in one great group as it is possible to arrange the imagines. And this imaginal divergence is accompanied by a difference of conditions, for butterflies *as a whole* live under very different conditions from moths *as a whole*. On the other hand, the want of divergence between the corresponding groups of larvæ is accompanied by a similarity of conditions. (On the other hand he points out that the larvæ of Rhopalocera can be divided into smaller groups corresponding with imaginal classification).

It seemed to me that it is worth adding a note about the pupæ to this most important comparison, for which we are indebted to Professor Weismann. The pupæ of Rhopalocera can be formed into a large group corresponding to the union of the imagines into one of the two chief divisions of Lepidoptera. The characters by which these pupæ can be identified *as a whole* are bright, or at any rate varied, colours; angularity of outline,

especially anteriorly; and mode of suspension. The divergence from the pupæ of Heterocera as a whole is also accompanied by a difference in conditions; the latter being protected from light in the earth or in cocoons, while the former are freely exposed to it. The natural colour of the chitinous pupal covering, *i. e.*, that colour which needs the least constructive energy for its formation, seems to be red-brown. This is the common colour of pupæ which are shut up in opaque cocoons (as *D. vinula*, &c.), where the colour can be of no importance. It is, however, a positive advantage to those species which pupate in, or upon the surface of, the earth. Hence this colour is almost universal among the pupæ of Heterocera, being of direct (protective) or indirect (by saving energy) advantage to nearly all of them. One group of exceptions is very significant, *i. e.*, the colours, &c., of the pupæ of *Ephyridæ*. These Heterocera pass the pupal state under the same conditions as those of Rhopalocera, freely exposed to light and air, suspended by a band round the body, and by a pad to which the posterior spine is attached. The conditions are thus the same as those of Rhopalocera. (The suspension, *i. e.*, the way in which the condition of exposure is attained, is identical with that of many pupæ of Rhopalocera). Corresponding with these similar conditions the pupæ of *Ephyridæ* possess bright colours (Pl. I., figs. 9—12), and are anteriorly angular. The bright colours depend upon the transparency of the chitin, which allows underlying tints to shine through. Hence in these pupæ the colours disappear shortly before the appearance of the imago, and the markings and colours of the latter gradually become completely visible. This is also true of Rhopalocera as a whole. The bright colours in these cases are of protective value, either by special or general resemblance. The red-brown tint is not a good protection, except in the situations mentioned above. The warning colours of distasteful pupæ are very different to the bright protective colours of the pupæ referred to (*e. g.*, compare the pupa of *A. grossulariata* with those of the *Ephyridæ* or Rhopalocera).

It thus appears that the pupæ of Rhopalocera form a chief group corresponding to the imagines, and that the differences from the other chief group of Heterocera are in both cases accompanied by a divergence in the respective conditions. The angular outline must also

be a result of the same conditions. There is no doubt that this outline is protective, or has been descended from a protective ancestral character, and such protection by an angular outline, of course, follows from the fact that the pupæ are freely exposed. These facts are true of the pupæ of *Rhopalocera* as a whole, but there are exceptions, just as in the imaginal characters.

EXPLANATION OF PLATE I.

FIG. 1.—Natural size. Adult larva of *Smerinthus ocellatus*, seen from the left side. The ground colour is bright yellowish green, and the three rows of red spots are seen to form an alternate pattern, the spots of the highest row being placed nearly vertically over those of the lowest; while the middle spots are approximately intermediate. The anterior remnant of the subdorsal is normal. The slight oblique stripe anterior to the seven-stripe system is indicated. The shagreen dots are arranged in rings parallel with the intersegmental furrows, and there are generally eight rings in the larger segments. The anterior borders of the oblique white stripes are darker green than the ground colour.

FIG. 2.—Natural size. Apparently adult larva of *S. populi*, seen from the left side; from a painting by Mr. G. C. Bignell. The larva is remarkable in its light ground colour, and especially in the extreme development of the red spots, which are continued anteriorly, where there are no oblique stripes, and the spots have no tendency to become drawn out into coloured borders. They are rather feebly developed on the claspers. Anteriorly they are not distributed regularly on the segments, since they exceed the latter in number. The alternate arrangement is less marked than in the last figure. This unusually-marked variety does not bear out Prof. Weismann's theory that the spots tend to become drawn out into coloured borders to the light stripes, and yet here the system of spots reaches a far higher development than in *S. tilix* (as far as I have seen figures of the variety of this species).

FIG. 3.—Natural size. Rather exceptionally large adult larva of *S. ocellatus*, from the left side. The ground colour is light bluish green. No red spots are present, but there is the normal red line round each spiracle. The subdorsal is retained for its whole length, although but faintly, posteriorly to the normal limits. It ends posteriorly in the last oblique stripe (the limit shown in an earlier

stage of the ontogeny). The small 8th oblique stripe is shown. The ground colour is darker in front of the oblique white stripes.

FIG. 4.—Natural size. The head and anterior segments of the same larva as Fig. 3, seen from the left side in the *Sphinx* attitude of repose. The spiracle on the 2nd segment is nearly hidden among the folds due to the attitude. The anterior part of the subdorsal is bent down into approximate parallelism with the oblique line system. It is seen that the latter system would have been marred if it had been repeated anteriorly with the same relation to the segments that it possesses posteriorly. The slight 8th stripe deepens the impression that the subdorsal belongs to the oblique system. The effect is less complete in this figure than in the normal larva, because the subdorsal does not disappear posteriorly in this particular larva.

FIG. 5.—Adult (and probably enlarged) larva of *Endromis versicolor*, seen from the right side, copied from the plate on page 203 of Newman's 'British Moths.' The horizontal spiracular or subspiracular line seems to be normal on segments 2—6. Posteriorly to this point it becomes oblique on each segment, forming a line with the (true) oblique stripe of the segment in front. The older marking is thus completely subordinated to the more recent system, except where the latter is absent (segments 2 and 3), or but little developed (segments 4 and 5). The older form of marking is easily recognised, even in the segments in which it has been modified, by a single row of longitudinally arranged dots always present upon it, but absent from the true oblique system.

FIG. 6.—Natural size. Some segments of a nearly full-grown larva of *Sphinx ligustri*, seen from above. The slightly-marked dorsal line is due to the dorsal vessel. Each oblique white stripe passes into a yellowish green line posteriorly (as it reaches the limits of the segment in which its chief course lies). Each purple border similarly passes into a dark green line. The short yellowish green and dark green lines much resemble the colouring of the oblique system in *Smerinthus* (yellow in *S. populi*, &c.), and suggest that this was the primitive marking.

FIG. 7.—Natural size. The posterior segments of a larva of *S. ligustri* fairly advanced in the last stage, seen from the right side. (The larva was the same as that shown in Fig. 6, but this figure [7] was made previously). The same relation of the pure white and purple stripes to yellowish green and dark green lines is seen from the side. Each white stripe becomes scattered and shagreen-like anteriorly and inferiorly, The purple border becomes darker anteriorly and inferiorly, and is continued on the posterior side of the white stripe (inferiorly) as a dark blotch. On the 12th segment there is a slight indication of a white stripe, and a considerable, though interrupted, purple line.

FIG. 8.—Natural size. Larva of *Nematus curtispina*, probably nearly full-grown, seen from above. In the middle line is the black (dark green), posteriorly dilated, dorsal line caused by the dorsal vessel. It does not extend to the posterior end of the body, and its continuity (as a line) is broken by the intersegmental furrows. This line is situated in a white stripe, which was seen to move with the pulsations of the dorsal vessel, and to be lobed, like fat-tissue. It is caused by a longitudinal accumulation of the cells of the fat body shining through the transparent skin. Outside this there is true black pigment in the skin, forming a dark line on each side, and beyond this the ground colour is green, chiefly due to internal tissues and fluids. Laterally (not seen here) a fine spiracular line is formed by the main longitudinal trachea shining through the skin. Thus all the colours and markings, except the black shading, are due to internal structures. The protective resemblance is to the edge of the leaf to which the larva clings, and the effect is increased by the appearance of lateral compression caused by the dark shading.

FIG. 9. — Natural size. The pupa of *Ephyra omicronaria* (green form), attached to a twig of maple.

FIG. 10.— Natural size. The pupa of *Ephyra omicronaria* (brown form), attached to a twig of maple.

FIG. 11.—Natural size. The pupa of *Ephyra pendularia* (green form) attached to a twig of birch, after the manner of the pupa of a butterfly (by a band round the body, and a pad to which the anal spine is fixed). The bright colours and the pair of anteriorly-placed angular projections give to the pupæ of the *Ephyridæ* an appearance singularly like those of butterflies.

FIG. 12.—Natural size. The pupa of *Ephyra pendularia* (light brown form), attached to a twig of birch.

III. *On the classification of Australian Pyralidina.* By
E. MEYRICK, B.A.

[Read December 5th, 1883.]

In the present paper I have put together and classified all the species of the families *Epipaschiadæ* and *Pyralididæ* (as limited) known to me as occurring in Australia. No species of either family is indigenous to New Zealand, though *Asopia farinalis* occurs (introduced).

The fauna is limited and fragmentary. Fifteen genera are given, including twenty-four species; two of these (*Aglossa* and *Asopia*), with one species each, are recently introduced from Europe; nine of the remainder are endemic, so far as is at present known. The other four are presumably derived from a Malayan source, though *Cacozelia* is not yet known, except from North America. It is not, however, possible yet to judge of the geographical distribution of this group, of which the species seem often to range very widely.

In dealing with Walker's species of Pyrales a difficulty of nomenclature occurs to which I direct attention, as it is frequent in this group. We find such names as *marcusalis* and *sabirusalis*, which are unintelligible. No mode of dealing with them is free from objection, though I think it would be most dignified to reject them altogether. The fact is that Walker named a certain number of species after historical characters, *e. g.*, from *Cræsus* he forms *cræsusalis*, which requires absolutely to be altered into *cræsialis* or *cræsalis*; and, running short of classical names, he apparently conceived the idea of making up fresh ones, adding a classical termination, and placing *-alis* after it in the same way. I propose to do with these (since entomologists are not agreed to reject nonsense-names) what I presume Walker himself wished to do, to treat them as classical names, and alter the barbarously-formed termination into conformity with classical rules; thus, in the present paper, for *ægusalis* I have written *ægalis*. Fortunately many of these names

are synonyms, and will lapse altogether. I shall, however, alter them on this principle whenever required.

I have described such new species as I happened to possess, and have also redescribed those species and genera of which the characters have previously been insufficiently given.

EPIPASCHIADÆ.

Antennæ in male with a strong horny basal process thrown back over crown. Fore wings with 12 veins, 1 generally furcate, 8 and 9 stalked out of 7. Hind wings with 8 veins, 6 and 7 from a point or stalked, 8 generally free.

Distinguished from the *Pyralididæ* only by the curiously developed process from the base of the antennæ of male; the character is, however, unique, and persists in at least ten naturally associated genera already known. The genera included in the family are *Epipaschia*, Clem., *Mochlocera*, Z., *Toripalpus*, Grote, *Homura*, Ld., and *Deuterollyta*, Ld., besides the five given below. Grote also places *Tetralopha*, Z., here; I have not seen it, but the fore wings have only 11 veins, and I have therefore little doubt that Zeller was right in referring it to the *Phycidæ*. Except the following all the genera are at present known only from North and South America. The characters of *Deuterollyta* are incompletely given by Lederer, and its distinctness is not perfectly assured.

1 a. Vein 8 of hind wings free.

2 a. Maxillary palpi of male tufted, pencil-like .. 3. *Cacozelia*.

2 b. Maxillary palpi of male filiform, simple .. 4. *Stericta*.

1 b. Vein 8 of hind wings anastomosing with 7.

2 a. Maxillary palpi present.

3 a. Basal process of antennæ long .. 2. *Catamola*.

3 b. Basal process of antennæ short .. 5. *Astrapometis*.

2 b. Maxillary palpi obsolete. 1. *Titanoceros*.

TITANOCEROS, n. g.

Clypeus flat. Ocelli present. Tongue well developed. Antennæ in male serrate, shortly ciliated; basal process very long, reaching beyond thorax, extremity naked. Labial palpi moderate, curved, ascending, slender, second joint rough beneath, terminal joint short. Maxillary palpi obsolete. Fore wings with veins 4 and 5 separate. Hind wings with veins 4 and 5 stalked, 8 anastomosing with 7.

This and the following genus, with *Astrapometis*, differ from all the rest in having vein 8 of the hind wings anastomosing with 7 instead of free. From *Catamola* the present genus is distinguished by the absence of maxillary palpi, and the more largely developed basal process of the antennæ, of which the apex appears to be naturally naked.

1. *Titanoceros cataxantha*, n. s.

♂, 19 mm. Head, palpi, antennæ, and thorax dark fuscous, mixed with reddish fuscous; extremity of patagia whitish ochreous. Abdomen pale ochreous. Legs dark fuscous, apex of tarsal joints whitish. Fore wings triangular, costa slightly arched, apex obtuse, hind margin somewhat obliquely rounded; dark fuscous, somewhat mixed with reddish fuscous; an ochreous whitish line from costa at two-thirds to before anal angle, middle half curved outwards; beyond this the hind marginal area light reddish fuscous, mixed with dark fuscous towards anal angle; hind margin dotted with dark fuscous. Hind wings deep yellow, with a rather broad blackish hind marginal band; cilia dark grey, tips paler.

Easily recognised by the deep yellow hind wings.

Sydney, New South Wales. One specimen in the collection of Mr. G. H. Raynor, probably bred.

CATAMOLA, n. g.

Clypeus flat. Ocelli present. Tongue well developed. Antennæ in male flatly subdentate, shortly ciliated ($\frac{1}{2}$); basal process long, reaching prothorax. Labial palpi moderate, curved, ascending, second joint smooth, terminal joint short. Maxillary palpi short, filiform. Fore wings with 1 strongly furcate, 4 and 5 separate or stalked. Hind wings with 4 and 5 separate or stalked, 8 anastomosing with 7.

The stalking or separation of veins 4 and 5 afford no character of value in this genus; both forms occur well marked in *C. funerea* (male). In *C. funerea* vein 10 of the fore wings is approximated to 7 before 8 for a short distance, as if about to anastomose. In all the species there is a tuft of raised scales on fold.

1 a. Head and thorax black.

2 a. Hind wing light yellow 3. *xanthomelalis*.

2 b. Hind wing whitish 4. *funerea*.

1 b. Head and thorax not black. 2. *thyridalis*.

2. *Catamola thyridalis*, Walk.

Bertula thyrisalis (!), Walk., Brit. Mus. Cat., 167.

♂, ♀, 23—25 mm. Head and thorax pale whitish ochreous, mixed with reddish brown. Palpi dark fuscous. Antennæ ochreous whitish. Abdomen whitish ochreous, irrorated with fuscous. Legs dark fuscous, beneath white irrorated with brownish red, posterior tibiæ and apex of joints white. Fore wings triangular, moderate, costa slightly arched towards apex, apex rounded, hind margin somewhat oblique, slightly sinuate, rounded beneath; whitish ochreous, densely irrorated and suffused with brownish red; basal third suffused with dark fuscous, except on base of inner margin, bounded by a slightly angulated line from two-fifths of costa to middle of inner margin; a tuft of raised scales on fold at one-fourth; a whitish dark-margined subdentate line at two-thirds, irregularly curved outwards in middle; space between first and second lines whitish, slightly irrorated with red, and posteriorly suffused with light ochreous; a small blackish spot on costa before middle, and another on anterior margin of second line; hind margin narrowly pale; a blackish hind marginal line, interrupted by whitish dots; cilia pale whitish ochreous, with cloudy median and apical reddish lines, and obscurely barred with dark fuscous. Hind wings grey or whitish grey, generally with a broad diffused dark hind marginal band, costa suffused with whitish; an obscure darker discal spot; cilia whitish, with a dark grey line.

I have reformed Walker's inadmissibly barbarous name.

Sydney, New South Wales. Several specimens taken by Mr. G. H. Raynor in October. Walker states that he has also received it from Ceylon.

3. *Catamola xanthomelalis*, Walk.

Acrobasis xanthomelalis, Walk., Brit. Mus. Cat. (Cr.), 32.

♂, ♀, 30—33 mm. Head, palpi, antennæ, and thorax blackish; abdomen pale yellowish, more or less suffused with dark grey. Fore wings triangular, moderate, costa slightly arched, apex obtuse, hind margin somewhat obliquely rounded; blackish, markings obsolete; cilia blackish. Hind wings pale whitish ochreous-yellow; a moderate evenly broad rather dark fuscous-grey hind marginal band, continued to inner angle; cilia dark grey.

I have described Walker's types, not having met with the species elsewhere. It is very easily recognised. I

have not been able to examine properly the generic characters, but it is probably correctly referred here; the antennal process is quite as in *C. funerea*.

Sydney, New South Wales. Three specimens in the British Museum.

4. *Catamola funerea*, Walk.

Acrobasis funerea, Walk., Brit. Mus. Cat. (Cr.), 31.

♂, ♀, 21—23 mm. Head, palpi, antennæ, and thorax black; collar whitish. Abdomen dark fuscous, with ochreous whitish rings towards base. Legs black, apex of tarsal joints white. Fore wings elongate-triangular, costa moderately arched towards apex, apex rounded, hind margin rounded, rather oblique; blackish, irrorated with grey; markings almost obsolete, deeper black; a tuft of scales on fold at one-fourth; an irregular line at one-fourth, a discal spot, and a dentate outwards-curved line at two-thirds, sharply indented below middle; a black hind marginal line, interrupted by white dots; cilia fuscous-grey, with a darker line near base. Hind wings semitransparent, whitish, towards costa and inner angle somewhat suffused with fuscous; veins fuscous; hind margin narrowly suffused with rather dark fuscous; cilia whitish, with a dark fuscous cloudy line near base.

The black colour is protective. The species occurs at rest on the stems of fibrous-barked *Eucalypti*, which are almost invariably blackened by bush fires.

Sydney, New South Wales; Ardrossan, S. Australia. Not uncommon in October, February, and March.

CACOZELIA, Grote.

The following species agrees entirely with the characters of this genus as given by Grote, except that veins 4 and 5 are separate in both wings. In view of the variability of this character within specific limits in the preceding genus, no stress can be laid on this. The long pencil of hairs which terminates the maxillary palpi of the male is strongly developed, and is the peculiar characteristic of the genus, of which one North American species is known.

5. *Cacozelia cholica*, n. s.

♂, 27—28 mm. Head and thorax ochreous-brown, mixed with dark fuscous. Palpi and antennæ dark fuscous; hair-pencil of maxillary palpi ochreous-white. Abdomen whitish. Legs dark fuscous, apex of tarsal joints white. Fore wings triangular, moderate, costa arched towards apex, apex rounded, hind margin somewhat oblique, slightly rounded, faintly sinuate below apex; ochreous whitish, almost wholly suffused with brown, and densely irrorated with dark fuscous; an ill-defined ochreous whitish blotch on inner margin at base, followed by a dark fuscous suffusion; veins suffusedly dark fuscous; a very obscure irregular dark fuscous line at one-third; an obscure dark fuscous discal spot, connected with costa by a dark suffusion; an obscure dentate dark fuscous line from costa at three-fifths to inner margin at three-fourths, bent outwards in middle, indented inwards above inner margin, followed by a pale line; a dark fuscous hind marginal line, interrupted by white dots; cilia ochreous whitish, with basal and median fuscous lines, and obscurely barred with dark fuscous. Hind wings whitish, faintly ochreous tinged posteriorly, with a moderately broad fuscous hind marginal band, becoming dark fuscous on hind margin, and shortly preceded by a cloudy fuscous line; cilia white, with a dark fuscous line near base.

This does not appear to be at all close to the American species, *C. basiochrealis*; it more nearly resembles the much darker *C. funerea*.

Duaringa, Queensland. Two specimens received from Mr. G. Barnard. I have two females from Sydney which may be the other sex of this species, but as they are darker and broader-winged, and the localities are so widely separate, it would be unsafe to assume their identity.

STRICTA, *Ld.*

The characters of the male of this genus were unknown to Lederer, as well as to Guenée; and I am not aware that they have been published. Snellen describes the male of what he considers a new species of this genus, but makes no mention of the generic characters. These give with certainty its position in this family.

Antennæ of male dentate, ciliated with tufts of hairs; basal process long, stout, reaching prothorax. The other characters are not different from the female.

6. *Stericta habitalis*, Gn.

Glossina habitalis, Gn., Pyr., 125; *Pyralis nauplialis*, Walk., Brit. Mus. Cat., 272; *P. porphyralis*, ibid, Suppl. 1243.

The male is smaller and shorter-winged than the female, which, however, itself varies very considerably in size. I have seen about a dozen females, but only one male.

Sydney, New South Wales; Mount Lofty range and Ardrossan, South Australia; in December and May.

ASTRAPOMETIS, n. g.

Clypeus flat. Ocelli present. Tongue well developed. Antennæ in male flatly dentate, ciliated; basal process short, not reaching collar. Labial palpi moderate, curved, ascending, second joint smoothly scaled, terminal joint rather short. Maxillary palpi short, filiform. Fore wings with veins 4 and 5 separate. Hind wings with veins 4 and 5 separate, 8 anastomosing with 7.

7. *Astrapometis saburalis*, Walk.

Pyralis saburalis, Walk, Brit. Mus. Cat., 914.

♂, ♀, 25—27 mm. Head and thorax grey, coarsely irrorated with dark fuscous. Palpi and antennæ dark fuscous. Abdomen light yellow ochreous, posteriorly greyish-tinged. Legs dark fuscous; posterior tibiæ yellowish. Fore wings triangular, moderate, costa almost straight, apex almost rectangular, hind margin slightly oblique, rounded beneath; fuscous-grey, markings suffusedly dark fuscous; a large blotch on costa about one-fourth, reaching half across wing, including a tuft of raised scales on fold; a smaller somewhat triangular blotch on middle of costa, surrounded by a more or less broad whitish suffusion; a very indistinct double subdentate line at four-fifths, middle third curved outwards; a hind marginal line interrupted by white dots; cilia fuscous-grey, with a darker line towards base. Hind wings pale ochreous-yellow; a moderately broad rather dark fuscous-grey border round apex, continued along hind margin, but not nearly reaching inner angle; a dark fuscous hind marginal line; cilia yellowish whitish, with a dark grey basal line.

The form of the fore wings is rather peculiar.

Sydney, New South Wales; Melbourne, Victoria. Several specimens in March.

PYRALIDIDÆ.

Antennæ without basal process. Fore wings with 12 veins, 1 simple or furcate, 8 and 9 stalked out of 7. Hind wings with 8 veins, 6 and 7 from a point or stalked, 8 free or anastomosing with 7.

- 1 a. Vein 8 of hind wings anastomosing with 7.
- 2 a. Maxillary palpi present.
- 3 a. Labial palpi porrected, with long rough hairs beneath 13. *Enogenes*.
- 3 b. Labial palpi ascending, nearly smooth beneath 12. *Edekatophaga*.
- 2 b. Maxillary palpi absent.
- 3 a. Patagia in male extremely elongated, expandible 15. *Endotricha*.
- 3 b. Patagia in male not very long 14. *Scenedra*.
- 1 b. Vein 8 of hind wings free.
- 2 a. Ocelli absent.
- 3 a. Anterior femora in male with expandible brush of hairs 10. *Ocrasa*.
- 3 b. Anterior femora in male simple.
- 4 a. Maxillary palpi present 11. *Asopia*.
- 4 b. Maxillary palpi absent. 6. *Cardamyla*.
- 2 b. Ocelli present.
- 3 a. Tongue absent 9. *Aglossa*.
- 3 b. Tongue well developed.
- 4 a. Fore wings in male with a thickened gland beneath costa 7. *Balanotis*.
- 4 b. Fore wings in male without gland 8. *Stemmatophora*.

CARDAMYLA, *Walk.*

I have not been able to examine the characters of this genus, but they are given by Lederer, who accepts Walker's name.

8. *Cardamyla carinentalis*, Walk.

Cardamyla carinentalis, Walk., Brit. Mus. Cat., 282; Ld., Pyr., pl. vi., 9.

A very conspicuous species, which I have not yet met with.

Richmond River, New South Wales.

BALANOTIS, n. g.

Clypeus with a slight transverse ridge, or flat. Ocelli present. Tongue well developed. Antennæ in male stout, dentate, moderately ciliated with tufts of hairs ($\frac{3}{4}$ to 1). Labial palpi rather long, curved, ascending, second joint smooth, terminal joint short. Maxillary palpi short, filiform. Fore wings with vein 1 furcate, 4 and 5 separate. Hind wings with veins 4 and 5 separate or from a point, 6 and 7 short-stalked, 8 free. Fore wings in male with a thickened glandular swelling beneath costa beyond middle.

Specially characterised by the glandular swelling of the male, which is circular, and appears solid when cut through; the veins which should pass through the space occupied by this are bent so as to pass round it. In *B. recurvalis* the upper margin of the cell is unusually short. *B. didymalis* is only known to me in the female sex, and is conjecturally referred here; it agrees in non-sexual characters. The larva of one species is known; it feeds in stiff silken tubes amongst the leaves of a Myrtaceous shrub. The genus has evident relationship with the *Epipaschiadæ*.

- | | | | |
|--|---------|----|-------------------------|
| 1 a. Head yellow | .. .. . | .. | 9. <i>didymalis</i> . |
| 2 b. Head not yellow. | | | |
| 2 a. Second line from costa at two-thirds | | .. | 10. <i>recurvalis</i> . |
| 2 b. Second line from costa at four-fifths | | .. | 11. <i>mnesibrya</i> . |

9. *Balanotis* (?) *didymalis*, Walk.

Cardamyla didymalis, Walk., Brit. Mus. Cat., 283.

♀, 27—30 mm. Head deep yellow. Palpi ochreous-whitish, sometimes fuscous-tinged. Antennæ grey. Thorax ochreous-whitish, somewhat mixed with yellow; a spot on each side of collar, on side of back, and on extremity of patagia dark fuscous. Abdomen whitish, segmental margins light ochreous-yellow, with central and lateral rows of dark fuscous spots. Legs dark fuscous, apex of joints whitish, posterior tibiæ whitish yellowish, beneath with dark fuscous subapical ring. Fore wings triangular, rather broad, costa somewhat arched towards apex, apex rounded, hind margin rather obliquely rounded; white, finely irrorated with light olive-green; an irregular transverse olive greenish shade near base, broad on costa; a dentate dark grey line from one-third of costa to two-fifths of inner margin, suffused with greenish; a dark grey discal spot; a dentate dark grey line, suffused with greenish, from two-thirds of costa to four-fifths of inner margin, middle third

curved outwards; an obscure interrupted greenish shade from middle of inner margin to middle of second line; a large dark grey apical blotch, connected with anal angle by three greenish spots; cilia white, broadly barred with blackish grey. Hind wings white, irrorated with greenish; costa broadly and inner margin more narrowly bright yellow; a dentate greenish line before middle, mixed with dark fuscous, and a strongly dentate blackish grey median line suffused with greenish, both terminated before costal yellow band; a large dark grey apical blotch, connected with inner angle by a row of six greenish spots; cilia white, barred with blackish grey. Wings beneath deep yellow, markings partly obsolete.

A pretty species, somewhat resembling *Cardamyla carinentalis*, of which Walker suggested that it might be the female; it has, however, distinct ocelli and maxillary palpi, and *Cardamyla* is stated by Lederer to be without either.

Brisbane, Queensland. I received my specimens from Mr. Diggles.

10. *Balanotis recurvalis*, Walk.

Salma recurvalis, Walk., Brit. Mus. Cat. (Cr.), 107.

♂, ♀, 28—32 mm. Head, palpi, and thorax whitish, sometimes partially suffused with greenish, irrorated with dark fuscous and brownish red. Antennæ grey. Abdomen ochreous-whitish, irrorated with dark fuscous. Legs dark fuscous, irrorated with white and red, apex of joints white. Fore wings triangular, moderate or rather broad, costa slightly arched towards apex, apex rounded, hind margin somewhat obliquely rounded; scales somewhat rough, tending to form tufts on fold at one-fourth, and in disc above and below middle; light fuscous or greenish, closely but irregularly irrorated with white, dark fuscous, and red scales; sometimes several short scattered black linear marks; an irregular obsolete blackish line from one-third of costa to two-fifths of inner margin; a small blackish discal spot; a dentate well-marked blackish line, followed by a pale line, from two-thirds of costa to four-fifths of inner margin, strongly curved outwards, indented inwards above inner margin; a dark fuscous hind marginal line, interrupted by whitish dots; cilia whitish, with basal third ochreous and a grey median line, barred with dark grey. Hind wings whitish, more or less suffused with grey, with a small discal spot and a broad darker grey suffused hind marginal band, becoming obsolete before reaching inner angle, and shortly preceded by an obscure darker line;

cilia white, with an ochreous or reddish grey median line, spotted with dark fuscous.

Variable to some extent in the distribution of colour ; a stoutly-built species.

Larva 16-legged, stout, undescribed ; forming firm silken galleries covered with refuse along the twigs and amongst the leaves of *Leptospermum lanigerum* (*Myrtaceæ*).

Sydney, New South Wales ; Launceston, Tasmania. Rather common from December to February, but of rather retired habits.

11. *Balanotis mnesibrya*, n. s.

♂, 20 mm. Head, thorax, and abdomen ochreous-whitish ; head tufted between antennæ. Palpi long, considerably exceeding crown, dark fuscous mixed with whitish. Antennæ white, ringed with fuscous. Legs dark fuscous, irrorated with white, posterior tibiæ and apex of joints white. Fore wings triangular, rather broad, costa somewhat arched at apex, apex rounded, hind margin rather obliquely rounded ; ochreous-whitish, scantily irrorated with dark fuscous ; costa irrorated with blackish ; a slender blackish line from costa at one-third to inner margin at two-fifths, interrupted above middle, forming a small spot on costa and another in disc, preceded by raised scales ; a black discal spot, preceded by raised scales ; a small fuscous spot on costa beyond middle ; a very slightly dentate slender blackish line from costa at four-fifths to inner margin before anal angle, sinuate outwards in middle, followed by a pale line, beyond which the hind marginal area is suffused with light fuscous ; a blackish interrupted hind marginal line ; cilia whitish, with two fuscous lines. Hind wings whitish grey, more whitish at base ; a dark grey hind marginal line ; cilia whitish, with a grey line.

Considerably smaller than the preceding, with the second line quite different.

Murrurundi, New South Wales. One specimen in November.

STEMMATOPHORA, *Gn.*

12. *Stemmatophora vibicalis*, Ld.

Stemmatophora vibicalis, Ld., *Pyr.*, 457, pl. vii., 4.

I have two specimens, taken by Mr. G. Barnard near Duaranga, Queensland, which I consider undoubtedly identical with Lederer's species, which he founded on a

specimen from Ceylon. Many of the Queensland species of *Botydidæ* are also found to range as far as Ceylon. My specimens are both males, whereas Lederer's was a female, but they are truly referable to this species; they are exactly the same size as his, and agree in all particulars with his description and figure.

AGLOSSA, *Latr.*

13. *Aglossa cuprealis*, Hb.

Acrobasis incultella, Walk., Brit. Mus. Cat., Suppl., 1712.

Sydney, New South Wales, in November. Occurs occasionally in or near dwellings, doubtless introduced from Europe.

OCRASA, *Walk.*

Clypeus almost flat. Ocelli absent. Tongue well developed. Antennæ in male subdentate, ciliated with tufts of hairs (1). Labial palpi moderate, obliquely ascending, second joint smooth, thickened towards apex, terminal joint moderate, directed forwards. Maxillary palpi short, filiform. Anterior femora in male with large dense expansible brush of hairs. Fore wings with 1 furcate, 4 and 5 separate or stalked. Hind wings with 4 and 5 separate or stalked, 8 free.

Nearly allied to *Asopia*, from which it differs especially by the brush of hair on the anterior femora of the male.

1 a. Fore wings appearing greyish fuscous 14. *decoloralis*.

1 b. Fore wings appearing pale whitish ochreous . . 15. *albidalis*.

14. *Ocrasa decoloralis*, Ld.

Asopia decoloralis, Ld., Pyr., 458, pl. vii., 10.

I have both sexes; Lederer was unacquainted with the male, and could not therefore separate the species from *Asopia*. The male is rather more distinctly marked than the female, but does not otherwise differ. The species cannot be mistaken for the following.

Sydney, New South Wales. Taken by Mr. G. H. Raynor.

15. *Ocrasa albidalis*, Walk.*Ocrasa albidalis*, Walk., Brit. Mus. Cat., Suppl., 1212.

♂, ♀, 21—29 mm. Head, palpi, antennæ, thorax, abdomen, and legs pale whitish ochreous; palpi and legs irrorated with fuscous-carmine; anterior coxæ in male purple-black, brush of hairs yellow ochreous. Fore wings triangular, moderate, costa somewhat arched before apex, apex rounded, hind margin somewhat oblique, slightly rounded; ochreous-whitish or pale whitish ochreous, faintly irrorated with grey, sometimes with a few light fuscous-carmine scales; costal edge in male ochreous-yellow, in female yellowish tinged; a faint darker discal dot; a faint light fuscous-carmine or grey line from two-thirds of costa to four-fifths of inner margin, almost straight; cilia dull fuscous-carmine, with rows of ochreous-whitish dots, basal third suffused with pale whitish ochreous. Hind wings ochreous-whitish, faintly irrorated with greyish or pale carmine; cilia ochreous-whitish, posterior half suffused with pale carmine.

Superficially recalling some species of *Asopia*.

Peak Downs, Queensland; Sydney, New South Wales; Mount Lofty range, South Australia. Four specimens in March.

ASOPIA, Tr.

16. *Asopia farinalis*, L.*Pyralis fraterna*, Butl.

Does not appear to differ at all from European specimens; now a cosmopolitan species.

Sydney, New South Wales; Adelaide, South Australia; Christchurch, New Zealand; in October, and from February to April, in houses. Introduced from Europe.

Pyralis fraterna, Butl., from Japan, is simply the ordinary form of this species.

CEDEMATOPHAGA, n. g.

Clypeus in male with a rounded projection of scales, in female smooth. Ocelli present. Tongue well developed. Antennæ in male shortly dentate, strongly ciliated with tufts of hairs (3). Labial palpi in male moderate, obliquely ascending, second joint smooth, terminal joint moderate, with rather long rough erect hairs above; in female longer, ascending, second joint erect, terminal joint rather short, loosely scaled. Maxillary palpi short, filiform.

Anterior femora in male with an expansible tuft of hairs. Fore wings with 1 shortly furcate, 4 and 5 separate. Hind wings with 4 and 5 separate, 8 anastomosing with 7.

Larva feeding gregariously in large galls, 16-legged.

A curious genus, characterised by the peculiar palpi of the male and the expansible hairs of the anterior femora.

17. *Ædematophaga ægalis*, Walk.

Pyralis ægusalis, Walk., Brit. Mus. Cat., 912; ? *Gauna subferralis*, *ibid*, Suppl., 1253.

♂, ♀, 15—22 mm. Head and palpi pale whitish ochreous, irrorated with fuscous-carmine. Antennæ whitish ochreous. Thorax grey mixed with ochreous-whitish, shoulders purplish. Abdomen ochreous-whitish, purple-shining, irrorated with dark grey, base and apex more yellow. Legs purplish carmine, mixed with dark fuscous, apex of joints whitish yellowish. Fore wings elongate-triangular, costa slightly sinuate in middle, abruptly arched before apex, apex obtuse, hind margin slightly sinuate below apex, bowed in middle, rather oblique; fuscous, somewhat purple-shining, suffused with dark fuscous towards base and inner margin; a slender curved whitish line from two-fifths of costa to three-fifths of inner margin, lower half followed by a blackish red shade; a small dark fuscous discal spot; a slender sinuate whitish line from three-fourths of costa to three-fourths of inner margin; beyond this a fuscous-red costal patch, shading into dark fuscous beneath; cilia light fuscous, with two darker lines. Hind wings fuscous, suffused with dark reddish towards inner angle; two slender whitish lines, first before, second beyond middle, obsolete on costa, broader and more conspicuous towards inner margin, much more nearly approximated on lower half; cilia fuscous, with a darker line, becoming carmine towards inner angle.

The type of *Gauna subferralis* is so poor that it can hardly be identified.

Larva feeding gregariously in large very irregularly spherical rough galls, three or four inches in diameter, on the branches of a phyllodineous *Acacia*, which was not in flower at the time of my visit, and is therefore at present not identified; the larva eats galleries through the substance of the galls, ejecting a good deal of the excrement from holes in the surface.

Brisbane, Queensland. I found the larvæ feeding in September, and bred several specimens in November and December.

ÆNOGENES, n. g.

Clypeus smooth. Ocelli present. Tongue well developed. Antennæ in male ciliated with tufts of hairs (3). Labial palpi moderate, porrected, second joint with dense long rough hairs beneath, terminal joint moderate, ending in a long pencil of hairs. Maxillary palpi short, filiform. Fore wings with 1 obsoletely furcate, 4 and 5 separate. Hind wings with veins 4 and 5 separate, 8 anastomosing with 7.

Separated from its allies by the quite different palpi.

18. *Ænogenes fugalis*, Feld.

Botys fugalis, Feld., Reis. Nov., pl. cxxxiv., 37.

♂, ♀, 16—17 mm. Head, thorax, and abdomen brownish ochreous, mixed with dark fuscous; anal tuft of male reddish-tinged. Palpi ochreous-whitish, mixed with dark fuscous on sides. Antennæ fuscous. Legs ochreous-whitish, somewhat mixed with dark fuscous, middle tibiæ carmine-tinged. Fore wings triangular, costa sinuate in middle, arched before apex, apex rounded, hind margin rather oblique, slightly rounded; ochreous, more or less wholly suffused with carmine-reddish, and irrorated with blackish, especially in male; anterior two-thirds of costa with very small whitish-yellowish spots; an ochreous-whitish dot near base; an irregular ochreous-whitish line from beyond one-third of costa to inner margin at two-fifths, twice dentate; a small subquadrate whitish ochreous spot following discal spot; a dentate ochreous-whitish line from costa at four-fifths to inner margin at four-fifths, slightly sinuate inwards in middle; cilia whitish, basal third fuscous-carmine, with ill-defined dark grey bars, obsolete towards apex. Hind wings dark fuscous, with an irregular yellowish band before middle; in female base suffused with yellowish, and a small yellowish patch towards inner angle suffused with dull light carmine; cilia ochreous-whitish, basal third dark fuscous.

Melbourne, Victoria; Mount Graham, South Australia. Taken commonly in October amongst grass by Mr. G. H. Raynor, but apparently limited in geographical range.

SCENEDRA, n. g.

Clypeus smooth. Ocelli present. Tongue well developed. Antennæ in male shortly dentate, ciliated with tufts of hairs (3). Labial palpi short, curved, ascending, loosely scaled, terminal joint moderate. Maxillary palpi obsolete. Fore wings with 1 furcate,

4 and 5 separate. Hind wings with 4 and 5 separate, 8 anastomosing with 7. Thorax with patagia in male somewhat elongate, pointed.

Nearly allied to *Endotricha*, from which it is separated by the well-marked furcation of vein 1 of the fore wings, and the patagia of male not conspicuously elongate. *S. externalis* is hardly likely to be truly referable here, but in the absence of the male it may be placed provisionally in this position; it may be an *Endotricha*.

- 1 a. With a reddish patch on costa before apex .. 20. *externalis*.
 1 b. Without reddish patch 19. *decoratalis*.

19. *Scenedra decoratalis*, Walk.

Pyralis decoratalis, Walk., Brit. Mus. Cat., Suppl., 1242; *P. contentalis*, *ibid*, 1242.

♂, ♀, 14—17 mm. Head, palpi, antennæ, thorax, and abdomen whitish ochreous. Legs dark fuscous, apex of joints whitish ochreous. Fore wings triangular, moderate, costa deeply sinuate in middle, abruptly arched towards apex, apex rounded, hind margin somewhat oblique, bent in middle; whitish ochreous, almost whitish in disc beyond first line, somewhat irrorated with brownish ochreous; a double ochreous-grey or blackish line from one-third of costa to one-third of inner margin, strongly curved outwards; a minute blackish discal dot; middle third of costa faintly dotted with white; a double ochreous-grey or blackish line from two-thirds of costa to four-fifths of inner margin, very slightly angulated outwards above middle; a suffused blackish grey patch towards middle of hind margin; sometimes the grey suffusion is more general; a blackish grey cloudy interrupted hind marginal line, forming three small black spots towards apex; cilia grey-whitish, with two dark grey lines. Hind wings with colour and lines as in fore wings, but both lines irregularly dentate; a grey apical patch; a row of hind marginal blackish grey spots; cilia as in fore wings.

Duaringa and Brisbane, Queensland; Newcastle and Sydney, New South Wales; Melbourne, Victoria; and one of the British Museum specimens, more brightly and richly marked than usual, is said to be from West Australia. Common in September, March, and April.

20. *Scenedra* (?) *externalis*, Walk.

Curena externalis, Walk., Brit. Mus. Cat., Suppl., 1253.

♀, 18 mm. Head, antennæ, thorax, and abdomen dull purplish ochreous. Palpi and legs dark purplish fuscous; a patch of snow-white scales behind middle pair of legs. Fore wings triangular, rather elongate, costa gently sinuate in middle, abruptly arched towards apex, apex obtusely angulated, hind margin hardly oblique, rounded beneath; light ochreous, purplish-tinged, becoming ashy whitish posteriorly, with scattered dark grey scales; a curved faintly double dark grey line from one-third of costa to one-third of inner margin; a dark grey discal dot; a dark grey slightly inwards-curved line from three-fourths of costa to anal angle, beyond which the hind marginal area is purplish grey, becoming deep reddish towards upper anterior angle; cilia grey-whitish, with two dark grey lines, first suffused with purple-carmine. Hind wings purplish ochreous, deeper towards hind margin; base suffused with grey; three grey slightly-curved lines forming a moderately broad median band; cilia as in fore wings.

Sydney, New South Wales. One specimen in December.

ENDOTRICHA, Z.

Characterised by the peculiarly elongated patagia of the male, and the absence of maxillary palpi. The genus is a good and natural one, but there is some variation in the neuration; vein 1 of the fore wings is simple in *E. pyrosalis* and *E. flammealis*, but minutely furcate in *E. puncticostalis*, and perhaps in other species. The affinity of the species is correctly indicated by the structure of veins 4 and 5 of both wings; in *E. heliopa* they are separate, in *E. pyrosalis* very shortly stalked, in *E. flammealis* and *E. puncticostalis* moderately stalked, and in *E. æthopa* long-stalked. The patagia are shortest in *E. heliopa* and longest in *E. æthopa*. The genus seems characteristic of India, the Malayan Islands, and Eastern Australia. Snellen has described a species from Celebes which I have not seen, but which is allied to *E. puncticostalis*, and there are several others in the British Museum unrecognised. *E. mesenterialis*, Walk., from Ceylon is closely allied to *E. puncticostalis*.

- 1 a. Hind wings more or less grey.
 2 a. First line of fore wings white 23. *puncticostalis*.
 2 b. First line of fore wings not white 24. *æthopa*.
 1 b. Hind wings not grey.
 2 a. Hind wings with a dark purplish shade before
 middle 21. *heliopa*.
 2 b. Hind wings without a dark purplish shade
 before middle 22. *pyrosalis*.

21. *Endotricha heliopa*, n. s.

♂, 21 mm. Head, palpi, antennæ, thorax, abdomen, and legs ochreous-yellow. Fore wings triangular, rather elongate, costa slightly sinuate, moderately arched before apex, apex obtusely angulated, hind margin somewhat oblique, bent in middle; deep ochreous-yellow, becoming light purplish towards hind margin, except on costa, basal third mixed with purplish; some minute scattered black scales; a slightly irregular-curved pale yellow line from two-fifths of costa to two-fifths of inner margin; a dark fuscous discal dot; an almost straight indistinct pale yellow line from four-fifths of costa to a little before anal angle; a blackish widely interrupted hind marginal line; cilia ochreous-white, basal third carmine-fuscous. Hind wings rather light purple, finely irrorated with blackish; costa broadly pale whitish yellowish; a rather narrow deep ochreous-yellow median band, slightly curved, margined by slender pale yellow lines, beyond which is a darker purplish shade; hind marginal line and cilia as in fore wings.

Rather like *E. pyrosalis*, but broader-winged, more distinctly marked, and with the hind wings purplish towards base, the yellow colour restricted to a well-defined median band; it differs also in venation, as noted above.

Sydney, New South Wales. Two specimens in November.

22. *Endotricha pyrosalis*, Gn.

Endotricha pyrosalis, Gn., Pyr., 219 (♂); *E. ignealis*, ibid, 220 (♀); *Pyralis stilbealis*, Walk., Brit. Mus. Cat., 913 (♀); *P. docilisalis*, ibid, 913 (♀); *Messatis sabirusalis*, ibid, 918 (♂); *Paconia albifimbrialis*, ibid, Suppl., 1255 (♂); *Tricomia auroralis*, ibid, 1259 (♂); *Rhodaria robina*, Butl., Ann. & Mag. N. H. (5), ix., 96 (♂).

Guenée's descriptions are sufficiently good, and easily recognisable. The male has the most elongate wings of

the genus; the female is considerably broader-winged, and much less yellow.

Brisbane, Queensland; Sydney, New South Wales; Melbourne, Victoria; and Launceston, Tasmania. Generally common in September, and from January to March. I suspect, however, that it does not occur west of the Ninety-Mile Desert.

23. *Endotricha puncticostalis*, Walk.

Rhisina puncticostalis, Walk., Brit. Mus. Cat., Suppl., 1924; *Endotricha ustalis*, Snell., Tijd. v. Ent., 1880, 201.

♂, ♀, 14–16 mm. Head, palpi, antennæ, thorax, and abdomen whitish ochreous, mixed with ochreous and sometimes irrorated with dark fuscous. Legs ochreous-whitish, anterior pair dark fuscous. Fore wings elongate-triangular, costa very slightly sinuate in middle, slightly arched towards apex, apex rounded, hind margin rather oblique, bowed; whitish ochreous, almost wholly suffused with reddish fuscous, and irrorated with dark fuscous; costa spotted with dark fuscous and whitish; an irregular almost straight blackish-grey fascia from one-third of costa to one-third of inner margin, anteriorly suffused, posteriorly sharply defined and bordered by a white line, sometimes followed by a second less distinct; an obscure dark fuscous discal dot; an indistinct whitish line from costa at five-sixths to inner margin before anal angle, hardly sinuate, beyond which the hind marginal area is suffused with fuscous; cilia white, with two cloudy dark grey lines. Hind wings grey, with two somewhat irregular white dark-margined lines, tending to become suffused in intermediate space; first at one-third, preceded by a dark shade, second in middle, followed by a dark shade; cilia as in fore wings.

Duaringa and Peak Downs, Queensland. Several specimens received from Mr. G. Barnard. Also occurs in Java and Celebes. I have seen a specimen identified by Snellen himself with his *ustalis*.

24. *Endotricha athopa*, n. s.

♂, 22 mm. Head, palpi, and thorax reddish fuscous, mixed with ochreous and irrorated with blackish; patagia very long, blackish grey. Antennæ whitish ochreous, obscurely ringed with fuscous. Abdomen reddish fuscous, irrorated with blackish grey, suffused with ochreous towards base and on anal tuft. Legs dark fuscous, posterior pair whitish. Fore wings elongate-triangular,

costa slightly sinuate, moderately arched towards apex, apex rounded, hind margin rather oblique, bent in middle; reddish fuscous, irrorated with blackish grey, broadly paler and more ochreous beyond first line and towards anal angle; costa spotted with whitish ochreous; a pale line from one-third of costa to two-fifths of inner margin, slightly curved outwards, almost merged posteriorly in ground colour; a cloudy dark grey discal spot; a pale slightly dentate line, margined with grey, from five-sixths of costa to before anal angle, bent outwards beneath costa; cilia ochreous-white, carmine-tinged towards apex and anal angle, with a dark fuscous line near base suffused with carmine. Hind wings dark grey, suffused with whitish grey on costa and towards inner margin; an obscure irregular darker line beyond middle; cilia ochreous-white, with a dark fuscous line near base suffused with carmine.

Characterised by the entire absence of yellow or white markings.

Sydney, New South Wales. Two specimens in September.

IV. *On a new species of the genus Orthezia.* By
J. W. DOUGLAS.

[Read February 6th, 1884.]

PLATE II.

IN June, 1881, Monsieur J. Lichtenstein, of Montpellier, had the kindness to send me two examples, male and female, of an *Orthezia*, with the following very interesting information:—"I send you the male of an *Orthezia* which I consider is different from *O. urticæ*; it comes from the island of Montecristo, Italy, where it feeds on *Erica arborea*. I enclosed it, as a nymph, between two pieces of mica, but it has nevertheless undergone its change to imago, and is perfectly fresh, without a bristle of its fine tail lost. I intended to describe the insect, but, as I have no time left now, I send also the female, put alive between two pieces of glass, and there some young ones have emerged from her. Of course they came out of eggs enclosed in the pouch formed by the chalky tail-piece, and were not laid alive. If you please you can describe the whole, having male, female, and young." After long hesitation, caused by the imperfect condition of the female, I have now, in default of having obtained a better example, resolved to make the description, as well as the material at hand admits; the deficiency may be supplied hereafter.

Orthezia mænariensis.

Mas. Niger. Capite parvo, transverso, antice angusto, declivi, postice tribus ocellis munito; oculis magnis, productis; antennis longissimis, articulis duobus primis brevibus, crassis, parce setosis, cæteris (7) longis, subæqualibus, filiformibus, subtiliter setulosis, piceo-nigris; pronoto magno, subquadrato, in quatuor partes convexas, diviso, angulis anticis depressis; scutello magno; alis (ant.) longissimis, latis, margine postico late rotundato, griseis, hyalinis, farinosis, vena furcata fusca; halteribus parvis, nigris, apice obtuso duabus setis recurvis instructo; abdomine brevi, segmento abdominali ultimo pluribus setis longissimis albis superne instructo, segmentis genitalibus liberis; pedibus piceo-nigris, setulosis. Long. corp. fere $\frac{1}{2}$ lin., cum alis plus 1 lin., cum penicillo $1\frac{1}{2}$ lin.

Fem. Atra. Corpore supra laminis cereis albis instructo (in hoc exemplo fortuito fere abruptis); antennis brevibus, 9 articulatis, nigris; marsupio niveo, supra canaliculato, infra valde convexo, levigato, leviter striato; pedibus nigris. Long. cum marsupio 1 lin.

Hab. in insula Montecristo (olim Mænaria) in *Erica arborea*.

♂. Black. Head small, transverse, anteriorly narrow and incurved, posteriorly with three distinct ocelli; eyes large, anterior, prominent; antennæ pitchy black, very long, the 1st and 2nd joints short, thick, sparingly setose, the remainder filiform, long, subequal, finely setulose. Pronotum large, subquadrate, anterior angles depressed, surface divided into four elevated convex portions. Scutellum large. Wings of the generic form,—very long, except at the base very broad, posteriorly broadly rounded,—transparent, smoky grey, farinose; the furcate nervure fuscous. Halteres small, sinuate, black, the obtuse apex with two recurved setæ.* Abdomen short; from the upper surface of the last true abdominal segment projects a very long pencil of slender white setæ, beneath which the genital segments lie free. Legs pitchy black, setulose.

♀. Black; above clothed with snow-white, cereous laminations (in the specimen before me nearly all these have been rubbed off, only two or three anterior and two posterior ones remaining, the latter overlapping the base of the marsupium). Antennæ short, stout, 9-jointed, the apical joint setigerous.† Marsupium snow-white, above as long as the visible part of the body, canaliculate; beneath arising at the posterior coxæ and entirely covering the abdomen, very convex, and posteriorly curved upwards, like the stern of a ship, smooth, finely striate. Legs black, finely setulose.

* Burmeister, among the generic characters of the male *Dorthezia*, merely gives briefly “kurzen blattförmigen Schwingen” (Handb. ii. 76). Amyot and Serville do not denote the presence of halteres in the male of this genus, and, although Prof. Westwood does notice them (Introd. Mod. Class. Ins., ii., p. 445), he does not indicate them in his figure (Frontisp., fig. 8). In his ‘Essai sur les Cochinelles’ Dr. Signoret does not mention halteres among the characters assigned to the male of the genus *Orthezia*, but, in the introductory remarks on the *Coccidæ* generally, he says (p. 32), after describing the fore wings (“les élytres”), “En dessous on observe deux balanciers plus ou moins longs et plus ou moins larges, paraissent articulés et finissant généralement par une soie en forme de crochet.” The “balanciers” are represented in the figures of species of several genera.

† The antennæ of the adult female of *Orthezia urticæ* are reported by all authors as having only eight joints, but in the present species there are certainly nine, as shown in figs. 4, 4a, and 5.

Some of these particulars are, of course, generic characters, yet the species being new, and the male in all the known species being rare, at least in collections, I have deemed it best to mention them; but some of the characters are hardly in accordance with those ascribed to *Orthezia*, of which the formula should be enlarged accordingly.

The exuviated skin of the nymph or pupa of the male (fig. 6), ruptured in front by the exit of the perfect insect, is a transparent mask of the imago, except as to the wings, caudal setæ, and antennæ (of seven joints only); it is also of great interest in showing, unexpectedly, *two* claws at the end of all the monomerous tarsi, instead of the single one in the larva and imago. I cannot find that the pupa has been noticed in any species of this genus, the reason being, probably, that it is inconspicuous and secluded, and that the duration of existence in the pupa-state is very short.

The young black larvæ which came out of the maternal marsupium, as before stated, still remain between the glasses; I apprehend they had soon died, and, being loose, have become somewhat damaged by shaking about during their travel to me, but there yet remain on the anterior part of their bodies some distinct bud-like lamellæ.

M. Lichtenstein, however, having written, "All larvæ, male and female, are born entirely bare, and the secretion comes only after some days," I communicated this to the late Mr. G. Norman, who was then paying great attention to *O. urticæ* and *O. cataphracta*, at Pitlochry, and he replied:—"As to the larvæ being quite free from the waxy covering on being hatched, I much doubt it. I did not see the actual hatching-out, but I saw the larvæ when they would scarcely have been more than a few hours, or perhaps a day, old, and they certainly were then not naked, but covered with the lamination which showed the pattern quite distinctly; they were then not larger than small grains of sand,—decidedly smaller than the eggs themselves." In proof of his statement he sent a larva of *O. urticæ*,—a perfect miniature of a full-grown larva,—and the egg-shell out of which it had come, and the insect was not longer than the shell.

In the Trans. Ent. Soc. Lond., n. s. iv., Proceed., p. 5, is a note by the late Mr. E. Newman "On the parturition of *Dorthesia characias* (*O. urticæ*)", written *more suo*, in

which, after giving an account of the way in which he saw the young ones come out from the body of the mother, he says:—"After their death, measured longitudinally and transversely, I found the body was $\cdot 024$ in., so that it was nearly a circular disk, presenting, however, a number of elevations, depressions, and irregularities, which possibly resulted from drying: the colour was pitchy red, but attached to the dorsal envelope in several places, and without any semblance of regularity, were a number of minute flattened bodies, perfectly white, and having the appearance of little flakes of snow; these are so numerous as to give the little creatures quite a dusty appearance."

MM. Amyot and Serville (Hemipt., p. 622) quote the following original observations by l'Abbé d'Orthez, saying:—"L'abbé d'Orthez a trouvé dans un seul de ces sacs (marsupium) quatre-vingt-cinq petits éclos, tous recouverts de leurs lames farineuses, et une quinzaine d'œufs qui pétillaient sous l'ongle qui les écrasait. . . . La première mue arrive environ un mois après leur sortie; l'insecte sort de son fourreau par une ouverture qui se fait sur la partie antérieure du dos; il est alors tout nu, son corps et ses pattes couleur de chair; le même jour, on le voit se recouvrir de nouvelles lames, qui, trois ou quatre jours après, ont pris un accroissement considérable; et alors les pattes deviennent noirâtres." Speaking also of a female which had been purposely deprived of its scales, the Abbé says:—"L'insecte, ainsi dépouillé, ne paraît pas en souffrir; il court et mange comme à l'ordinaire. Au bout de quelques jours, il se trouve recouvert d'une poussière blanche qui augmente peu à peu et finit par prendre le même arrangement qu'auparavant. Cependant ceux qui ont été élevés dans des boîtes n'acquièrent jamais une régularité aussi parfaite."

The deduction from all these observations is that the larva, in all the species of *Orthezia*, is bare when excluded from the egg-shell; that it is also bare at the occurrence of each successive moult; and that in all these cases it is quickly covered by the deposit of waxy secretion, which more or less rapidly increases and assumes the form and disposition of the lamination characteristic of its species, which in the female continues during the duration of the life of the insect, even after the marsupium is formed, and in the male until the pupa is formed beneath the integument.

Notwithstanding the imperfection of diagnosis, in consequence of the accidental want of lamellation on the back of the female of *O. manariensis*, the species appears to be of the type of *O. urticæ*, but it is quite distinct from it, notably by its very diminutive size (not half) especially noticeable in the female, which sex has 9-jointed antennæ, is blacker in the body, legs, and antennæ, has the channels on the upper surface of the marsupium proportionately slighter, the under side being much more convex and more decidedly striate; while in the male there are three ocelli posteriorly on the head, the pronotum has another formation, &c.

PS. (Dec. 10th, 1883). — Since the foregoing was written I have received from M. Lichtenstein another example of the male, which quite confirms my description. At the same time he had the goodness to send some other specimens of the species, prepared for the microscope, illustrating the life-history. Of these two are figured:—

Fig. 5. An adult female deprived of its waxy covering.

Fig. 7. An oval, luteous, naked pupa or nymph, which I apprehend had only just assumed this form, and that its ultimate development as a pupa, including another moult, had been arrested,* for although, as might have been expected, there is no rostrum yet, as compared with the skin (fig. 6), the antennæ are very short and the articulations ill-defined, the legs are short, and there is but one tarsal claw instead of two, as seen in figs. 6 and 6*a*. Most remarkable also are the two large lateral projections, one on each side of the mesothorax, which I think represent sheaths containing incipient wings, such as are seen in the nymph form of the *Psyllidæ*. They appear also to be analogous to the thoracic adjuncts,

* Jan. 22nd, 1884. This supposition may now be regarded as a certainty, for in an extremely interesting article in the January number of the 'Wiener ent. Zeitung,' iii., p. 11, Dr. Franz Löw has given in detail the results of his study of the life of *Orthezia urticæ*, Linn., from the larva to the imago, and he has found that in the male the nymph has two distinct stages, of which the first ("Pronymphe") lasts but three days, and the second ("wahre Nymphe") lasts for eight days, and from the last form the imago emerges. In the present species fig. 7 represents the Pronymph and fig. 6 the true nymph. The information contained in this excellent paper fills up several gaps in our knowledge of the biology of the remarkable genus *Orthezia*, and deserves special attention.

described and figured by Dr. Signoret as appertaining to the nymph, or what he, with some hesitation, regards as the nymph-form, of *Gossyparia ulmi*, Geoffr., and which he terms "moignons d'élytres" (Ess. Coch., pp. 318 and 320, pl. 15, fig. 2 *b*). I can find no trace of these wing-sheaths in the pupa-skin.

The objects represented by the figures 5 and 7 having been mounted in Canada balsam are thereby rendered transparent, and the segmentation of the bodies, as well as the base of the projections on No. 7, is not clearly recognisable.

EXPLANATION OF PLATE II.

ORTHEZIA MÆNARIENSIS.

- FIG. 1. Male, upper side.
 1 *a.* ,, origin of caudal setæ.
 2. ,, under side.
 2 *a.* A halter, enlarged.
 3. Female, upper side.
 4. ,, under side.
 4 *a.* ,, antenna (beneath).
 5. ,, denuded.
 6. Male, pupa-skin.
 6 *a.* ,, a tarsus showing the two claws.
 7. ,, young pupa or nymph (under side)

V. *Note on the Papilio polydecta of Cramer.* By
LIONEL DE NICÉVILLE.

[Read December 5th, 1883.]

PLATE III.

THE correct identification of species described by old authors is a matter of much importance to all workers in Natural History, and as that of the above butterfly is shrouded in considerable doubt I write the following in the hope that the specimens described may be accepted by lepidopterists as finally settling what this insect really is.

I have lately received a pair of a *Mycalesis* from Mr. F. Mackwood, taken in Ceylon, one of which bears a ticket with the following in Mr. Moore's handwriting—" ? *polydecta*. Not in Lep. Ceyl." These specimens do not agree with Cramer's figure (Pap. Ex., vol. ii., pl. cxliv., figs. E, F, 1777) of *P. polydecta* in the following points:—On the upper side of the hind wing there is only one ocellus in the second median interspace, the second ocellus in the first median interspace in *M. polydecta* being absent, and the fulvous marginal lines are obsolete. On the under side of the fore wing *M. polydecta* has two fulvous marginal bands inwardly defined with black lines, which are absent from my specimens; the four discal ocelli are more prominent and perfect, and placed one in each interspace from the first median to the lower discoidal interspace, while the Ceylon male has no ocellus in the third median interspace, but there is one in the first discoidal interspace, the total number (four) thus remaining the same. The female, however, has five ocelli, the missing one in the male being minutely present. The number of ocelli in the hind wing in the Ceylonese specimens is the same as in *M. polydecta*, but they are all much smaller, and arranged in a more sinuous line. In *M. polydecta*, however, beyond the ocelli is a prominent bluish-white band, a dark, very zigzag, fuscous line, then a pale yellow band,

and lastly a fulvous line defined on both sides with black. In the Ceylon specimens the area beyond the ocelli is pale violet, having an obscure sinuous dark line, and two finer lines on the margin, with the area between them fulvous.

The variation in the number and size of the ocelli I consider unimportant, as the only two specimens of this species I have seen differ the one from the other in this respect; and, as regards the other markings, I think it may be conceded that Cramer's figure is much too highly coloured, differing in this respect from any species of the genus *Mycalesis* known to me. This being granted, our Ceylon specimens may be referred to *P. polydecta*, Cramer, as surmised by Mr. Moore. It comes in Mr. Moore's group *Samanta* of *Mycalesis*, and is nearest to *M. Langi*, de N. (Butt. of India, vol. i., p. 130, n. 112, 1883), from which it differs, on the upper side of the fore wing, in having no subapical ocelli, and the lower ocellus being smaller. The tone of coloration of the under side also differs considerably. I append a full description of the species:—

♂. Upper side: Both wings dark brown. Fore wing with a large ocellus placed in the first median interspace, and extending some distance beyond it above and below; black, with a prominent white pupil and ochreous iris, this ocellus being placed on a discal band, inwardly sharply defined, outwardly diffused, paler than the ground colour. Hind wing with a small ocellus in the second median interspace; a submarginal waved indistinct fuscous line and two marginal lines continued obscurely on the fore wing. Under side: Both wings paler brown, glossed with ochreous; with a subbasal irregular fuscous line and a discal ochreous nearly straight line inwardly sharply defined, outwardly diffused, with the ground colour beyond it paler and passing into pale violet; a submarginal sinuous obscure dark line and two finer marginal black lines. Fore wing with four very small ocelli, hind wing with seven. Cilia pale brown throughout. Female a little larger, the wings broader and more rounded, and lacking the usual male secondary sexual characters. The under side of the forewing has five ocelli; otherwise as in the male. Expanse, ♂, 1.95 in.; ♀, 2.05 in.

Hab. Tranquebar (Cramer), Ceylon.

The *Mycalesis polydecta* of Butler (Ann. & Mag. of Nat. Hist., third series, vol. xx., p. 402, pl. ix., figs. 5, 6,

female, 1867) must now be considered to be but a local variety (if even that) of *M. mineus*, Linnæus, as pointed out by Mr. Distant in his 'Rhopalocera Malayana,' p. 51; as also the specimens identified by Mr. Moore as varieties of *polydecta*, and described in the 'Butterflies of India,' p. 119, n. 98; but Major Marshall and I therein correctly expressed our opinion that they "appear to us to be varieties of *mineus* rather than of *polydecta*."

NOTE BY W. L. DISTANT.

Our colleague, Mr. de Nicéville, having presented this note to the Society through my hands, I take the opportunity to make a few remarks on a species of Indian *Satyridæ* belonging to the genus *Ypthima*; the accompanying plate affording an opportunity to give additional figures.

In 1882 (Ann. & Mag. Nat. Hist., ser. 5, vol. x., p. 406) I described an Indian Satyrid (captured by our member, Mr. F. E. Robinson) under the name of *Ypthima Robinsoni*. In their 'Butt. Ind. Burm. and Ceyl.,' p. 230, Messrs. Marshall and de Nicéville truly remarked that the species was probably synonymic with *Y. Ypthimoides*, Moore. I can only plead, in justification of renaming the species of my friend Mr. Moore, that before doing so, and after having worked out the other species of the genus, I submitted the typical specimens to his examination, and he failed to recognise that it was the species he had described in error under the genus *Callerebia*. I now figure it to prevent further confusion, and the synonymy will therefore stand thus:—

Ypthima Ypthimoides. (Pl. III., fig. 4).

Callerebia Ypthimoides, Moore, Trans. Ent. Soc. Lond., 1881, p. 307.

Ypthima Ypthimoides, Marsh. & de Nic., Butt. Ind. Burm. & Ceyl., p. 230, n. 221 (1883).

Ypthima Robinsoni, Dist., Ann. & Mag. Nat. Hist., ser. 5, vol. x., p. 406 (1882); Marsh. & de Nic., Butt. Ind. Burm. & Ceyl., p. 229, n. 220 (1883).

At the time of redescribing the above I described a species of the Oriental and Ethiopian genus *Melanitis*

from Masassi, East Africa, which I have now an opportunity to figure.

Melanitis Libya. (Pl. III., fig. 5).

Melanitis Libya, Dist., Ann. & Mag. Nat. Hist., ser. 5, vol. x., p. 405 (1882).

EXPLANATION OF PLATE III.

- FIG. 1. *Papilio polydecta*, after Cramer.
2. *Mycalesis (Samanta) polydecta*, Cram., male; from Ceylon.
3. *Mycalesis (Samanta) Langi*, de Nic., male; from Sikkim.
4. *Ypthima Ypthimoides*, Moore.
5. *Melanitis Libya*, Distant.

VI. *Note on Tachyris melania of Fabricius.* By
W. H. MISKIN.

[Read December 5th, 1883.]

THIS species is very briefly characterised by Fabricius in *Syst. En.*, p. 475, n. 140 (1775), and is figured by Donovan, *Ins. N. Holland*, t. 17, fig. 2 (1805). The type is in the Banksian collection in the British Museum, and is referred to by the late Mr. Hewitson, *Trans. Ent. Soc. Lond.*, 1868, p. 99, and is refigured and redescribed by Mr. Butler in '*Cruise of Curaçoa*,' p. 471, pl. 49, figs. 4, 5 (1873).

The fact of the existence of the type seems to have been overlooked by Mr. Wallace in his paper on Eastern *Pieridæ*, *Trans. Ent. Soc. Lond.*, 3rd ser., vol. iv., p. 371 (1867), where he proposes to drop the Fabrician name altogether, as being a species "which has never yet been properly identified, and probably never will be."

I am glad to be able to throw a little additional light on this species. I have in my possession, from Cape York, specimens of both sexes, or at least what is certainly the female, and, I have no doubt, the opposite sex also.

Mr. Butler's description and figure enable me to determine my specimen of the female beyond question (he, however, describes the specimen in the Banksian collection erroneously as a male; it is undoubtedly the female). The only difference to be discerned between my specimen (female) and Butler's figure and description is that in mine the expanse of wing is rather less, rather less white in primaries (occasioned by the outer marginal band being continued to hinder angle, and the somewhat increased dark basal area), the apical spots being continued in a row nearly to hinder angle; in secondaries by the white area extending nearly across the wing, and on the under side of primaries the base being greenish yellow instead of orange; in all other respects it exactly agrees, the generally distinguishing feature of the species being the predominating uniform grey-blue tint of the

upper side in the female, the male being entirely grey-blue, and the rosy shining brown of the under side in both sexes.

The male is *T. Clementina*, Felder, Reise Nov. Lep., ii., p. 162, n. 133, t. 25, fig. 6 (1865), with which figure and description my specimen exactly agrees.

There can be no doubt, after seeing these two insects together, that they are the sexes of one species; both my specimens were captured at one time and in the same locality (Cape York).

It is possible that in another locality a different form of the female may be produced, and Mr. Wallace's surmised female still be correct, although I am inclined to think it belongs to another species.

The *T. melania* of Boisduval has been long satisfactorily determined to be the female of *T. Ega* of the same author; this is one of our most common species, and there is no doubt whatever of the correctness of this conclusion.

VII. *Descriptions of new Australian Rhopalocera.* By
W. H. MISKIN.

[Read December 5th, 1883.]

PAPILIONIDÆ.

PIERINÆ.

DELIAS, *Hübner.*

Delias Nigidius, n. s.

♂. Upper side: Pearly white, broadly margined with dense black, clouded at base. Primaries, costa, apical region, outer margin, and hinder angle, black, the black extending from extremity of cell, in a curved line to hinder angle, where it terminates in a moderately wide band; subapical curved row of three (sometimes four) white spots, largest towards apex. Secondaries with broad black outer marginal band in a straight line across wing, enclosing apical and anal angles, embracing about one-third of whole wing; in some specimens with three or four marginal white points between the nervures. Under side: The black of rich purplish hue; base of both wings sulphur-yellow. Primaries with black marginal band not extending to hinder angle; subapical row of spots larger, and extending much further down the wing; first three bright yellow. Secondaries with only costal area and small portion of cell white; submarginal band of wide crescent-shaped marks from apical to anal angle ochre-yellow. Thorax grey. Abdomen white. Expanse, $2\frac{3}{4}$ — $2\frac{5}{8}$ inches.

Hab. Rockingham Bay and Johnstone River, N. Queensland (coll. Miskin).

The nearest ally of this species, as far as I am able to determine, is *D. Ennia*, Wallace, from which, however, it is well distinguished, but to which it bears about the same relation as does our *Mysis* to *Bagoe*, Boisdu.

My specimens, all captured by myself, are females; the male is at present unknown.

NYMPHALIDÆ.

NYMPHALINÆ.

ATELLA, *Doubl.**Atella propinqua*, n. s.

Upper side: Rich reddish brown, with black markings. Primaries, costa from about half way narrowly, apex (except where deeply indented on inner side) broadly, outer margin nearly to posterior angle, less widely black; a row of three small black spots (one of which is within the indentation) parallel with outer margin within the apical area; five short transverse lines within the cell; a curved irregular transverse band at end of cell; a square blotch (touching the costa) between last-named band and black portion of apex. Secondaries with well-defined caudal prolongation of first median; from apex to anal angle margined with black, and a submarginal row of black lunule-shaped marks; otherwise without markings. Under side: Brown, with pink-violet shadings, and various silvery crescent-shaped marks disposed in irregular transverse line across both wings about the centre; a row of dark spots parallel with the last, nearer to outer margin. Primaries with silvery lunules at apex; two short transverse dark bands within the cell; a silvery patch at termination of cell touching costa. Outer margins of both wings with indistinctly defined line of crescent-shaped marks. Head, thorax, and abdomen rufous. Antennæ black. Expanse, $2\frac{1}{2}$ inches.

Hab. Rockingham Bay (coll. Miskin).

This insect very closely resembles my N. Indian specimen of *A. Sinha*, Koll., on the under side, but differs very considerably from it on the upper. Its capture is interesting, as representing a genus hitherto unknown as Australian.

LYCÆNIDÆ.

THECLINÆ.

HYPOCHRYSOPS, *Felder.**Hypochrysops Hecalius*, n. s.

♀. Upper side: Dark brown, with central patch of light orange on each wing. Primaries with the central orange patch extending lightly along the median, nearly to the base. Secondaries with the central orange patch smaller than in the primaries; outer margin from apical to anal angle bordered with reddish orange; nervures from centre of wing to termination orange; fringe light buff, with

dark points at ends of nervules. Under side: Chrome-yellow, with scarlet transverse bands and patches, edged with black and metallic-blue. Primaries with a short band within cell; one at termination of cell; a longer one nearly crossing the wing towards outer margin; an outer marginal imperfect one. Secondaries transverse at intervals throughout, with more or less irregularly curved and connected bands. Thorax, head, and abdomen above dark brown, beneath light yellow. Expanse, $1\frac{1}{2}$ inch.

Hab. Victoria (*Kershaw*). Coll. *Miskin*.

PSEUDODIPSAS, *Felder*.

Pseudodipsas Brisbaneensis, n. s.

♀. Upper side: Violet-blue, margined with black. Primaries, costa narrowly, outer margin broadly, black. Secondaries, costa to apical angle black; outer marginal line of black; between 2nd and 3rd median branches a black spot, and another black spot at anal angle; abdominal margin pale; fringe pale, with black points. Under side: Pale shining brown, with numerous dark brown transverse narrow bands edged with white. Primaries with sub-marginal narrow band; a wider band traversing the wing towards the middle; a short band at end of cell; another about middle of cell; a spot near costa between the two last, and two spots below; a spot near the base. Secondaries with several irregularly curved disconnected bands; a marginal band of red spots, and spot of black crowned with red; another between 2nd and 3rd median branches; the whole row surmounted by a crenated line of black. Expanse, $1\frac{2}{3}$ inch.

Hab. Brisbane (coll. *Miskin*).

DEUDORIX, *Hew*.

Deudorix Democles, n. s.

Upper side: Violet-blue, margined with black. Primaries all black, excepting basal-hinder area, which, bounded by median and 2nd median branch, and hinder margin extending nearly to hinder angle, is shining violet-blue. Secondaries same as primaries, the blue confined to centre of wing, nearly but not quite touching outer margin; abdominal margin brown. Under side: Very light brown, with darker transverse bands bordered with white. Primaries with indistinct marginal band; one beyond middle nearly crossing wing; a shorter one between last and base. Secondaries with apical area white; a curved irregular central band traversing the wing, and

returning along abdominal border nearly to base; a short band within cell, and one at the base; between the extremities of 2nd and 3rd median branches a black spot crowned with red, above which a blue lunule; three other blue spots around the anal angle; anal lobe black and very slightly developed. Thorax and abdomen above black, beneath light brown; between the eyes white. Expanse, $1\frac{1}{2}$ inch.

Hab. Basilisk Range (Johnstone River, N. Queensland). *Coll.* Miskin.

VIII. *Further Notes on the Caprification of domestic Figs, with reference to Dr. Paul Mayer's comments thereon.* By Sir SIDNEY S. SAUNDERS, C.M.G.

[Read February 6th, 1884.]

IN my former remarks on Count zu Solms-Laubach's investigations at Naples, as set forth in his exhaustive Essay on "The origin, domestication, and culture of the common Fig-tree, *Ficus Caricæ*, L.," I observed that, as regards promoting the distension, maintenance, or maturity of the crop, by the so-called "Caprification-process," there was a lack of evidence which rendered it difficult to reconcile this traditional doctrine with any reputed virtues ascribed thereto in certain parts of Southern Europe and the Levant, though ignored in other regions; an operation, moreover, which Count Solms has himself denounced as supererogatory (jetzt kaum mehr nützliche), in modification, as he observes, of Olivier's formulary,* characterizing this process as "un tribut que l'homme payait à l'ignorance et aux préjugés"; a verdict (Ausspruch) which, as the Count explains (pp. 24 and 26), Olivier's imperfect acquaintance with the practice did not justify.

Dr. Paul Mayer, Superintendent of the German Zoological Station at Naples, who assisted the Count in many of his researches, and himself the author of an elaborate treatise on "Fig-Insects," referred to with deserved encomium in our 'Transactions' on more than one occasion, has now favoured me with various interesting explanations to which he is desirous of calling attention; and in order to admit of full scope to his valuable expositions on these matters, I append hereto a copy of his communication, coupled with some subsidiary remarks. Nevertheless Dr. Mayer is labouring under some misconception in supposing that my commentary upon the Count's essay applied conjointly to the works

* Sei dem jedoch wie es wolle, auf alle Fälle darf man dem oben p. 26 citirten Satze Oliviers mit Grund einen anderen substituiren der etwa wie folgt formulirt werden könnte (Solms, p. 44).

of both alike. On the contrary, his own treatise aforesaid was only casually alluded to as summarizing the Count's remarks on the abstruse topic of *impracticable oviposition*, for which no reasons had been suggested by either. There was, moreover, the less need of entering into a twofold controversy upon these matters, when both writers had been cooperating from first to last, and had worked out their results in harmony with each other; the Count's conclusions as to his appreciation of Caprification having been adopted verbatim by Dr. Mayer; as also the observations of the Count on anomalous oviposition (p. 560); so that in adhering to the recital of the latter there seemed to be no reason to anticipate any divergence therefrom on the part of his coadjutor, the homogeneous character of their intimate convictions being assumed as unquestionable; which indeed the tenor of Dr. Mayer's present communication amply serves to corroborate.

Passing now to the new facts elicited, Dr. Mayer commences by informing us that, in a certain passage of *his* treatise referring to opening a fig having the wings of the female *Blastophaga* adhering to the scales of the ostium (Eröffnet man also eine junge Feige, deren Aussenseite am Ostium die Flügel der Blastophaga ankleben—p. 559), he was speaking of a *domestic* fig (eine *zahme*), which he conceives is clear from the context. This was by no means evident—nor even presumable—when compared with the parallel passage in Count Solms' version—to which alone my remarks applied—where the latter unmistakably refers to a *wild* fig; for in his Chapter III. (p. 19), treating of the "Insects dwelling in the fruit of the *Caprificus*," he narrates how the disrupted wings of the females issuing from the *wild* winter-figs (*Mamme*), are found adhering to the ostium of the *wild* spring-figs (die jungen *Profichi*); on opening which (Eröffnet man nun die *Profichi*) he gives also a corresponding account to that supplied by Dr. Mayer of the proceedings of these wingless females in traversing the florets hither and thither for the purpose of oviposition; of their frequently perishing in endeavouring to find their way in or out of the "*Profico*"; of their corpses being often met with in the cavity; of Godeheu de Riville's remark on "ripe figs," &c.; all which appear in serial sequence in Dr. Mayer's version (p. 559); followed alike, in both instances, by the Count's *woodcut*

illustrating the *normal* process of oviposition; no allusion being made in either case to any *anomaly* in this respect, as *subsequently* adverted to in the *domestic* figs ("Bei den essbaren Feigen verläuft der Vorgang anders"—Mayer, p. 560). Hence the presumption could only be that *both* were speaking of the *same* description of fig—namely, a *wild* one—left ambiguous in one version, but defined as such in the other; the more especially when, in the presence of this specification by the Count, no explanatory character in a different sense was imparted by his colleague.

Secondly—Dr. Mayer, when speaking of the "edible" or "domestic" figs in several cited passages, adverts to the proceedings of the *Blastophagæ* on such occasions; namely (1) to their futile attempts at oviposition in the first crop of *edible* figs—the so-called "Fiori di Fico"—in their young stage early in April (pp. 560 and 562); (2) to their conveyance of pollen, whereby fructification of the seeds ensues (p. 561); (3) to their ovipositing—also without progeny—in the *second* crop of *edible* figs, while these are still very small, at the time when these insects issue from the caprificating wild-figs (*Profichi*) in June and July, and when moreover they also invade the wild-figs of the *third* crop—the so-called "*Mammoni*" (p. 562); all which circumstances, in so far as referred to by the Count, were comprised by me under the category of "experimental essays," which—now authoritatively denied—offered the only apparent solution of problems involving the presence of these insects in such domestic figs. But the remarkable factor which has now to be taken into account—namely, that of their ingress on these occasions being the *normal result* of caprification—cannot but serve to intensify the mystery of their subsequent proceedings and disappearance therefrom. In a passage already adverted to, Count Solms informs us, as the result of his own investigations, that in the aforesaid "Fiori di Fico" these insects try to pierce a perpendicular channel from the florets above to the required depth below (as shown in his woodcut at p. 21) in order to deposit their ova, but cannot succeed in effecting this, the egg never attaining its proper place. This, Dr. Mayer now tells us "*presupposes* that they had entered the fig in the usual way—through the scales."

The Count proceeds to state that the creature seems to have soon perceived the inutility of its efforts and to

have retrograded. After usually attempting to pierce a very small number of florets, conscious of her mistake, she quits the fig by the ostiolum, between whose scales she frequently remains affixed and terminates her existence (häufig stecken bleibt und verendet); her egg being found in very different places according to circumstances; occasionally hanging loose, as described by Gasparrini; in other cases more or less tightly thrust down in the semi-pierced channel; sometimes even in a reversed position, with the pedicel in front stove in (Solms, pp. 36, 37).

Hence it would seem that in the Caprificus figs the female *Blastophagæ* usually continue depositing their ova until at length they die exhausted within the interior of the fig, where their bodies, in fact, are found (schliesslich gehen sie dann peractis peragendis zu Grunde, häufig erst beim Versuch den Ausweg aus der Profico wieder zu gewinnen—Solms, p. 21); whereas in the domestic figs, having become speedily aware of their error, they are earlier disposed to retreat, and thus effect their escape betimes, unless entrapped by the obstructing scales when quitting.

But the disqualification of these domestic figs for the reception of the ova has yet to be considered; for although partial desiccation may still influence the result of actual investigation, as already suggested, yet the absence of progeny under ordinary circumstances, after the ingress effected by these insects consequent upon caprification, would seem to indicate some anachronism in the respective stages of these figs, as compared with those of the Caprificus where no such obstacles are encountered. Thus, whereas the *first matured crop* of the latter (so-called "*Mamme*") passes the winter on the trees and ripens early in April; the earliest domestic figs (the "*Fiori di Fico*") still in their infancy, whose trees had not incurred the depletion of a hibernating crop, would be more forward in their growth, and their internal organism presumably less accessible to the delicate function of oviposition, than the budding "*Profichi*"—or *second crop* of wild-figs—to which the *Blastophagæ* then emerging from the winter-figs are accustomed to resort for the development of their offspring. This relative retardation in the one case would operate to a corresponding extent upon the successive crop of wild-figs in June and July, when the females of

the caprificating brood, emanating from the aforesaid "*Profichi*," find the incipient "*Mammoni*," or *third* crop of wild-figs, more or less available for their reception, though some are still quite small and scarcely visible at that time (Mayer, p. 562); while the young *domestic*-figs of the forthcoming *second* crop are comparatively more advanced and their condition practically unfitted for effective oviposition, as already exemplified.

But the Count has taken considerable pains to ascertain the limits within which the dogma of caprification has prevailed; and, among the many writers cited, has been unable to find any allusion to such a practice in the heart of Asia; while from the evidence obtained in other quarters it results, that the middle and north of Italy, the Tyrol, Sardinia, Corsica, the south of France, the north of Spain, the north of Portugal, the Canaries, the Azores, and Egypt, are beyond the pale of these doctrines and ignore them altogether (Solms, pp. 60, 61).

That in these widely divergent regions ficiculture should be in nowise trammelled with such tactics would seem to discredit the notion of any benefit being conferred by this institution beyond fertilizing the seed-germs; which ingeference, as the Count pronounces in his formula, "once necessary," is now "scarcely useful," such seedlings, unless specially favoured—as in the instance cited by Cavolini of "quel fico ora detto del vescovo che nacque in Sorrento su di un muro di un pollajo di quel arcivescovo"—being generally worthless, and the fig-tree at the present day being almost exclusively propagated by layers (fast ausschliesslich durch Marcotten vermehrt—Ib. p. 17).

The incongruous device prescribed as a remedy of equivalent efficacy in the absence of *Caprificus* figs, by substituting in their stead the leaf-galls of the elm (die Aphiden-Blattgallen den Ulm—Ib. p. 76) and other anomalous practices, can only serve as a mere salvo for conscience sake, though inculcated by Theophrastus and his disciples! So also when a single *Caprificus*-tree is planted in the fig-gardens as adequate protection for all the other fig-trees, the result "being left to chance" (Ib. p. 24); as if it were possible for *each fig*, or for the greater part of the crop, to be influenced thereby in the sense which the Neapolitans attribute to this precautionary measure, namely to prevent them from fall-

ing unripe, and to accelerate their maturity.* Others, however, abstaining from traditional theories, have pinned their faith to those principles formulated of old and still maintained unimpaired at Rome, as set forth in the following precept by Cato "*de re rustica*"—reiterated by Varro—whereby both the aforesaid contingencies are provided for without having recourse to equivocal allies: "*Fici ut grossos teneant facito omnia quomodo oleæ et hoc amplius. Cum ver adpetit terram adaggerato bene. Si ita feceris et grossi non cadent et fici scabræ non fient et multo præcociore erunt*" (Solms, p. 86).

Thirdly—we are further informed by Dr. Mayer that, on entering the domestic figs as aforesaid, these insects bring pollen with them, if they should have been furnished therewith in creeping out of the wild-figs; for, notwithstanding their efforts to cleanse themselves therefrom as recited by the Count, some of it still remains, whereby fecundation is effected; no other influence being here ascribed to it. The amount thus retained, however small, must be still further reduced during the "arduous efforts" subsequently made to penetrate through the scales: but, in another passage to which Dr. Mayer adverts, the Count speaks of certain other domestic figs, highly esteemed, termed "*Pedagnuoli*"—† caprificated in summer by means of the "*Profichi*"—in whose florets he could generally discover neither perforation (Stichkanal) nor *Blastophagæ*, but only here and there some very small brown superficial specks (Punkte), which, as he states, must have proceeded from wounds inflicted by the insect, whose puncture had apparently become impracticable from some obscure cause requiring further investigation. Nevertheless, every such floret, which by its brown stains (Flecken) indicated insect-visitation, is encumbered with shifting masses of pollen (mit wech-

* "Ueber den durch die Caprification zu erzielenden Erfolg, sind die Meinungen getheilt. Die neapolitanischen Bauern halten dafür, dass sie das Abfallen der unreifen Feigen verhindere und eine frühere Reife bedinge. Doch sind nach ihrer Meinung nicht alle Sorten derselben in gleichem Maasse bedürftig, wenschon sie niemals schaden kann" (Ib. p. 24). Gasparrini's adverse testimony, founded upon experiments as to the alleged maintenance and earlier ripening, has been already cited (Trans. Ent. Soc. Lond. 1883, p. 391).

† "Die ersten untersten Früchte, die '*pedagnuoli*' der Neapolitanischen Landleute, sind besser und geschätzter als die oberen, die sie '*cimaruoli*' nennen" (Solms, p. 8).

selnden Mengen von Pollen behaftet) that could only have reached the secluded female inflorescence from without. This causes such "*Pedagnuoli*" to produce fertile seed in great abundance, which, as a rule, cannot be expected in figs which no insect has fecundated (sich keines Insektenbesuches erfreuten—Solms, pp. 37, 38).

I may here observe also that the cleansing process habitually practised by the *Blastophaga* on issuing from the wild-fig, is no less applicable to the *Idarnella Caricæ* (*nuper Idarnodes* Westw., Trans. Ent. Soc. Lond., 1883, Errata, p. viii.), according to my Smyrna correspondent, who states:—"I have seen both *Chalcis* and *Blastophaga* clean themselves carefully as soon as they had emerged from their prison."

Fourthly—Dr. Mayer seems to think that, in adverting to Godeheu de Riville's assertion, and to the Count's remark thereon, I treated that passage as applicable to *wild-figs*; whereas the whole tenor of my argument in that paragraph served to show that, in so far as could be gathered from the Count's recital, there was apparently no corresponding evidence bearing upon *ripe domestic-figs*; and that neither the Count himself nor others—save as alleged by this one antiquated writer—had found any *Blastophagæ* in the *latter* (cited by Solms as "*in den reifen Feigen*"—p. 21), the *wild-figs* being their *natural habitat*.

Finally Dr. Mayer tells us the Count and himself had anticipated that, after the appearance of their works, entomologists would take an interest in this apparently hitherto neglected field—where, however, other pioneers had not been wanting to stimulate researches in this direction. He then laments over technical complications in synonymy, &c.; dwelling also on the supreme importance of anatomical investigations for the discrimination of sexual characters; whence we arrive at the gist of his argument, in the reflection which he conceives to have been cast upon himself, in being supposed to confound the male of Cavolini's *Ichneumon ficarius* with the subapterous female of *Sycoscapter insignis*; maintaining his accuracy, not only on anatomical grounds, but also as having witnessed the union of the former with its long-tailed winged partner, so that no mistake can exist thereon. He will however have been gratified to perceive, from Professor Westwood's subsequent memoir in our 'Transactions' (1883,

p. 375; Plate xvi., fig. 1, 1a-f), that, by a fortunate coincidence in the case of a nearly-allied Ceylonese species, no tardy rectification had been made, fully exonerating him from any such imputation long prior to his present remonstrance. I was indeed unfortunate enough to participate myself to a certain extent in this lamentable hallucination (Ibid. p. 16), without however having lapsed quite so far as to implicate the sex.

Stazione Zoologica, Napoli, 28 Dic, '83.

SEHR GEEHRTER HERR,

Indem ich Ihnen für die freundliche Uebersendung Ihrer neuesten Arbeit über Feigeninsekten bestens danke, möchte ich mir gestatten Sie auf einen Irrthum aufmerksam zu machen, den Sie mit Bezug auf Solms' und meine eigene Arbeit begangen haben. Sie sagen p. 390, es gehe aus unserer Darstellung nicht hervor, dass wir in den Blütenständen des zahmen Feigenbaumes *Blastophaga* ♀ gefunden hätten, und es sei daher sowohl in dieser Beziehung als auch betreffs der Uebertragung des Pollens "a lack of evidence" (p. 391 oben). Indessen ist das Gegentheil hiervon der Fall. So sage ich z. B. p. 559 Zeile 12: * "Eröffnet man also eine junge Feige," &c., und dies ist, wie aus dem Vorhergehenden klar wird, eine zahme. Ferner sage ich p. 560 Zeile 5: † "bei den essbaren Feigen," &c. "Hier scheinen die Insekten den Einstich nur zu versuchen," &c. Ebenso p. 561 Zeile 6: ‡ "Was die Einwirkung des Insektenbesuches und auf den zahmen Feigenbaum betrifft, so dass sie die Bestäubung der weiblichen Blüten," &c. Ferner p. 562 Zeile 2: § "als auch in die erste Genera-

* "Eröffnet man also eine junge Feige, deren aussenseite am Ostiolum die Flügel der *Blastophaga* ankleben," &c.

† "Bei den essbaren Feigen verläuft der Vorgang anders. Hier scheinen (Solms, p. 36 und 37) die Insekten entweder den Einstich nur zu versuchen," &c.

‡ "Was die Einwirkung des Insektenbesuches auf den *Caprificus* und auf den zahmen Feigenbaum betrifft, so habe ich oben schon kurz angedeutet (p. 553, Note), dass sie zunächst die Bestäubung der weiblichen Blüten und so die Erzeugung von Samen herbeiführt."

§ "Die ausgeschlüpften ♀ wandern nun sowohl in die zweite Generation des 'Profico,' die sogenannten 'Profichi' (welche in

tion der *essbaren* Feige," &c., und p. 562 Zeile 8:* "die zweite Generation der *essbaren* Feigen." Und *Solms* sagt ausdrücklich p. 36 letzte Zeile: "In den Fiori di Fico stechen die Thiere in der That in den Griffel ein," was also doch voraussetzt, dass sie in das Innere des Blütenstaudes auf dem gewöhnlichen Wege (durch die Bracteen) eingedrungen sind. Sie legen dann das Ei ab, aber nicht in der richtigen Weise, und bringen Pollen mit, falls sie beim Auskriechen aus den Blütenständen des wilden Feigenbaumes sich mit ihm versehen konnten. Vergl. hierüber *Solms* p. 37 unten und 38 oben, wo sogar von Pollenschläuchen die Rede ist.

Wenn sie ferner p. 390 sagen, "which I did not succeed in doing," so bezieht sich die ganze Stelle der *Solms'schen* Abhandlung auf den *Caprificus* und nicht auf die essbare Feige, kann also nicht als Argument gegen uns angeführt werden. Es geht also aus dem Gesagten hervor, dass wir die Hypothese von der Bestäubung der *zahmen* Feige nicht gemacht haben "upon experimental essays made with figs laid open for the purpose of artificially introducing the Blastophagæ, which otherwise are not to be found therein" (*Saunders*, p. 391), sondern dass in der That *ganz normal* die Blastophaga in die zahme Feige eindringt, vorausgesetzt dass der Baum mit den Blütenständen des *Caprificus* behängt, also caprificirt ist. Und da das Insekt trotz seiner Bemühungen, sich vom Pollen zu reinigen, doch noch etwas davon mit sich führt, so bringt es auch die Bestäubung zu Wege.

Das nach dem Erscheinen unserer Arbeiten sich die Entomologen des bis dahin ziemlich vernachlässigten Arbeitsfeldes annehmen würden, haben wir vorausgesehen. Leider scheint aber die Verwirrung der Synonymie und Systematik einstweilen noch im Zunehmen begriffen zu sein, was ich im Interesse der Sache sehr bedauere. Ich finde es aber unrecht, wenn man bloß Beschreibungen neuer Arten mit zum Theil recht

Form und Grösse von den 'Mamme' sehr verschieden sind) als auch in die erste Generation der essbaren Feige, die sogenannten 'Fiori di Fico' ein, legen aber nur dort ihre Eier ab."

* Diese, aus den 'Profichi' hervorgekommen, stechen eben sowohl die um jene Zeit noch sehr kleinen 'Fichi' d. h. die zweite Generation der essbaren Feigen—allerdings auch diese ohne Erfolg—als auch die dritte Generation der wilden Feigen, die sogenannten 'Mammoni' an."

ungenügenden Zeichnungen veröffentlicht, ohne sich um die Anatomie der Thiere zu kümmern, welche in so exceptionellen Fällen das einzige Mittel ist, um das Geschlecht der Thiere zu bestimmen. So z. B. Westwood (Trans. Ent. Soc. Lond. for 1883, p. 30) der mir vorwirft, ich habe ein "subapterous insect," das wol identisch mit *Sycosapter insignis* ♀ sei, für das Männchen des "*Ichneumon ficarius*" gehalten. Natürlich habe ich das nur auf Grund anatomischer Untersuchung gethan, aber auch die Begattung beobachtet, sodass hierüber kein Zweifel sein kann. Prof. Mayr in Wien wird später wol viel Arbeit bekommen, um die inzwischen entstandenen falschen Synonymien wieder zu beseitigen, ist aber glücklicherweise der Mann für derartige schwierige Unternehmungen auf systematischem Gebiete.

Vielleicht finden Sie, geehrter Herr, bei einer späteren Publikation Gelegenheit, auf die oben berührten Punkte zurückzukommen und bei Ihren Landsleuten, die wohl mehr Ihre Kritik unserer Arbeiten, als die Originale lesen werden, das Misverständnis zu beseitigen. Inzwischen bin ich,

Ihr ganz ergebener

Dr. PAUL MAYER

IX. On the "Pediculus Melittæ" of Kirby and its affinities, with reference to the larvæ of Meloë.
By Sir SIDNEY S. SAUNDERS, C.M.G.

[Read April 2nd, 1884.]

AMONG the mysterious problems which have perplexed entomologists during a considerable period, and for which no solution has hitherto been afforded, is one affecting the character and economy of a British insect found not unfrequently in the immediate vicinity of this metropolis, whose natural affinities still remain debatable ground, notwithstanding the attention bestowed thereon by many distinguished writers. This insect was first figured and described by Kirby in the second year of the present century under the name of *Pediculus Melittæ* (Mon. Ap. Angl., vol. i., tab. xiv., No. 11, figs. 10, 11, 12; and vol. ii., p. 168), for which he afterwards substituted that of *Melittophagus Melittæ* (K. & S., Introd. to Entom., vol. i., p. 163, 5th edit., note, 1812).

In the former work, after describing his *Melitta fuscata*, he proceeds to say:—"On this insect I found a *Pediculus* nearly related to the *P. Apis* of Fabricius, but I think distinct, which I shall define in the margin."* The latter, Kirby explains, is not uncommon upon this genus of bees, having found fourteen or fifteen upon the same individual, and having likewise frequently met with it upon genuine *Apes*; but the former he had only taken on this occasion. He was fully aware that the *P. Apis* aforesaid had been reared from the eggs of *Meloë* by Frisch, Goedart, and DeGeer; whence, as he admits, "it appears evident that the hexapod, of which the latter author gives a long account as the larva of *Meloë*

* Kirby's description of his *P. Melittæ* is as follows:—Linearis, niger; ore tibiisque testaceis. Long. corp. lin $\frac{3}{4}$. Hab. in Melittis semel lectus. Major *P. Apum* et distinctus. Corpus angustum, lineare, nigrum. Antennæ biarticulatæ seta terminali. Thorax trium segmentorum. Tibiæ Tarsique pallide testacei; hi fere lanceiformes, exarticulati, utrinque seta armati. Anus setis quatuor instructus exterioribus brevibus.

proscarabæus, strange as it may seem, is no other than this insect"; but its subsequent life-history being at that time unknown, he could not "help suspecting that there is some illusion in the case."

In 1817 Baron C. A. Walckenaer, in his 'Mémoires pour servir à l'histoire naturelle des Abeilles solitaires qui composent le genre *Halictus*,' adverts to the *Pediculus Melittæ* as having been thus reared from the eggs of *Meloë* (pp. 86, 87); and describes under this name a yellow specimen which he had found on *Halictus quadristrigatus*, Latr. (*ecaphosus*, Walck.), giving Kirby's description of the black *Pediculus* as a "variety" of the former. He misquotes Kirby's reference to DeGeer as indicating that the *P. Melittæ* was the larva of *Meloë*, adding that his own insect aforesaid was in all essential characters exactly similar to Kirby's specimen; "ils diffèrent seulement entre eux par la couleur, qui est noire dans le *P. Melittæ* (of Kirby), et fauve-claire dans l'individu que j'ai décrit; et par les soies qui terminent l'abdomen; dans le *P. Halicti* ce sont les supérieures qui sont les plus longues; dans le *P. Melittæ* de M. Kirby ce sont les inférieures"; but he proceeds to explain that this difference in the relative length of the caudal setæ might be attributable to misplacement in the setting of his specimen—"de la manière dont ces soies étaient dirigées lorsqu'on les dessina." Thus he placed no reliance upon the accuracy of his description "*anus setis quatuor instructus exterioribus longioribus*," as represented in his figure. He considers these two insects as varieties of the same species, observing that "très certainement les observations faites sur l'un seront vraies pour l'autre; et ils sont tous deux également des insectes aptères et complets ou des larves du Proscarabée" (p. 84).

In a memoir by Professor Westwood, which appeared in the second volume of our 'Transactions' (1836) respecting "the larva of the *Stylopidæ* and the animal produced from the eggs of *Meloë*," at a time when the hexapod larvæ of the former were regarded as parasites upon the adult apod larviform female, it is observed that these supposed parasites "reminded him most strongly of the parasite of the bee, which Mr. Kirby has described under the name of *Pediculus melittæ*, and Dufour under that of *Triungulinus andrenetarum*; and that no one, it is admitted, has ever seen the larva of

Meloë, except as one of these minute *Pediculi melittæ*, as Kirby calls them." But the identity of the latter with the former was not accepted by Kirby, who treated them as distinct; and Dufour described his *Triungulinus* as "*pallide rufus*," thus obviously coinciding with the now acknowledged larvæ of *Meloë*, to which indeed Dufour expressly refers it, as corresponding with the "*Pou d'abeille* que Linnæus designa sous le nom de *Pediculus Apis*, en l'accompagnant de cette courte phrase spécifique, *filiformis ferrugineus*" (Ann. Sc. Nat. Zool., Tom. xiii., 1828, p. 62; tab. ix., figs. 1—4). Nevertheless, it would seem far from improbable that this surmised identity, not hitherto established, may eventually be confirmed.

Mr. George Newport, in his first memoir "On the Natural History, Anatomy, and Development of the *Meloë*" (Trans. Linn. Soc., vol. xx., 1847, p. 297), mentions the circumstance that on the 16th of July, 1829, he captured a specimen of *Osmia spinulosa*, on which he found a parasite precisely similar, in form, size, and activity, to the larvæ from the eggs of *Meloë*, but "it differed entirely from the others in colour. It was *deep black*, with brown eyes." In this respect it closely agreed with the parasite found by the Rev. Mr. Kirby on *Andrena fuscata*, and regarded by him as distinct from the yellow larva described by Linnæus and Fabricius as *Pediculus Apis*, and also by M. Léon Dufour, as lately as 1828, as a distinct genus of apterous insects, by the name of *Triungulinus andrenetarum*. I have no doubt (he adds) of the correctness of Mr. Kirby's opinion, that the larva found by him on *Andrena* was distinct from the yellow larva of *Meloë*, the *Pediculus Apis* of Fabricius; and I have little doubt also of its identity with that taken by myself on *Osmia spinulosa*. These certainly are not the larvæ of either of the *Meloës* I have examined, although I am equally satisfied that they are the larvæ of *some genus of the same family*. The larvæ I have reared from the eggs of *Meloë violaceus*, *M. proscarabæus*, and *M. cicatricosus* have always so exactly resembled each other in their yellow colour and in form that I have been unable to distinguish them, excepting by a slight difference in size. The larvæ of *M. cicatricosus* are a little larger than those of the other species. I may also state that these larvæ always retain their yellow colour, and only become a little darker after they have been several days from the egg (pp. 310, 311).

He here refers in a footnote to the larva of *Cantharis vesicatoria*, which Zier says "is of a yellow colour when it leaves the egg, but soon afterwards changes to a deep black"; and Newport suggests that "perhaps the larvæ described by Mr. Kirby, and that found by himself on *Osmia*, may be more nearly allied to this insect." But of the aforesaid larva of *Cantharis*—as more accurately defined in Newport's second memoir on this subject (*loc. cit.*, p. 323)—I possess specimens reared from the egg by M. Jules Lichtenstein, of Montpellier, which, although exhibiting the usual structural analogy of the *Meloïdæ*, are utterly at variance with the specimens now under consideration, whether yellow or black.

The late Mr. Frederick Smith, who frequently met with both these insects, and who has recorded his observations thereon on several occasions, is most conflicting in his remarks respecting them. Thus in the third volume of our 'Transactions' (1842, p. 294), in his "Notes on the genus *Nomada* and on other insects," he states:—"In April, 1841, I found the supposed larvæ of *Meloë proscarabæus* in profusion in the flowers of a wild plant; as many as twenty in some flowers; I might have collected thousands. This was in Bishop's Wood, Hampstead. In June of the same year I found a similar insect or larvæ (*sic*) attached to the under side of the abdomen of *Nomada Schæfferella*. They are evidently distinct species, different in form and colour, *one being black, the other yellow.*"

He here speaks of the one and the other in the singular—which then are the *thousands* adverted to in the first instance? He must have conceived that in defining these multitudes as "the supposed larvæ of *Meloë*" it would be sufficiently obvious that such larvæ are always *yellow*, and consequently that the "similar insect" found on a *Nomada* could only be *the black*; but why invert their order of precedence? By appending the qualification "*or larvæ*" he would seem to hesitate as to the character of this second insect, in accordance with the doubts he has elsewhere expressed in regard to the *Pediculus Melittæ*, whether to be regarded as a *larval form* or as a *perfect insect*; and in employing the plural here (unless by a slip of the pen) he may have found more than one of this "similar insect" on the aforesaid *Nomada*, though he does not say so. They could not, however, have amounted to "*thousands*"! This

coincides with the comparative rarity of the *black* individuals; while it is a well-known fact that the larvæ of *Melöe* are most abundant in spots where the eggs have been deposited, a single stem being sometimes densely covered with them; and Newport who, as well as Goedart, counted their eggs, compute them alike at upwards of four thousand in the ovaries of a single female (Trans. Linn. Soc., *loc. cit.*, pp. 302—304).

In alluding however to Smith’s recital aforesaid, Newport considers that he found the *black* individuals thus numerous. He says:—“Mr. F. Smith, to whom I have referred in my former paper, has, as I have there stated (p. 310), taken similar *black* larvæ in great profusion on the *Andrenidæ*, especially on *Andrena fuscata*, captured in the spring on Hampstead Heath, where different species of the adult Meloës are often abundant. In April, 1841, he found similar *black* larvæ in such profusion within the flowers of the buttercup (*Ranunculus acris*, L.) in a damp field at Bishop’s Wood, Hampstead, that he might have collected thousands of them, there being often as many as twenty in the corolla of a single flower. But he never found a yellow-coloured specimen on any of the *Andrenidæ*!” In the former paper to which he adverts Newport also alleges that “all the specimens he (Mr. Smith) has found on the *Andrenidæ* have been *black*, like Mr. Kirby’s species, and he has not met with a single yellow one on any species of that family. On the contrary, all the specimens he has found on the *Nomadæ* and *Volucellæ* have been *yellow*, like the larvæ of *Meloë*!” Smith, however, distinctly refutes this curious assumption on another occasion, when, speaking of the “small *orange-coloured Pediculus*” which he had several times reared from the eggs of *Meloë*, he observes, with reference to Newport’s memoir aforesaid:—“In this paper it is shown that the larva of the beetle feeds on that of *Anthophora acervorum*; but it remains to be proved that the larva of an *Andrena* can serve as food of *Meloë*. I am inclined to think this can never be the case; and that *the fact of our finding them on these bees* is a mere indication of the usual habit of the larvæ of attaching themselves to *any insect* that comes in their way; for we as constanly find them on Diptera and flower-visiting Coleoptera, as upon the *Andrenidæ*” (Cat. Brit. Hym. in the Brit. Mus., *Andrenidæ* and *Apidæ*, 1855, p. 48). The same remarks are

recapitulated in the second edition of this work (1876, p. 24). It would indeed be preposterous to conceive that these parasitic larvæ, whether yellow or black, should be gifted with any special power of discrimination in the selection of particular individuals by intuitive perception at a single glance, their vast numbers serving to compensate for the preponderance of failures to obtain a suitable habitat on such occasions.

But a remarkable circumstance is recorded by Smith in a "Note on the *Pediculus Melittæ* of Kirby" which appeared in the second series of our 'Transactions' (vol. ii., 1852, p. 4), wherein he relates that on the 6th of April in the previous year, having "dug up on Hampstead Heath"* a number of specimens of *Anthophora*, when these bees were in a semi-torpid state, it being about six weeks earlier than their usual time of appearance, he "placed a number of them separately in pill-boxes, and on examining them some days afterwards, was surprised to see several living specimens of the *Pediculus* running over the bees. This observation," he continues, "appears to me to render the question even more perplexing than before, or it is confirmatory of Léon Dufour's opinion that these supposed larvæ are perfect insects."

Here we are again involved in a similar complication between the yellow and the black; for, as already shown, Dufour's *Triungulinus* was the ordinary yellow larva of *Meloë*; whereas those found in the cells of *Anthophora*, as aforesaid, are referred to "the *P. Melittæ* of Kirby, and were therefore black; as to be inferred also from the context, when adverting in the first instance to Newport's larva, found on *Osmia spinulosa*, "resembling that of *Meloë* in form, but of a deep black colour." Yet after citing Newport's observation that "this is certainly not the larva of either of the species of *Meloë* which he had observed, although he was equally satisfied that it is the larva of some genus of the same family," Smith forthwith confounds both these larvæ by stating that "M. Léon Dufour considered this animal to be an apterous perfect insect, as also did Mr. Kirby, who named it *Pediculus Melittæ*!"

But the main point to be considered in Smith's dis-

* These words are supplemented from Smith's version in the Brit. Museum Cat., elsewhere referred to.

covery is, that these “*Pediculi*” were “found in company with the perfect bees” within their closed cells; upon which circumstance he comments as follows:—“It is certain (he says) that, as the *Anthophoræ* had never quitted their cells, the *Pediculi* must either have made their own way into the nest, or have been conveyed thither by the parent bee of the previous season. Assuming the latter to be the case, we find a creature in every respect similar to those deposited, after twelve months have elapsed, neither changed in form or colouring”; whereas, as Newport has shown, “it is reasonable to suppose that the larva of *Meloë*, conveyed into the bees’ cells, arrives at the perfect condition in the following spring.” Hence Smith is “inclined to regard the *Pediculus* as being a perfect insect, which resides in the nests of bees, feeding on the pollen, depositing its egg, and undergoing its metamorphosis in the cells of bees; of similar habits to the *Acari* which infest Humble-bees, feeding on the honey and wax, and to be observed there during summer in various stages of development.”

In the Museum Catalogues of 1855 and 2nd edit. 1876, already referred to, Smith summarizes his observations upon this subject; remarking, in the first instance, that “what these *Pediculi* really are is at present involved in complete obscurity”; reiterating that “Mr. Kirby regarded them as insects in their perfect condition, naming them *Pediculi Melittæ*.” It does not however appear that any such opinion was expressed by the latter; and, in fact, Smith in a subsequent page, when treating of *Andrena fuscata* in the second edition aforesaid, retracts this assertion, when he states that “Kirby, relying upon the figure and description of De Geer, concluded that it was *the larva of a species of Meloë*” (p. 71)! Smith then refers to the incident of “Bishop’s Wood,” having, as he states, frequently observed these creatures in considerable numbers in the flowers of *Ranunculus acris*, as many as twenty or more in a single flower, about the month of April; and I think always before the usual time for meeting with the larvæ of *Meloë*. Here indeed he follows Newport, in attributing these “considerable numbers” to the *P. Melittæ*; unmindful of his original definition thereof as the larvæ of *Meloë*. As regards the living specimens found “in the same cell as the perfect bee,” he cites this circumstance as inducing him “to hesitate in adopting an opinion of the

Pediculus being a larva at all"; although, as he adds, it is certainly possible that they might have subsisted on a portion of the food laid up by *Anthophora*; but here was no change of condition, and how came they into the cell? He is therefore "inclined to think that they, being insects in their perfect condition, came there exactly in the same way as we find *Forficulæ*, having forced an entrance, which he did not observe, and that they were in quest of food, seeking what they might devour." But this opinion is also modified at a later page of the same edition (p. 71), for he there observes:—"That it is the larva of some insect is most probable; this, in Kirby's words, 'future observation will clear up.'"

Thus this question still remains in abeyance; nor does it appear to have occurred to Smith that these insects, structurally corresponding with the larvæ of *Meloë*, must, like them, be frequently transported by their Pegasi into cells where they are not likely to find available resources for their future development; although, as he admits (*loc. cit.*, p. 71), "we know now that the larvæ of *Meloë* only increase in size after they have changed to the apod condition"; for, as Fabre has shown, in his interesting Mémoire on the habits of *Sitaris* and *Meloë* (Ann. Sc. Nat., 4e Sér., Zool., Tome vii., 1857), it is essential to these larvæ not only that they should be conveyed to a suitable abode, but also that they should find the undeveloped egg of the bee disposable in the first instance, in order to undergo their primary metamorphosis and assume such apod condition, after which they would be enabled to plunge into and feed upon the honey-store provided by their victim for its own progeny. Failing successful issues in both instances these larvæ must incur the risk of being shut up in a closed cell until the following year, together with the young bee of the succeeding brood unmolested in its development, as Smith found them.

Their means of sustenance during this prolonged interval does not appear to offer any insuperable difficulty. Smith himself, as already mentioned, admits "that they might have subsisted on a portion of the food laid up by *Anthophora*"; and Newport adverts to a circumstance which strengthens this probability; for, having placed a few of the larvæ in the cells of a piece of old honeycomb, he "found that, contrary to their usual habit of wandering, they remained perfectly quiet at the bottom

of their cells” (Linn. Trans., *l. c.*, p. 315). The young hexapod larvæ of *Sitaris*, according to Fabre, remain fasting for a considerable period—“sept ou huit mois d’abstinence absolue” (Ann. Sc. Nat., *loc. cit.*, p. 326)—before they can obtain access to the cells of the forthcoming brood; and, considering the opportunity which is afforded to the incarcerated larvæ of *Meloë* of obtaining some nutriment when thus unable to effect their primary metamorphosis, there would seem to be nothing unreasonable that they should be enabled to survive until the newly-developed bees emerge with them early in the ensuing spring, when (as Smith has observed) they would be met with before the usual period for the appearance of the ordinary *Meloë* larvæ, and ready to avail themselves of another opportunity of finding a suitable domicile.

That such hibernating larvæ, in their more mature condition, should be of *larger size* and *darker hue* is by no means incompatible with such preliminaries; for Newport comes “to the conclusion, in opposition (as he says) to the opinion often advanced by others, that the larvæ grow slightly while on the bodies of the bees, before they are conveyed to their nests” (*loc. cit.*, p. 325). So also with respect to colour, Newport has observed that these larvæ “become a little darker after they have been several days from the egg” (*l. c.*, p. 311), which a longer period would be likely to intensify; so that it would seem to be a natural consequence of such protracted seclusion in a state of torpor within a closed subterranean cell, that their aspect should be further affected thereby in merging to pitchy black, as we find them.

It has been clearly determined that these are not the *newly-hatched larvæ* of any of the species of *Meloë* frequenting Hampstead, all of which have been reared from the egg by Newport as well as by Smith, while perfectly coinciding therewith in all the minutiae of structural details: nor can they be referred to any other *Meloïdæ* met with there; neither can we hesitate to recognise that in functional propensities they must in like manner be closely allied to the aforesaid; for it cannot be entertained that these insects, endowed with all the appliances so essential to the existence of the young larvæ of *Meloë*, should controvert all recognised doctrines of analogy and affinity by riding steeple-chases at random from place to place in mere idleness of sport.

It may indeed be conceivable that Kirby himself eventually renounced his original notion as to the *P. Melittæ* being distinct from the *P. Apis*, for, in adverting to his *Melittophagus*, as corresponding with the species cited in his *Mon. Ap. Ang.* (*ante*, p. 107), he inserts a memorandum, copied from his common-place-book, under date of May 7th, 1812, wherein he states that he had found on certain flowers "a great number of this insect, which seemed extremely restless, running here and there over the flowers and over each other, with great swiftness mounting the anthers, and sometimes lifting themselves up above them, as if looking for something." This is precisely the character of the young larvæ of *Meloë*, when met with in a swarm near the place of their birth, but inapplicable to the *black* individuals, which are far more sluggish and not found thus congregated. Nevertheless, Kirby makes no mention of *colour* here, while unreservedly referring this multitude to his *P. Melittæ*, under a new generic name, without any comment thereon, though still diffident as to their imputed lineage.

But, in order to obtain some clue to the presumable identity of Kirby's so-called *Pediculi*, alias *Melittophagi*, with the larvæ of *Meloë*, three tests may be propounded, the successful issue of any one of which may suffice for this purpose:—

1. By segregating some of the former in separate tubes with suitable accompaniments—such as the brood-cell of an *Anthophora* furnished with a newly-deposited egg of the bee, or other substitutes, as mentioned below—their characteristic metamorphosis to the apod larva would afford adequate proof to this effect. But the pollen-paste (which might also be artificially prepared with honey) should be somewhat *dry*, to avoid any glutinous tendency impeding fresh access to the egg, which would be fatal to the hexapod, accustomed to slip down on the latter at the moment of oviposition, to avert such a calamity. The egg, moreover, might be provided from the ovary of a fresh-killed specimen of this bee, or even from that of a wasp; for M. Jules Lichtenstein, of Montpellier, whose indomitable perseverance in such researches is well known, found the young larvæ of *Meloë cicatricosus* readily tempted to avail themselves of such a medium (*Ann. Soc. Ent. Fr.*, 5e Sér., Tome v., 1875, p. clxiii). Other devices may also be resorted to

in case of need, the honey-bag of a hive-bee having proved acceptable to the larva of *Cantharis vesicatoria* (*Ibid*).

2. Another test, no less efficacious, would be the converse of the former, involving less preliminary complications and readily applicable. This would consist in simply inclosing within separate tubes some of the ordinary yellow larvæ of *Meloë*, whether bred or found at large; supplying them with some suitable pabulum, such as they might find in the cells of *Anthophora*, and leaving them for a certain period in complete obscurity, the tubes not corked, but well closed with an admixture of paper and earth, to prevent all possibility of escape, whereby their contested pseudo-metamorphosis in size and colour might be verified in the sequel.

3. A further test, depending upon the structure of the antennæ in different species of *Meloë* larvæ, would also be available, for in those of *M. cicatricosus* the terminal 3rd joint is very elongate and slender (twice as long, and less than half as broad, as the 2nd); whereas it is as short as, or shorter than, the 2nd in other species. A corresponding diversity in the antennæ should therefore be apparent among the *black* as among the *yellow* individuals, when any of the latter have been occasionally arrested in their development.

In the *P. Melittæ* found at Hampstead, where *M. cicatricosus* is not met with, the antennæ invariably exhibit the short terminal joint as aforesaid, which likewise occurs in some few specimens that I have obtained from other localities (Norwich and Tunbridge Wells); but, strange as it would appear, the former are not known to occur on the Continent, where the *M. cicatricosus* is not uncommon; and M. Lichtenstein, to whom I am indebted for the young larvæ of this species reared from the egg, has not succeeded in finding any *black* individuals within the range of his researches. He has however observed that artificial honey-paste proves more attractive to some of these hexapod larvæ when combined with a portion of animal matter, such as the macerated larvæ of a bee or wasp, thus imparting a delectable flavour which they seem to relish, and whereby (in the case of *Cantharis*) he succeeded in obtaining the first moult (*Ibid*).

I may mention, in conclusion, that I possess two other *black* larvæ considerably broader and proportionally less elongate than the *P. Melittæ*; these were presented to

me by Mr. Smith, who, as he thought, had received them from Italy, with other insects, ticketed as the larvæ of *Meloë variegatus*. These have all the characteristics of the ordinary larvæ of *Meloë*, with the usual peculiar tarsi, the antennæ having the 2nd joint very short, the terminal more slender and moderately long, with a hair-like apical seta as usual; the thorax and abdomen furnished, at the base of each segment, with two or three long lateral spines, as also the base of the head, the vertex having several short stout spines in front; the abdomen terminating in four elongate setæ; the outer pair shorter than the intermediate pair, though the former much longer than usual. I am not aware that the larva of this species has ever been noticed before, but, as the adults are habitually found along the coast near Margate (Leach, Trans. Linn. Soc., vol. xi., 1813, p. 39; Ent. Mo. Mag., vol. xviii., 1882, p. 277), it would be interesting to determine the character of their young by rearing some of these from the egg, in order to ascertain whether they really correspond with the aforesaid, and also whether they are originally of such jet-black hue.

This recital, involving questions for the solution of which the materials lie within easy reach, and almost at our very doors, but which have nevertheless challenged the acumen of many of our ablest entomologists during the last eighty years, may possibly induce some of our younger members to direct their attention to the habits of this remarkable group, and to the closer investigation of those still obscure phases in their life-history which have proved so embarrassing heretofore.

As bearing on the question of age and origin it may be desirable to place on record the most important captures of these insects at different periods, serving to indicate their usual times of appearance, though sometimes divergent therefrom.

1. Of the *black*.

The earliest period at which I have met with these at Hampstead was on 4th April, 1875, when I was enabled to detect no less than six specimens of the *P. Melittæ* on the southern slopes of "The Vale of Health," closely affixed, like long polished rolls, to the thoracical region of various *Andrenæ* basking in the sun, chiefly on *Andrena atriceps*; when also I captured on the wing, in

the same locality, a fully-developed male *Stylops* (*S. Melittæ*, Kirby), now in my collection.

On the 7th May, 1877, I captured a *Nomada lineola* in the same locality, having no less than three fine specimens of the *P. Melittæ* affixed below the thoracical region. My latest dates of captures there have extended only to the following:—May 20th, on *Andrena fulvescens*, one specimen; May 23rd, on *A. Afzeliella*, ditto; May 9th, Tunbridge Wells, one on *Andrena* [specific name omitted, E. A. F.]; May 10th, Norwich, on *A. nigro-ænea*.

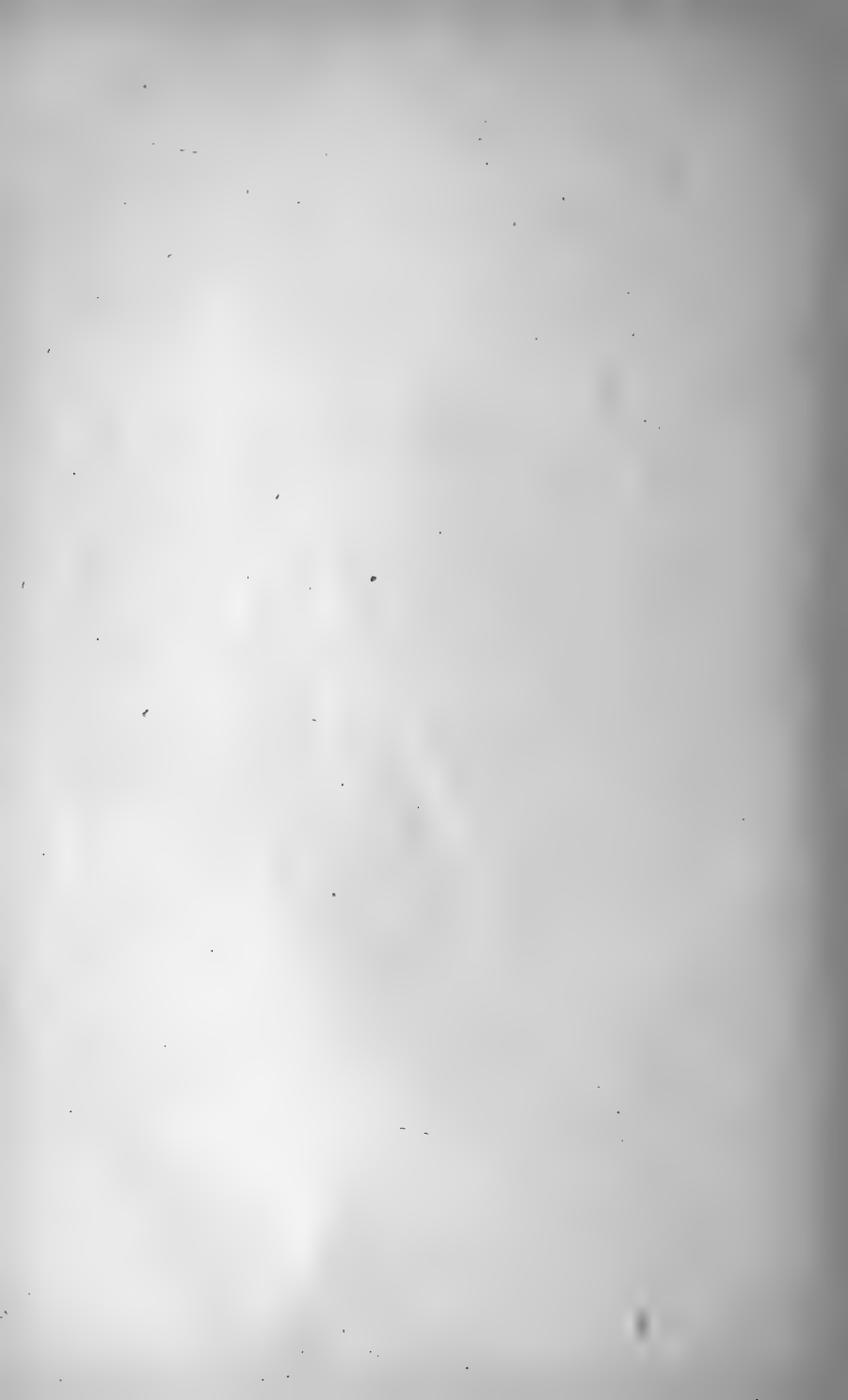
2. Of the yellow.

The earliest specimens of the *P. Apis* of Linnæus are found at Hampstead towards the middle or end of May. Newport removed (the 8th April) a packet of eggs which *M. violaceus* had deposited in her burrow on that day. The young hexapods did not emerge therefrom until 25th April (17 days).

Newport also records a specimen of *Meloë proscarabæus* found digging her burrow for oviposition on 1st May. A later batch was deposited by the same *Meloë* on 30th May. The broods were respectively developed on 24th May and 14th June. Hence Newport computes the average period of their appearance from the egg to absorb from four to five weeks (*loc. cit.*, p. 305).

I once took a *Volucella plumata* on the 11th June on Reigate Hill, when settled on a low flower, on which *Volucella* I found thirty-six specimens of the yellow larvæ of *Meloë*, which I counted on my return home. Intending to retain these larvæ *in situ*, I killed this fly in cyanide of potassium. I pinned and expanded it for this purpose. When dry, however, two or three days later, I observed that some of these larvæ were still alive, and none of them being attached to the hairs as before, they all came off. I then removed the apparently lifeless specimens to a bottle of water, to prevent contraction, where they remained immersed about a week (in fact until the 20th), when, on proceeding to mount these specimens, I found them still moving their legs, and likely to recover from this protracted immersion, during which their abdominal segments had become considerably distended, leaving a wide translucent streak between each.

[At this point the manuscript was laid down, as the author was unable to write more; his death on the following day prevented its completion.]



X. *North American Tortricidæ*. By Lord WALSINGHAM,
M.A., F.Z.S., &c.

[Read April 2nd, 1884.]

PLATE IV.

IN the course of the last two years I have received from a well-known collector, Mr. H. K. Morrison, several boxes of *Tortricidæ*, *Tineidæ*, and *Pterophoridæ* from North America. The *Tortricidæ*, of which I propose to give a complete list, so far as they can be properly identified, include specimens from Arizona, Mexico, Florida, North Carolina, Wisconsin, and Montana. These several collections are interesting, not only on account of the rather numerous undescribed species represented in them, but more especially as illustrating the subject of geographical distribution.

In the following list I propose to adopt the provisional arrangement and classification followed in Prof. Fernald's Catalogue, published in the 'Transactions' of the American Entomological Society, Philadelphia, in 1882; but I trust that the time is not far distant when the results of those more mature studies which he has foreshadowed may be made known. The collection from Arizona contains a large proportion of species which range northward to California, some even to Oregon, and which exhibit no important degrees of variation within these limits. The few Mexican specimens belong, with one exception, to undescribed species.

From Florida we get two species, originally figured by Hübner under the names *Eucosma circulana* and *Pharmacis sartana*; the reappearance of the latter is interesting as dispelling the illusion that it was equivalent to Robinson's *Conchylis bimaculana*.

North Carolina yields many species described by Clemens and Robinson; but, with very few exceptions, these, as well as those from Wisconsin and Montana, are found to be exclusively representatives of the fauna of the Eastern States, although not a few of them have

a widely-extended range of distribution to north and south.

The great dividing range of the Rocky Mountains exercises, as might have been expected, a very important influence upon the Micro-Lepidoptera of North America, forming a barrier over which these delicate insects are apparently unable to pass. The proportion of eastern species found on the western side of this barrier is remarkably small, although the same genera are for the most part represented more or less abundantly in both parts of the continent.

It has been a matter of regret to me that the single plate which accompanies this paper was prepared before a number of the more interesting species reached me. I am unwilling to delay the publication of the paper until the return of the artist, who is now abroad; but I trust that at some future time I may be able to include, in another publication, good figures of the greater portion of the species herein described, several of which, represented as they are by one or two specimens only, I am unable at present to distribute among my many obliging correspondents in America.

Pædisca giganteana, Riley, and *Cænectra irrorea*, Rob., were not recognised as described species until after they had been included in the plate; but figures of both these species will, I hope, be found useful.

TORTRICIDÆ.

TORTRICINÆ.

CACÆCIA, *Hüb.*

Cacæcia rosaceana, Harris.

One male. Wisconsin.

Cacæcia purpurana, Clem.

One male. Wisconsin.

Cacæcia cerasivorana, Fitch.

One pair. Wisconsin.

Cacæcia parallela, Robs.

Three males, one female. Wisconsin.

C. obsoletana, Walk., one male, Montana; *C. transiturana*, Walk., three females, Montana.

It is extremely probable, as suggested by Professor Fernald, in his "Catalogue of the Tortricidæ of North America," p. 12 (Trans. Am. Ent. Soc., Phil., 1882), that these may be the opposite sexes of one and the same species.

In addition to the four specimens above mentioned, I have received from Florida a pair, evidently belonging to one species, which agree entirely with Robinson's figure and description of *C. sanbornana* (Trans. Am. Ent. Soc., ii., p. 265, pl. 1, f. 8). The under sides of the wings are more decidedly ochreous than in the more northern specimens—the fasciæ obsolete, indicated only by patches of purplish scales. I have no doubt that Fernald is right in regarding *sanbornana*, Rob., as a synonym of *transiturana*, Walker, but the male differs somewhat in appearance from the Montana male of *obsoletana*, which agrees more closely with the figure and description of the variety (?) described by Clemens under the name *vesperana*.

LOXOTÆNIA, Steph.

Loxotænia virescana, Clem.

One male. Arizona.

This specimen is somewhat larger than Zeller's type of *L. sescuplana*, which Fernald has identified as this species. *L. glaucana*, Wlsm., although much darker in colour than any specimens that have reached me from the Eastern States, may not impossibly prove to be also a large variety of the same.

LOPHODERUS, Steph.

Lophoderus triferana, Walk.

Five specimens. N. Carolina.

Lophoderus politana, Haw.

Four specimens. Wisconsin.

? *Lophoderus mariana*, Fern.

One male. Florida.

Not having seen specimens of this species, I am somewhat doubtful if I have rightly identified it, but it does not appear to belong to any other described species.

SCIAPHILA, *Treits.**Sciaphila arizonana*, n. s. (Pl. IV., fig. 1).

Palpi dirty white above, brownish fuscous at the sides. Head dirty whitish, the joints of the antennæ brownish fuscous, strongly pubescent, with greyish white hairs. Thorax fuscous. Fore wings (with the costa slightly arched near the base, straight beyond, the apex rounded, apical margin very slightly concave) pale whitish straw-colour, the margins shaded and blotched with fuscous. The costal half of the wing at the base is fuscous; beyond the base is a small costal spot of the same colour, from which some scattered dark scales are traceable to the dorsal margin. Scarcely beyond the middle of the wing is a large fuscous costal blotch, its inner edge tending obliquely outwards towards the anal angle, in which direction it can be faintly traced by a few scattered dark scales. At the apex is a similar dark patch connected with the base of the wing by a shade of the same colour around the apical and dorsal margins. Between the more conspicuous costal blotches are some small fuscous dots. The cilia are of the paler ground colour of the wing, with a fuscous line along their middle. Hind wings dull greyish; cilia paler, with a fuscous line along their middle. Tarsi pale straw-colour, spotted with fuscous. Exp. al. 16 mm.

Two males. Arizona.

TORTRIX, *Linn.**Tortrix pallorana*, Rob.

Two females. Montana.

I am not quite confident that I have rightly identified this species; the specimens are both females, and are much larger than Robinson's measurement, one being 33 mm. in expanse; the hind wings have a slight greyish tinge, rather than very pale ochreous, as stated in the description of the type.

Tortrix quercifoliana, Fitch.

One male. N. Carolina.

Tortrix peritana, Clem.

Twelve specimens. N. Carolina.

AMORBIA, *Clem.**Amorbia humerosana*, Clem., var.

One male. N. Carolina.

This is a fine dark variety of the species described by Clemens, if indeed it is not specifically distinct from it. It differs in the absence of the conspicuous rufous tinge about the dorsal margin, which distinguishes the ordinary varieties, and which in this is replaced by scattered tawny scales not plainly distinguishable from the ground colour of the wings. The whole surface of the wings is considerably darker than usual, being of a dark smoky grey throughout, on which the ordinary darker shade, although occupying the same position as in the paler varieties, are less noticeable. The hind wings are also very much darker than in the usual form.

ÆNECTRA, *Guenée*.

Ænectra irrorea, Rob. (Pl. IV., fig. 3).

Robinson's figure (Trans. Am. Ent. Soc., vol. ii., pl. v., fig. 44) scarcely gives a sufficiently accurate idea of this lovely species; a redescription may be useful.

Palpi dark brown externally, tinged with ochreous on their inner side. Head and antennæ brown, tinged with ochreous. Thorax dull ochreous above, the patagia blotched with deep brown. Abdomen pale ochreous. Fore wings with costa much arched, bright ochreous, the extreme base of the costa deep purplish black, followed by a chestnut-brown shade. A deep purplish black blotch above the outer half of the fold, surrounded by a bright chestnut-brown shade reaching to the dorsal margin, on which are a few black scales. Above and below this blotch is a spot of similar purplish black scales on the subcostal vein, also surrounded by a chestnut-brown shade, and immediately below the costal margin at the commencement of the outer third of its length is a slightly larger spot of the same colour, from which a bright chestnut shade is extended outwardly along the costa not reaching the apex; from this shade to the anal angle, running nearly parallel with the apical margin, is a series of six or eight purplish black dots, each accompanied by a few chestnut-brown scales. There is a narrow line of chestnut-brown along the apical margin; the cilia bright ochreous. All the wings freely reticulated with brown on their under sides. Hind wings pale cinereous, showing through them the reticulations of the under side. Expanse, 19 mm.

One male. N. Carolina.

Ænectra violaceana, Robs.

Four specimens. Wisconsin.

Ænectra? striata, n. s. (Pl. IV., fig. 2).

Head and palpi pale ochreous, tinged with reddish brown at the sides. Antennæ strongly pubescent, dull ochreous. Thorax ochreous, tinged with reddish brown, with a few iridescent bluish scales at the back. Fore wings (with the costa nearly straight, the apex rounded; apical margin convex, scarcely oblique) straw-yellow, the extreme costal margin narrowly tinged with reddish. A broad distinct bright reddish purple streak commencing in the middle of the base of the wing runs to the apex, overspreading the costa beyond the middle. There are also a few scattered bluish metallic scales below the fold. Hind wings whitish, with a delicate tinge of straw-colour. Abdomen and anal tuft straw-colour. Exp. al. 22 mm.

One male. Montana.

This single specimen is not in very good condition, but it is very distinct from anything I can find described. It has the palpi and neuration of *Cenopsis*, but the head being somewhat worn the distinctive character of that genus is not distinguishable, and in the absence of a costal fold it would naturally fall into the genus *Ænectra*, but its straightened costal margin renders it doubtful whether it can be finally retained in this genus.

Ænectra distincta, n. s.

Palpi ochreous, tinged with purplish above. Antennæ purplish fuscous, somewhat serrated and pubescent in the male. Head and thorax ochreous, touched with purplish fuscous. Fore wings elongate, with the costa arched, the apical margin oblique and convex; rich ochreous, streaked and reticulated with brilliant greenish metallic scales. Hind wings shining pale tawny, with somewhat paler cilia. Abdomen pale tawny. Expanse, 22—23 mm.

One male, three females. Arizona.

This species has much the appearance of Walker's *Teras directana*, which it resembles in the ground colour of all the wings, and in the series of beautiful greenish iridescent scales which adorn them, although these are scarcely noticeable by the unassisted eye; whilst it differs in the absence of an oblique fascia and of other dark markings beyond it.

I am not able to agree with Prof. Fernald in regarding *T. directana*, Walk., as a synonym of *Cenopsis reticulata*, Clem., which differs from it in its larger and more

brightly-coloured palpi, in the more orange hue of the fore wings, and in their reticulated appearance visible to the naked eye. I am still of opinion that Walker's *directana* is a pale variety of *C. testulana*, Zell., but, as the locality from which the typical specimen was obtained is unknown, it may yet be proved to belong at least to a distinct local race.

There is a peculiarity about the neuration of the species above described which is especially worthy of notice when comparing it with various species of the allied genus *Cenopsis*. In the male sex vein 4 of the fore wings arises about equidistant from veins 3 and 5; whereas in the female it branches from a common stem with vein 3. The female of *Cenopsis testulana* has these veins situated as in the male of *Ænectra distincta*; whereas in both sexes of *C. demissana*, Wlsm., vein 4 of the fore wings is decidedly nearer to 5 than to 3.

DICHELIA, Guenée.

Dichelia sulfureana, Clem.

Specimens from N. Carolina, Wisconsin, Florida, and Montana.

AMPHISA, Curt.

Amphisa discopunctana, Clem.

One male. N. Carolina.

PLATYNOTA, Clem.

Platynota flavedana, Clem.

One male. N. Carolina.

Platynota stultana, n. s.

Head with very long palpi and antennæ, half the length of the fore wings, cinereous. Fore wings dull chestnut-brown towards the base, paler beyond the middle. A large ill-defined blackish fuscous patch extends somewhat obliquely outwards from before the middle of the costa, its lower extremity reaching to the fold; beyond this patch is a small triangular costal mark of the same colour. A narrow chestnut-brown shade profusely speckled with blackish fuscous scales extends along the apical margin before the brownish ochreous cilia. Hind wings cinereous. Exp. al. 12 mm.

This species is easily distinguished from others of the same genus hitherto described by its smaller size and

shorter costal fold, which extends but a short space from the base, and is suffused with blackish fuscous scales. The usual lines of raised scales are scarcely observable in my specimens, although sufficient to indicate that in fresher examples they would be more conspicuous. Exp. al. 12 mm.

Four specimens from the province of Sonora, Mexico.

Platynota labiosana, Zell.

Eight specimens. Arizona.

Platynota sentana, Clem.

One female. Montana.

Platynota semiustana, n. s.

Head, palpi, and base of antennæ dark purplish fuscous. Fore wings dark purplish fuscous, except the outer fourth, which is greyish ochreous, crossed by two slender dark purplish fuscous oblique lines of raised scales, and slightly mottled, especially towards the apex, with purplish fuscous. In the dark portion of the wing are four or five patches of conspicuously raised scales, two above and two below the fold being most noticeable; the first of the two upper ones (which is further from the base than the first of the two lower ones) and the second of the lower ones, are much mixed with greyish ochreous; the dark purplish fuscous costal fold is not extended so far along the wing as in *P. flavedana*, Clem., but is somewhat larger than in *P. stultana*, Wlsm. Hind wings cinereous. Abdomen greyish ochreous at the base, cinereous beyond. Exp. al. 13—14 mm.

One male. N. Carolina.

CONCHYLINÆ.

Conchylis, Treitschke.

Conchylis edwardsiana, n. s.

Head pale straw-colour; palpi the same, tinged with brownish on their outer sides. Antennæ pale brownish. Thorax ferruginous above, inclining to pale straw-colour at the sides. Fore wings pale straw-colour, faintly reticulated with yellowish scales. Cilia pale straw-colour. A ferruginous basal patch expanding below the costa is continued along the dorsal margin in the form of a band of scattered ferruginous scales, ending in a triangular patch of the

same colour, reaching to the anal angle; in this patch, and generally interspersed among the ferruginous band, are shining purplish grey or lilac scales. Hind wings pale greyish, with a slight rosy tinge. Under side of the fore wings pale brownish, of the hind wings white. Legs very pale straw-colour, the 1st pair marked on their upper surface with brown. Expanse, 23 mm.

One female. Arizona.

At first sight this insect reminds one much of *Ptycholoma semifuscana*, Clem. I have named it after Mr. Henry Edwards of New York, whose intimate knowledge of the Lepidoptera of the Western States of America is an unfailing source of useful information to his entomological friends.

Conchylis comes, n. s.

Head pale straw-colour. Palpi projecting more than the length of the head beyond it; pale straw-colour, tinged with brownish on their outer sides; the 2nd joint long and straight, with scales projecting on its under side as far as the end of the short apical joint. Antennæ pectinated, pale straw-colour, tinged with brownish on their upper sides. Fore wings rather broad, with the costa arched before the middle, where is a small scaled flap turned downwards beneath it, pale straw-colour, tinged with pale tawny brown along the dorsal part of the wing beneath the fold from the base to the end of the cell. The base of the costa is narrowly ferruginous; at the commencement of the outer half of the costal margin is a triangular ferruginous patch followed by a more extended patch of the same colour reaching to the apex; in each of these are a few purplish scales. Fringes unicolorous with the pale ground colour of the wing. Hind wings shining pale tawny. Under side of fore wings shining unicolorous tawny. Under side of hind wings shining straw-white. Expanse, 18 mm.

One male. Arizona.

This appears to be allied to *C. cnicana*, Dbld., differing chiefly in the absence of the dorsal markings.

Conchylis sartana, Hüb.

Four specimens have reached me of what is undoubtedly the true *Pharmacis sartana*, Hüb. ('Zuträge,' 223, 224) captured, as I am informed by Mr. Morrison, in North Carolina and Florida.

This species, regarded by Prof. Fernald as equivalent to *Conchylis bimaculana*, Rob., differs from Robinson's

figure (Trans. Am. Ent. Soc., ii., pl. viii., f. 78), as well as from specimens in my possession, in that the first of the two dark markings on the fore wings is distinctly and throughout its lower edge connected with the dorsal margin instead of being entirely separated from it. In this it agrees with Hübner's figure, and there can be no doubt that the two species are quite distinct. Robinson's *Conchylis bimaculana* is therefore still entitled to retain its place in our lists.

Head, palpi, thorax, and fore wings rich brownish ochreous, the outer sides of the palpi, the antennæ, and the extreme costal margin (in fresh specimens) shaded with chestnut-brown. A rich chestnut-brown triangular blotch pointing obliquely outwards from the middle of the dorsal margin, its apex reaching the costa beyond the middle is followed by a lunate blotch preceding the apical margin, its concave upper edge facing a small oblique oblong ovate subcostal spot. Hind wings fuscous. Expanse, 14 mm.

Conchylis sonora, n. s.

Head and palpi whitish ochreous, the latter, except on the apical joint, ferruginous-brown on their outer sides. Antennæ whitish ochreous. Fore wings whitish ochreous, much suffused with shining silvery scales. The extreme costal margin ferruginous-brown at the base; in some specimens a ferruginous-brown line runs from the base nearly half the length of the wing immediately below and parallel to the costa. A ferruginous-brown central streak arises at the base of the wing, not contiguous to the dorsal margin, and dilating outwardly reaches nearly to the middle. Beyond the middle is a small ferruginous-brown costal spot partially blending with an oblique shade or streak of the same colour, which tends outward towards a point below the centre of the apical margin. An elongate triangular ferruginous-brown spot precedes the anal angle, to which its point almost attains, while its base is separated from the dorsal margin. Before the apex there is a second small costal spot, and along the apical margin a distinct streak, both ferruginous-brown. Expanse, 15 mm.

This species, of which I have received from Mr. Morrison several specimens from Sonora, in Mexico, all remarkably constant in the position of their markings, differs from *C. dorsimaculana*, Rob., and *C. promptana*, Rob., to which it is nearly allied.

The most noticeable distinction is to be found in the complete separation of the basal streak from the dorsal

margin, from which in both the above-named species it distinctly arises.

Conchylis hospes, n. s.

Head pale ochreous above, the face and inner side of the palpi whiter; outer side of palpi tinged with reddish brown. Antennæ brownish. Fore wings with the costal margin tinged with reddish brown at the base. A shining pale ochreous basal patch partially suffused with brownish ochreous scales, having its outer edge oblique, occupies the first third of the wing, and is wider on the costal than on the dorsal margin; beyond it is a conspicuous rather triangular purplish fuscous cloud, widest on the dorsal margin, and blending towards the costal margin and outwardly towards the apex with rich ferruginous-brown shading, sprinkled and streaked with shining steel-grey metallic scales, which extend into a pale ochreous border along the apical margin, and a pale costal spot of the same colour opposite the anal angle. Hind wings and under side of both pairs cinereous. Expanse, 12 mm.

Allied to *C. schreibersiana*, Froel., and probably to *C. erigeronana*, Riley, but easily distinguishable by its pale ochreous outer border and fringes. Behind and above the eyes are erect tufts of palmate ochreous scales. It may be that these should be laid back along the front of the thorax, and have been accidentally raised in pinning the specimen; but they present an unusual appearance.

I have received a single male of this beautiful species from N. Carolina.

Conchylis plicana, n. s.

Head, palpi, thorax, and fore wings creamy white, the costa tinged with rosy brown; a rather narrow oblique fascia from the middle of the dorsal margin reaches a point beyond the middle of the costa, beneath which it is bent outwards. There are some chestnut-brown scales at its outer angle and along its costal edge; preceding it on the basal third and following it on the outer portion of the wing are slight olivaceous shades; a small spot of brownish scales preceding the anal angle on the dorsal margin. Under side of fore wings with a distinct rosy tinge towards the costa. Hind wings greyish white, with a distinct narrow costal fold in the male, occupying two-thirds of the costal margin, and concealing a pencil of dark hairs. Expanse, $10\frac{1}{2}$ mm.

Three males and one female from Sonora, in Mexico. One only in good condition, so far as the markings are concerned.

Conchylis angulatana, Robs.

Four specimens. N. Carolina.

Conchylis fulvotinctana, n. s. (Pl. IV., fig. 5).

Head, thorax, palpi, and antennæ dingy whitish. Fore wings dull greyish white, somewhat speckled with fuscous scales, with a broad outwardly oblique reddish tawny patch above the middle of the dorsal margin, to which it does not extend, and beyond it a reddish tawny shade occupying the whole apical portion of the wing, its inner margin oblique and parallel with the outer side of the central tawny patch. Cilia greyish white, profusely speckled with fuscous scales. Hind wings pale cinereous. Expanse, 13 mm.

Two specimens. Arizona.

A narrow-winged species belonging to the same group as *ciliella*, Hüb.

Conchylis dorsistriatana, n. s. (Pl. IV., fig. 4).

Head and palpi whitish fawn-colour, more deeply tinged on their outer sides. Antennæ pale fawn-colour. Thorax and fore wings pale reddish fawn-colour, the fore wings rather more deeply tinged on the basal than on the outer half. A whitish fawn-coloured streak, gradually narrowed outwardly, extends from the base of the wing along the dorsal margin to two-thirds of its length; from the outer half of this arise on each side of the middle of the wing two straight slender but not very distinct parallel lines, the first longer than the second, both extending obliquely outwards towards the end of the cell. The fringes are of the same colour as the wing, and have a scarcely perceptible pale line along their base. Hind wings very pale tawny, with white fringes. Expanse, 18 mm.

One male. Arizona.

A large and rather broad-winged species, apparently belonging to the same group as *C. roseana*, but very distinct from any described species with which I am acquainted.

PHTHEOCHROA, *Steph.*

A species of this genus, allied to *amandana*, H.-S., from Sonora, in Mexico, agrees well with specimens lately received from Prof. Riley, and is undescribed.

PSEUDOCONCHYLIS, n. g.

Head broad; eyes large and projecting; palpi roughly clothed to the apex, projecting scarcely the length of the head in front. Antennæ stout, simple, about half the length of the fore wings, the basal joint clothed with scales, the joints closely set. Fore wings without a costal fold, narrow at the base, widening outwards, nearly three times as long as their width across the middle; the costa slightly raised at the base, depressed at the apex, which is rounded; the apical margin oblique, not indented; anal angle rounded. Hind wings rounded at the apex, of almost even width throughout their length, with long fringes. Neuration: Branches 7 and 8 of the fore wings from a common stem, branch 2 arising from the outer third of the cell; hind wings with branches 3, 4, and 5 remote from each other, 6 and 7 separate and nearly parallel; in this respect it differs from *Conchylis*, Tr., although the position of vein 2 in the fore wings places it without doubt in juxtaposition to this genus.

Pseudoconchylis laticapitana, n. s.

Head whitish ochreous. Palpi the same, sprinkled with brownish scales externally. Antennæ pale ochreous. Fore wings whitish ochreous, mottled and speckled with ochreous greyish brown and brown scales. Brown dots and spots are distributed around the costal and apical margins, the extreme base of the costa being also brownish. There is an ill-defined oblique fasciaform shade commencing below the outer third of the costal margin, and terminating in an aggregation of brown scales on the fold; the brown scales appear to be very fugitive, and in specimens only slightly worn are scarcely noticeable. Hind wings and abdomen pale brownish. Expanse, 17 mm.

Both sexes obtained in Lake County and Shasta County, California, June 25th to July 10th, 1871, by myself.

GRAPHOLITHINÆ.

RETINIA, *Guenée*.*Retinia*, sp. ?

A single male from North Carolina agrees with the example recorded in part iv. of the 'Catalogue of Typical Specimens of Lepidoptera-Heterocera in the British Museum,' p. 77, from Camp Watson, in Oregon, under the name *Retinia duplana*, Hüb. On re-examining this specimen I find that it differs from the European specimens of *duplana* in having the antennæ of the male very strongly pectinated.

BACTRA, Steph.

Bactra lanceolana, Hüb.

Several from Arizona; one from N. Carolina.

These do not appear to vary in the same degree as do specimens of this species obtained in Europe; they approach the North American variety described by Zeller under the name *Bactra lanceolana*, var. *verutana*.

APHELIA, Steph.

Aphelia ? inquadrana, n. s. (Pl. IV., fig. 15).

Head and palpi evenly sprinkled with brown and greyish white scales. The palpi projecting more than the length of the head beyond it. Antennæ cinereous. Fore wings evenly sprinkled with pale brown and greyish white; a few very dark brown scales scattered over their surface and contributing especially to the intensity of a series of short costal streaks and two oblique dorsal markings, of which the first commences on the outer edge of the basal third of the dorsal margin, and reaches rather more than half across the wing in an outwardly oblique direction; the second triangular at the commencement of the outer third (in the female somewhat nearer to the anal angle), not reaching to the middle of the wing; beyond this is a faint indication of an ocellated patch enclosed by sublustrous parallel bars of steel-grey scales. On the costal margin before the apex are two pairs of short white streaks somewhat more conspicuous than other similar streaks preceding them, the apex and part of the apical margin being also whitish; a short inconspicuous straight whitish streak runs from the extreme base along the middle of the wing. Fringes mottled in the same manner as the wing-surface. Hind wings dusky cinereous, somewhat darker towards the margins, with paler fringes. The female is much paler than the male, having the fore wings creamy white, with pale fawn-brown mottlings, and the markings as in the male, but less conspicuous, as containing fewer dark brown scales; the hind wings are also paler, and the antennæ simple and more slender than those of the other sex. Expanse, male 16 mm., female 18½ mm.

Arizona.

This appears to be allied to *Aphelia sareptana*, H.-S., having also the rather long palpi which distinguish this species, but differing in the markings arising from the dorsal margin instead of being separated from it. I am somewhat doubtful as to its proper generic position.

ECCOPSIS, Zell.

Eccopsis permundanum, Clem.

Two, N. Carolina; two, Wisconsin.

Eccopsis fasciatana, Clem.

Four. N. Carolina.

PENTHINA, Treits.

Penthina impudens, n. s.

Head, palpi, antennæ, and thorax dark greyish fuscous. Fore wings with a dull greyish fuscous basal patch occupying about one-fourth of the length of the wing, somewhat streaked with darker or more brownish fuscous lines, and slightly indented below the fold. The lower half of this basal patch, as far as the middle of the cell, is followed on its outer side by the rather creamy white ground colour of the wing, but the upper half, which recedes towards the costa, is connected by a greyish fuscous shade with an oblique brownish fuscous costal patch about the middle of the wing, which forms the upper one of an irregular and oblique series of three patches of the same colour forming a broken fascia to the dorsal margin, interspersed with olivaceous-ochreous scales, and margined on its inner side by an olivaceous-ochreous band. Following this interrupted fascia is a patch of the pale ground colour, shaded especially towards the costa with shining greyish scales; an oblique centrally distended olivaceous-ochreous band from the costal to the apical margin, and an oblique line of shining greyish scales before the brownish fuscous apex. The dark fringes with a brownish fuscous line along their base have a slight purplish hue in some specimens. The dark costal margin is marked with six pairs of paler streaks, of which the three outer pairs most nearly approach the creamy white ground colour. Omitting others more or less inconspicuous in the space occupied by the basal patch, these streaks are thus distributed: two pairs in the grey shade succeeding the basal patch, one pair immediately beyond the dark central patch or fascia, the other three beyond the distended olivaceous-ochreous band. Hind wings pale brownish fuscous, with lighter fringes, having a dark line along their base. The abdomen is of the same colour, but the bilobed upper plate of the clasping organs on the anal segment of the male partially concealed by the anal tuft is of a bright ochreous colour. Expanse, 12—13 mm.

I have received this species from N. Carolina, as well as, through the kindness of Prof. Fernald, from

Massachussetts. It will probably be found to be widely distributed.

Penthina hebesana, Walk.

N. Carolina.

Penthina malachitana, Zell.

One from N. Carolina.

SERICORIS, *Treits*.

Sericoris agilana, Clem.

A pair. N. Carolina.

Sericoris constellatana, Zell.

Eight specimens. Wisconsin.

Sericoris instrutana, Clem.

Four. N. Carolina.

Sericoris dealbana, Walk.

One male. Wisconsin.

Sericoris bipartitana, Clem.

One of two specimens from Wisconsin has the dark hind wings, described by Zeller as sometimes occurring in *S. cæsialbana*, Zell., which is regarded by Professor Fernald as a synonym of this species.

PÆDISCA, *Treits*.

Pædisca circulana, Hüb.

Two. Florida.

Pædisca robinsoniana, Grote.

One. N. Carolina.

Pædisca bolanderana, Wlsm.

Four. Arizona.

Pædisca caniceps, n. s. (Pl. IV., fig. 9).

Palpi white, the apical joint short, almost concealed by the closely-projecting scales of the 2nd joint. Head thickly clothed, hoary white, with projecting frontal tuft. Antennæ slightly pubescent, white. Thorax white, tinged with pale reddish fawn-colour. Fore wings (with the costa straight, apical margin oblique, dorsal margin convex towards the base) reddish fawn-colour, sprinkled with hoary white scales, especially above the middle of the wing and towards the apical margin. The costa beyond the costal fold white; fringes white; a silvery white line, slightly dilated before its depressed and pointed apex, follows the fold from the base, and terminates beyond the middle of the wing, not reaching the dorsal margin. There are three shorter and less conspicuous silvery white streaks, one along the basal half of vein 4, one (very short) at the upper angle of the cell, and almost reaching to this; another following the course of vein 8, from the costa immediately before the apex. Abdomen and hind wings shining whitish, faintly tinged with pale fawn-colour. The fringes white; on the under side the fore wings are tinged with fawn-colour; the costa white. Hind wings white, tinged with fawn-colour towards their costal margin. Expanse, 28 mm.

One male. Montana.

Pædisca emaciatana, n. s. (Pl. IV., fig. 7).

Palpi white, tinged with fuscous at the sides. Head, thorax, and antennæ white. Fore wings elongate, narrow at the base, with the costa straight; apical margin very oblique, white sprinkled with fawn-coloured scales; an oblique fawn-coloured patch about the basal third of the wing, containing a few dark umbreous scales, followed by a wider patch of the same colour beyond the middle, partially connected by an obliquely receding shade with the middle of the costa, and by a similar shade to a point beyond the middle of the dorsal margin. There are about six small fawn-coloured costal spots and a more conspicuous patch of the same colour at the apex of the wing, all containing a few umbreous scales. Cilia white, sprinkled with fawn-colour. Hind wings fawn-grey, with a rather iridescent opaline hue, and a dull line along the base of the whiter fringes. Expanse, 22 mm.

Three males. Arizona.

This species reminds one much of *P. larana*, Wlsm., but is somewhat more distinctly marked with fawn-colour; the fore wings are narrower in proportion to their length, especially at the base, and the apical margin

is more oblique; the costal fold is also decidedly darker than in that species.

Pædisca albiguttana, Zell.

N. Carolina.

Pædisca morrisoni, n. s. (Pl. IV., fig. 8).

Palpi white, the short apical joint quite concealed in the closely-packed projecting scales of the 2nd joint. Head white, thickly clothed with raised and projecting scales above and in front. Antennæ white. Thorax white, a pale fawn-coloured line dividing it along the middle. Patagia fawn-coloured. Fore wings (with the costa slightly arched, the apex acute, apical margin oblique and slightly concave) pale fawn-colour, with waved longitudinal streaks of silvery white, without dark margins, which may be divided into costal, median, and submedian. The costal streak runs narrowly along the costal margin nearly to the middle, whence it is deflected and dilated, assuming the form of more or less confluent short costal dashes, the first three tending obliquely outwards, the last two meeting them in the opposite direction before the apex. The median streak extends from the base of the wing to the end of the cell dilated outwardly for the first half of its length, where it is suddenly contracted, on its upper edge, by an angulated break, thence tapering to a sharp point which almost reaches a short detached waved longitudinal streak which lies between it and the lower half of the apical margin, and is itself somewhat connected by detached spots at each of its ends with the middle and end of the waved submedian streak. This submedian streak arises below the fold, not reaching the base, and is deflected to the dorsal margin before the middle following it thence nearly to the anal angle. A detached white spot lies near the base of the dorsal margin. Along the upper edge of the outer half of the median streak, and continued more conspicuously between the confluent costal dashes and the waved detached ultra-median streak nearly to the apical margin, is a curious wedge-shaped dash of pale fawn-coloured scales, each distinctly barred transversely with deep black. A line of similar scales runs along the apical margin at the base of the cilia, and is faintly reduplicated in the cilia themselves below the apex. Hind wings rather shining fawn-grey. Cilia slightly paler. Expanse, 20 mm.

One female. Montana.

There is a worn specimen of this species in Mr. Grote's collection at the British Museum, placed under the name *Grapholitha striatana*, Clem., together with others which are correctly referred to that species.

Pædisca giganteana, Riley. (Pl. IV., fig. 11).

I had instructed the artist to figure this fine species before I recognised it by the description. It bears a great resemblance to *Phthoroblastis juliana*, Curtis, but is of course much larger.

Two specimens, male and female. N. Carolina.

Pædisca canana, Wlsm.

One female. Arizona.

Pædisca agricolana, Wlsm.

One. Arizona.

Pædisca rectiplicana, Wlsm.

One male. Arizona.

Pædisca corosana, n. s. (Pl. IV., fig. 6).

Head roughly clothed, hoary whitish. The palpi projecting twice the length of the head beyond it, dusted with brownish fuscous scales at the base of their outer sides. Antennæ whitish. Fore wings dirty whitish, much sprinkled and shaded with fawn and greyish fuscous scales; these are chiefly collected in a short oblique streak about the middle of the basal third, containing a few black scales, and followed by a whitish patch; and in an oblique fascia-form shade from the middle of the costa to the anal angle, also containing a few black scales in its lower half, and followed by a whitish space of equal length, which terminates in the ill-defined ocelloid patch in which are two black dots. Immediately beyond these dots a narrow dull leaden line proceeds upwards to the costa, running at first parallel to the apical margin, but diverging inwards below the apex. The cilia of the general hue are preceded by a slight fawn-coloured shade. Hind wings pale brownish fuscous, with paler fringes. Expanse, 20 mm.

One male. Montana.

This species appears to be intermediate between *P. maculatana*, Wlsm., and *P. juncticiliana*, Wlsm.

There are two rather worn specimens in the collection of the late Prof. Zeller with the above unpublished name attached to them, which I have adopted. They are labelled as from "Texas."

Pædisca pulveratana, Wlsm.

Arizona.

Pædisca strenuana, Walk.

Several specimens from N. Carolina.

Pædisca aspidana, n. s. (Pl. IV., fig. 10).

Palpi hirsute, projecting more than twice the length of the head beyond it, speckled dull brown and whitish. Antennæ dull brownish, the head and thorax speckled. as are the palpi. The fore wings are much the same in colour as the head and thorax; an oblique dirty whitish line from before the middle of the dorsal margin reaches the costa beyond the middle; a similar and almost parallel line beyond the middle is bent outwards below the costa, which it reaches shortly before the apex, enclosing a small fuscous costal dot, which is followed by a larger dark spot at the apex. From the inner edge of the apical spot another pale line reaches the anal angle along the base of the fringes, which are slightly tinted with greyish fuscous and much speckled. Immediately before the anal angle is a conspicuous fuscous spot touching with its inner edge the lower part of the second pale line. Hind wings pale brownish, with darker cilia. Expanse, 17 mm.

Four specimens. Arizona.

Pædisca scudderiana, Riley.

A pair. Wisconsin.

Pædisca otiosana, Clem.

Two specimens. Florida.

Pædisca constrictana, Zell.

Five specimens. Florida.

The costal fold in the male is very distinctly visible in my specimens, which must, I think, belong to this species, although unfortunately there is no specimen in Zeller's collection with which to compare them.

Pædisca dorsisignatana, Clem.

Several specimens. N. Carolina.

SEMASIA, Steph.

? *Semasia corculana*, Zell., var.

These specimens differ from the type (now in my possession), which is from Vancouver, in the fore wings being more or less suffused with blackish scales, and in the deep blackish fuscous hind wings with dull ochreous fringes. Californian specimens are almost exactly intermediate between the two extreme forms, which, without these connecting-links, I should certainly have regarded as distinct.

If they may be correctly referred to the same species they supply a curious exception to the usual habits of variation among Lepidoptera, the more northern varieties being usually found to be the darkest. It is possible that they may belong to a distinct species, but this cannot be safely asserted until a larger number of good specimens are available for comparison.

The wide range of variation observable in European specimens of *Semasia aspidiscana* from different localities leads me to entertain some doubt of the distinctness of Zeller's *corculana* from that species. I have received from Mr. C. G. Barrett examples of *aspidiscana* which are indeed scarcely distinguishable from Zeller's type. The matter requires further study than I can devote to it for the purposes of this paper.

Semasia ochreicostana, n. s. (Pl. IV., fig. 13).

Palpi short, pale ochreous, tinged with ferruginous at the sides, the apical joint scarcely visible among the projecting scales of the 2nd joint. Head ferruginous. Antennæ ferruginous at the base, dull brownish fuscous beyond. Fore wings (with the costa almost straight, the apical margin oblique, slightly concave) pale ochreous, overshadowed, except along the costal third, by a dull greyish fuscous shade, which extends also over the thorax. The outer third of the wing bright reddish ochreous, containing five minute paler costal marks, from the first of which a silvery metallic streak runs obliquely outward to the upper edge of the ocelloid patch; from the second a similar but larger and more oblique streak runs around the upper and outer edge of the ocelloid patch nearly to the apical margin, where it meets a shorter and straighter metallic streak coming from the fifth pale spot near the apex. The third and fourth of these pale spots lie within the angle formed by two metallic lines, the fourth having also a few metallic scales attached

to it. The ocelloid patch reminds one much of that of *Semasia amphorana*, Wlsm., its upper half dull greyish fuscous, with three narrow longitudinal lines of black scales, having the appearance of rows of stitches, the lower half pale ochreous, margined at the sides and divided into two equal halves by three short bars of brassy metallic scales, each half containing six black spots. Cilia tawny. Abdomen and hind wings dull brownish fuscous, with pale straw-white fringes beyond the abdominal angle. On the under side all the wings are dull fuscous, except the pale costal and apical margins of the fore wings and fringes of the hind wings. Expanse, 19 mm.

Two females. Montana.

This species must be nearly allied to *Semasia taleana*, Grote, but his description does not agree with my specimens, the scales of which are certainly not blackish with white tips, nor is there a black patch below the median fold.

Semasia ? vestaliana, Zell.

This specimen differs from Zeller's type in the costal streaks being reduced to five small dots not actually touching the costal margin. Moreover, in the line along the apical margin being somewhat broken, not continuous as in Zeller's figure (Verh. z.-b. Ges. Wien, 1875, p. 80, pl. viii., fig. 21). A male in my own collection, taken in the cemetery at Denver, in Colorado, is more like Zeller's figure, but has a distinct fuscous shade along the inner edge of the marginal line. The male has no costal fold.

Following Heinemann's system of classification Prof. Fernald would be justified in placing this species in the genus *Semasia*, H.-S., rather than in *Grapholitha*, H.-S., the middle branch of the hind wings being decidedly bent towards its origin, and brought to the same point as the stem from which branches 3 and 4 arise, but in its small palpi and in the somewhat falcate apex of the fore wings it seems to approach the genus *Phoxopteris*, Treits.

One male. Montana.

Semasia argenticostana, Wlsm.

One male. Arizona.

Semasia tenuiana, Wlsm.

One male. Arizona.

Semasia montanana, n. s. (Pl. IV., fig. 12).

Head, thorax, palpi, and antennæ pale olivaceous-ochreous. Fore wings with the costa almost straight, apex acute; apical margin very oblique, not indented, pale olivaceous-ochreous. A very faintly indicated outwardly oblique fascia from beyond the middle of the costa is followed by some faint silvery lines, interspersed with a few inconspicuous blackish scales which appear to underlie the ochreous scaling. An outwardly oblique silvery streak following the edge of the faint fascia is continued along the subapical vein to the apex, enclosing three small festooned costal streaks in the apex above it. Beneath it are two more or less confluent silvery streaks along the veins. Cilia the same colour as the wings, interrupted by a faint line of darker scales along their middle, which forms also an oblique dash running inwards from the apex. Hind wings pale brownish grey, with paler cilia, a faint line near their base. Abdomen of the same colour as the hind wings; the anal tuft ochreous. Expanse, 18 mm.

One male. Montana.

This specimen, in good condition, is nearly allied to *S. messingiana*, F. R., but is smaller, paler, and less distinctly marked.

Semasia argutana, Clem.

Two males, one female. Arizona.

These are larger than the average of specimens from the Eastern States, reaching 16 mm. in the expanse of the fore wings. I have similar large specimens from California.

Semasia apacheana, n. s. (Pl. IV., fig. 14).

Palpi creamy white, with a few fawn-brown scales externally and on the very short apical joint. Head creamy white, roughly clothed above. Thorax creamy white. Antennæ slightly pubescent, faintly annulated. Fore wings creamy white, with an oblique triangular fawn-brown dorsal mark before the middle reaching half across the wing, beyond which is an oblique fascia-form shade running from a point beyond the middle of the costal margin to the dorsal margin immediately before the anal angle; in it are sometimes a few blackish scales near the dorsal margin, and it is mar-

gined externally by silvery white. The equilateral triangle formed by the apical portion of the wing is tinted with fawn-colour, and contains two pairs of rather wide silvery white costal streaks, between which and also at the apex of the wing the fawn-colour is somewhat more intense. The cilia are white; an ocellated patch above the anal angle, enclosed at the sides by silvery white, contains a few jet-black dots. Hind wings dull brownish, with greyish white fringes. Expanse, 14 mm.

Four specimens. Arizona.

? *Semasia helianthana*, Riley.

A single female from Arizona agrees with Riley's description, except in the absence of a basal shade on the fore wings. I am not confident that it is correctly identified, as I have never seen specimens of this species.

PROTEOPTERYX, *Wlsm.*

Proteopteryx emarginana, *Wlsm.*

One male and one female. Arizona.

These specimens have no clearly defined dorsal patch, as have nearly all my Californian varieties, but are distinguished by a wavy umbreous streak reaching from the apex nearly to the middle of the wing, nearer to the costal than to the dorsal margin. The costal fold also seems to be somewhat more conspicuous and more closely appressed in the male; but it would not be safe to separate it from a species exhibiting so wide a range of variation upon the evidence of such slight differences in two specimens only.

STEGANOPTYCHA, *Steph.*

Steganoptycha sp.

This is the same species as that which stands in Fernald's catalogue as *S. incarnana*. Haw., on the authority of a specimen collected by me in California, and recorded in *Cat. Lep. Het., B. M., part iv.* Six specimens now received from Mexico lead me to believe that it is really distinct from that species. All are alike in having a narrower central fascia than the European form of *S. incarnana*, as well as in some minor differences. A further examination of other allied species is necessary before I shall be justified in describing it under a new specific name.

Steganoptycha fasciolana, Clem.

Six specimens. Wisconsin.

One of Walker's specimens, under the name *Penthina dealbana*, belongs to this species, but is not the type.

? *Steganoptycha lagopana*, Wlsm.

Two females. Arizona and Montana.

These varieties, not impossibly representing a distinct species, differ from *S. lagopana* in having the whole base of the fore wings darkened so as to include the first dorsal streak in an almost unicolorous basal patch, slightly angulated outwards about the middle; they have also a dark streak in the cilia beneath the apex of the fore wings, and a dark shade in the cilia at the apex of the hind wings. I have two males and two females from California with these same characters, and have always been inclined to regard them as belonging to a distinct species.

Without possessing a larger number of specimens it is impossible to determine to what extent of variation the species above mentioned or its near allies are subject.

TMETOCERA, *Led.**Tmetocera ocellana*, Schiff.

One male. Wisconsin.

PHOXOPTERIS, *Treits.**Phoxopteris nubeculana*, Clem.

One pair. Wisconsin.

Phoxopteris burgessiana, Zell.

One specimen. N. Carolina.

Phoxopteris platanana, Clem.

One specimen. N. Carolina.

Phoxopteris sp.

One male. Arizona.

A large species, rather of the pattern of *P. dubiana*, Clem., but more distinctly marked, having a reddish

brown dorsal patch occupying two-thirds of the dorsal half of the wing, its outer margin being very oblique; beyond the middle on the costal half of the wing is a fuscous cloud, connected by a fuscous streak with a dark line at the base of the fringe immediately below the falcate apex. It would not be safe to found a new species in this difficult genus upon the evidence of a single specimen, but I am unable to recognise it as belonging to any species at present described.

GRAPHOLITHA, *Treits*.

Grapholitha vitrana, Wlsm.

Six examples. Arizona.

Grapholitha ? *duodecemstriata*, n. s. (Pl. IV., fig. 16).

Palpi white, the apical joint broadly barred with black on the outer side. Face white, with a black streak down the middle. Antennæ longitudinally streaked with black and white. Thorax and patagia greyish white, streaked and spotted with black. Fore wings beautifully streaked on the basal half with alternate waved lines of black and white converging obliquely outwards above the middle. A triangular greyish black dorsal patch extends more than half across the wing, meeting an oblique black line coming from the costa; beyond this patch is the ocelloid spot margined on both sides with light steel-coloured metallic bars, and containing twelve parallel transverse whitish lines set in deep black; above these are five pairs of oblique white costal streaks, each pair terminating in a line of greyish metallic scales. The apical margin is profusely dotted with white on a black ground; the cilia lustrous brownish grey. Hind wings dull whitish at the base, brown on their outer half, with snow-white fringes. Abdomen greyish; on the under side snow-white. Legs white, with black-spotted hinder tarsal joints. Expanse, 18 mm.

One male. Arizona.

A lovely species, which the discovery of the male may not impossibly show to belong to the genus *Carpocapsa*.

ECDYTOLOPHA, *Zell*.

Two examples from N. Carolina; and one labelled "Arizona." In the latter case I am inclined to think that a mistake may have occurred.

CARPOCAPSA, Treits.

Carpocapsa pomonella, Linn.

Wisconsin.

With the exception of about four additional species, which I am unable at present to determine satisfactorily, this constitutes a complete list of the Tortricidæ received from Mr. H. K. Morrison during the last two years.

It may be useful to remark, with reference to one species placed by Fernald in the list (appended to his catalogue) of those which he has been unable to determine, that the type of *Teras retractana*, Walker, in the British Museum, is labelled as received from Australia.

 EXPLANATION OF PLATE IV.

- FIG. 1. *Sciaphila arizonana*, Wlsm.
 2. *Ænectra* ? *striata*, Wlsm.
 3. *Ænectra irrorea*, Rob.
 4. *Conchylis dorsistriatana*, Wlsm.
 5. „ *fulvotinctana*, Wlsm.
 6. *Pædisca corosana*, Wlsm.
 7. „ *emaciatana*, Wlsm.
 8. „ *morrisoni*, Wlsm.
 9. „ *caniceps*, Wlsm.
 10. „ *aspidana*, Wlsm.
 11. „ *giganteana*, Riley.
 12. *Semasia montanana*, Wlsm.
 13. „ *ochreicostana*, Wlsm.
 14. „ *apacheana*, Wlsm.
 15. *Aphelia* ? *inquadrana*, Wlsm.
 16. *Grapholitha* ? *duodecemstriata*, Wlsm.

XI. Notes on two Australian species of *Trigona*.

By HAROLD J. HOCKINGS.

[Read August 1st, 1883.]

OF these stingless bees of Australia two varieties only have come under my immediate observation, but I believe there are several others both here (Queensland) and in the Southern Colonies, some of which differ but little from those described below.

“Karbi” or “Keelar” and “Kootchar” are the names given to them by the natives. The first species may be identical with *Trigona carbonaria*, Smith: it forms a very dark wax, almost black, and the propolis it uses is also very dark. It is nearly three-sixteenths of an inch in length, of a generally black colour, except that the front of the head or face and the sides of the thorax are covered with minute silvery hairs, which give those parts a whitish appearance, even when viewed at some distance, and the abdomen, which in its normal state is nearly circular, when viewed from above, is exceedingly black, and gradually discloses reddish rings at the edges of the segments as it becomes distended with honey. The queen, when *fully* developed, is usually one and a half to twice the length of the worker: when the ovary has not developed, the abdomen is nearly flat; both it and the legs and antennæ are a dirty brown, the head and thorax being black, but as she matures the abdomen increases to about three times its previous size, and develops five distinct rings; it, however, always retains its original downward curve. I have not yet observed drones of this variety, probably on account of their differing but slightly from the workers.

The second species (“Kootchar”) is also black in colour, but has a fine yellow streak across the upper part of the thorax just behind the butts of the wings,*

* This yellow mark is generally extended around the front of the thorax by a line of dots.

and has a few silvery hairs on the face *only*. The queen is fully three-eighths of an inch in length, sometimes a little longer, and is of a lighter colour than in the other variety, being glossy and of a reddish brown. The head and thorax nearly black. The drone is slightly longer and more cylindrical than the worker, and is of a somewhat lighter colour; the antennæ are divided nearer to the head, and are altogether longer; the compound eyes do not extend over the back of the head, as in *Apis mellifica*, but are perceptibly fuller and broader than in the female; the hind legs are convex, with a white line around their edges. They are exceedingly numerous in strong colonies from October to January, when they gradually die off. When the abdomens of workers and drones become distended with food they develop five distinct rings. In some cases a queen may be met with of exactly the same colour, &c., as in the first variety.

Both varieties build their nests in hollow trees, which they render impervious to water by the application (inside) of a very tough but pliable gum, which is insoluble in water, but is highly inflammable; it has a strong and decidedly turpentine-like odour, especially with the first variety.

The eggs, which are deposited in cells previously filled with food and are immediately sealed up, take about three months to come to maturity. I am not yet certain of the exact term, as the construction of the brood-nest makes observation difficult.

"Karbi" gather but little honey, which they store in pots of wax about three-fourths of an inch in height and half an inch in diameter, having their mouths on the top. Building in both varieties is commenced from the bottom and conducted upwards. The shape of isolated honey-pots is somewhat similar to a sparrow's egg, but as they multiply they are so attached to each other that the outer wall of one may form the inner wall in part of those around it, thus economising wax and space; they are usually built in layers, but sometimes in a shapeless mass, and always have some pollen-pots mixed up with them; these are placed near the brood-combs or comb, which is in one piece in the form of a spiral staircase compressed, but wide in the middle, and tapering at the ends, top and bottom; the layers are fastened about one-sixteenth of an inch apart by small stanchions of

wax placed wherever convenient. As the comb is built it is encased in a sheet or circular case of wax about one-sixteenth of an inch away from the cells, to which it is fastened by stanchions or beams of wax, though sometimes attached immediately to a cell in places. Outside the brood-nest and surrounding it, is usually a band of shapeless passages formed of wax and much smeared with adhesive gum, in which the bees seem to loiter much. The honey and pollen-pots are placed against this highly cellular structure on all sides. The pollen is damp or pasty, and is stored in pots exactly similar to those which contain honey. On account of the dark colour of the wax these pots cannot be distinguished, and to obtain the honey the whole mass is usually squeezed, so that it gets largely mixed with the pollen, and receives a sour taste that it has not when in a pure state. Four or five pounds of honey would be a fair yield for one of these hives, and they are not much valued even by the natives.

They are a very fierce variety, and are without fear, and, although they are stingless, are quite capable of defending themselves. Each bee, except when gathering pollen, has a small quantity of colourless gum, of an extremely adhesive nature, on its hind legs; this substance is placed in a thin coat over the wax in the hive, and the bees walk over it without inconvenience. The hive-entrance is very carefully guarded by a line of bees, who inspect every one that arrives, and it is surprising to see how soon a stranger is discovered and pounced on by several before it has time to alight; when caught one bee holds each leg, which it stretches out to its full extent, the wings are treated in a similar manner, and in this position they remain quietly about an hour, when the intruder is usually dead. The object of these robbers is to steal gum, which is placed about the entrance to keep vermin away.

On one occasion (December, 1882) two of these hives threw off swarms simultaneously, which unfortunately came in contact with one another, when a deadly fight ensued, and was continued until the whole were strewn about in a tangled mass dead, chiefly in and about a box which they seemed to have fought for; in single combat they catch each other by the abdomen and tear out the intestines, never releasing the hold once taken, both invariably being killed. The mandibles are well developed,

have two projections* on each in front, and give a very sharp bite when applied to tender skin.

If the hive be opened roughly, or is being robbed, the bees attack the operator most determinedly, chiefly in the hair of the head, beard, and eyelashes, which they gnaw at and smear with gum; they crawl inside the clothes, into the ears, nose, and mouth; very few persons could work at them long without a veil, in consequence of their sticking the eyelashes together, and their biting the lids being very painful. The natives usually kill the bees by smoke, and take the honey at leisure.

“Kootchar,” or the second variety, is slightly more bulky than the first; when injured or seized between the fingers it emits a not unpleasant, but somewhat ant-like, odour, and, although a timid insect, has not so many enemies as the other variety, chiefly, I believe, owing to the odour it is capable of emitting, which may also account for the fact of the other variety, as well as the wasp, hornet, and honey-bee, avoiding them. Should a strange insect be placed in their hive they follow it in a crowd, continuously placing small globules of gummy matter on to its body; this substance seems to be extruded from their mouths, and has a slightly greenish colour when wet, and soon becomes very hard, so that the stranger in time is unable to move, and it is then firmly fastened down and quietly dismembered, the parts being cast from the hive.

The wax of this variety is of a slightly yellowish grey or buff colour, and produces a beautifully white wax when carefully melted down, especially when done by the heat of the sun.

The honey and pollen-pots are a little smaller than those of the other variety, and the contents may be easily distinguished on account of the semitransparent nature of the wax; they (the pollen and honey-pots) are usually stored in different parts of the hive, the former within the entrance, the brood-nest in the middle, and the honey at the back partially surrounding the brood, the whole presenting a very clean and neat appearance.

The brood-cells are globular, about one-eighth of an inch in diameter, and are placed in a conical heap on the top of one another, without any regularity. As in

* A partly serrated edge.

the other variety, they are encased in a sheet of wax to economise the heat necessary for the maturity of the young.

If the hive is being robbed these bees eat the honey greedily at first, then get much excited, dashing aimlessly about in all directions; they do not attack the operator as the others do. In habits they are exceedingly industrious and tractable, but at times quarrel fiercely among themselves. The entrance to their hive is guarded or ornamented by a pipe of propolis about an inch in length, having an exceedingly sticky outer edge; it is by this pipe alone that access to the hive is gained, and it extends inside as far as the brood-nest usually, but sometimes not quite so far.

When the young have reached the second stage of their existence the wax is almost wholly removed from the cocoon, which assumes an oblong form; this wax is probably worked over again (I believe for honey and pollen-pots), as the bees that form them may sometimes be seen bringing a small piece of wax in their mandibles from the passages among the brood-cells. The larva of the queen spins its cocoon over the *whole* of its body (as do drones and workers). I have not observed that these larvæ receive any special treatment; the cells are situated low down in the nest, are much larger than the worker cells, and the food to all appearance is similar in all cases, the cells being filled, the eggs deposited and sealed up in the same way as those which produce workers; the same may be said of drones.

In forming brood-cells they build them with a funnel-shaped mouth, which is either pointed up or outward, according to the direction in which the nest is being extended, and fill them with semi-fluid food, which is prepared in the stomachs of the workers. The egg is forced into the food by the queen, with one end slightly protruding; the funnel-shaped mouth is then immediately closed by a worker-bee—never more than one—kneading it in so that the cell may assume a globular form. In doing this the insect works with the point of its abdomen inserted in the opening, on which it works as on a pivot, turning around and kneading the wax with the head until the operation is performed; if the bee is removed before the completion of the work it is immediately replaced by another; they seem anxious to close the cell directly the egg has been deposited. These

various operations, during which great excitement prevails, form an exceedingly interesting sight.

The pollen of this variety is drier or more firm than with "Karbi." As much as fifty pounds of honey may sometimes be obtained from a nest of these bees, which is an amazing quantity considering the size of the insect.

A great many bees of both varieties are white when hatched, gradually becoming darker, until in about a week they are as black as the others.

The brood-cells of "Karbi" are filled and sealed in the same way as the "Kootchar," but the tops and bottoms are merely oval, the sides being the same shape as in *Apis mellifica*; the mouths are always pointed upwards, except with queen-cells, which usually lie horizontally with the mouth outwards.

The queens are quite incapable of flight when the ovaries are developed, and even appear to walk with difficulty. At night the entrance of the hive is closed by numerous minute globules of semi-fluid gum placed against it, thus forming a thin wall full of air-holes; the hive is closed in a similar way during wet weather and winter.

Both varieties have a zigzag darting flight; they throw off swarms in the same way as other bees, except that I believe a young queen goes off with the swarm, the mother staying in the parent hive. A marked feature in them is that they do not hang together while building, as *Apis mellifica* do; each insect acts independently. There seems to be no cohesion among them, and, when thoroughly disturbed, they remain disorganised until nightfall, when they assemble in a hollow branch, and stand side by side; under no circumstances do they hang in clusters.

Both varieties are common with us in a wild state. "Kootchar" are only to be found where a sandy soil is prevalent; they are plentiful on the coast, but especially on Stradbroke Island, which seems to be their habitat, and the inland natives are also of opinion that they come from the coast. "Karbi" are very scarce near the coast, but abundant inland. The name above given is applied to them by the inland natives; the coast tribes call them "Keelar," and say they belong to the bush (interior).

The wings of both varieties project slightly over the

abdomen. The slightest degree of cold seems to deaden them, while heat induces activity. They treat their queens with the greatest respect, and appear even to fear them. When the young bees have hatched, the cocoons are removed and placed in a heap, each being rolled into a ball; this heap is reduced by fits and starts, and is sometimes not touched for as much as a month.

The "Kootchar" are easily united by simply taking one queen away and packing her brood-nest, bees and all, against the brood in the hive it is intended to be joined to; if any bees return to the old hive they may be shaken in at night and the hive removed. This cannot be done with "Karbi," as they would fight and kill one another.

When either variety takes up its abode in a space that is too large for them they partition it off at a convenient distance with a wall of Eucalyptus gum mixed with rubbish, which is added to from time to time, and gradually becomes very thick and hard. If broken pots of pollen be placed in a hive when the winter is approaching, the broken parts are covered up with wax to preserve it; but, if put in when the spring has broken, it is apparently unheeded.

Several small birds eat the "Karbi," but I am not aware of any eating "Kootchar." Both varieties have small heaps of soft gum about the size of a pea placed all over the inside of the hive; sometimes one is placed outside the entrance. This substance is similar to that with which they close their hives at night, and should their hive by any chance get broken a line of it is placed around the opening while it is being closed with a firmer substance.

The moth* is a small grey insect, the female about seven-sixteenths of an inch in length, the male a little less, having a remarkable yellow tuft over the whole of the front of the head. Eyes black; long, thin, hair-like antennæ; proboscis but slightly developed, about 1-32nd inch long, and curved inwards; outer wing rounded at the apex, with slight corrugations running half-way up; under wing, much lighter in colour than the outer, runs to a point at the edge; both wings have a hairy fringe, but it is fuller and more even on the *under*. The female

* *Achroea grisella*, Fabr.—E. A. F.

has a retractile ovipositor, somewhat more than one-sixteenth of an inch in length. When in repose the antennæ lie back along the wings, which are folded in the form of a half-cylinder.

It increases very rapidly, and is very destructive to bees' combs, especially those containing broods; it develops itself in the foundation, or division of the cells, which it gnaws away without injury to the bees further than that when they come to maturity they are often unable to emerge from the cell on account of their being fastened by the silk of these larvæ, and, should they emerge, their wings are so fastened with the silk that they cannot fly, and get lost on leaving the hive. The bees will destroy them, and cut the combs away to do so, when their young emerge or die in the cells.

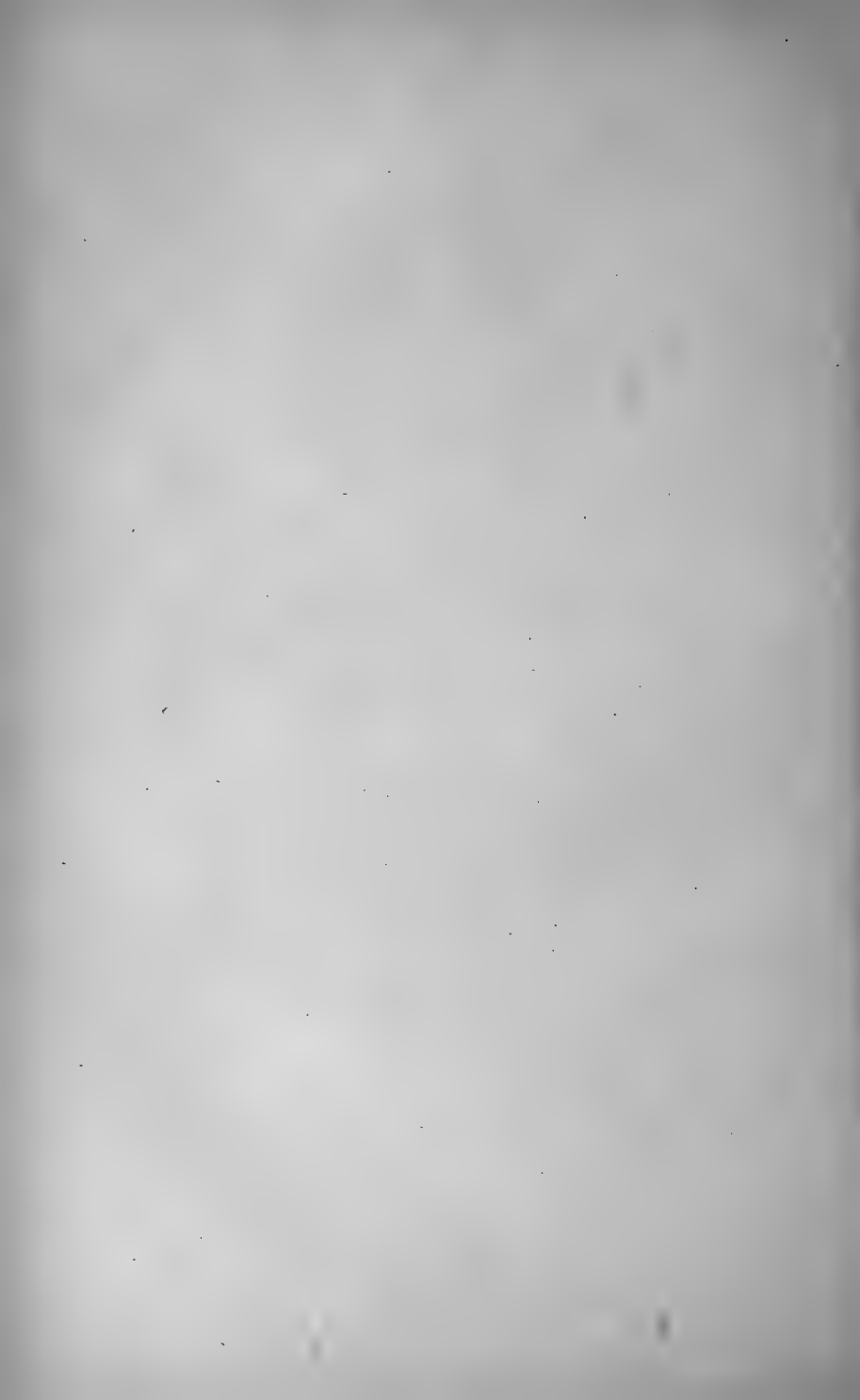
This insect thrives on raw sugar, which is manufactured in great quantities in this colony, but I have noticed that it develops itself more abundantly in imported dried fruits (currants and raisins), which I believe come from the Mediterranean, and it has occurred to me that it might possibly have been imported from thence. It cannot be *Galleria cereana*, as, from an illustration and description which appeared in the 'British Bee Journal,' I have identified that as a larger moth, which differs in several points.

The beetle* is a "flower-hunter," but sometimes attacks the bee-hives here in great numbers.

The specimens sent by Mr. Hockings and exhibited at the Meeting held on August 1st, 1883, were (1) two "Kootchar" queens; (2) numerous "Kootchar" workers; (3) numerous "Kootchar" drones; (4) one "Karbi" queen; (5) numerous "Karbi" workers; (6) "Karbi" wax and propolis; (7) "Kootchar" wax and propolis; (8) "Karbi" honey-pots; (9) "Karbi" brood; (10) "Kootchar" honey-pots; (11) "Kootchar" brood; (12) "Karbi" queen-cell; (13) "Kootchar" queen-cell; (14) numerous wasps "from a nest containing thousands," a very distinct small *Odynerus* not in the National Collection; (15) greenish bees—two specimens of a *Nomia*

* *Protætia mandarina*, Weber.—E. A. F.

near *N. australica*, Smith; (16) sand bees—two specimens of *Allodape simillima*, Smith; (17) large bee with red abdomen—*Megachile ustulatus*, Smith; (18) Wax Moth—*Achroea grisella*, Fabr.; (19) hive beetle—*Protetia mandarinea*, Weber; (20) smaller but somewhat similar beetle—*Euryomia brunnipes*, Kirby; (21) bright green beetle—*Diphucephalus* sp. ?, two specimens unnamed in the National Collection.—E. A. F.



XII. *Synopsis of British Hymenoptera. Anthophila; part II., Apidæ.* By EDWARD SAUNDERS, F.L.S.

[Read March 5th, 1884.]

PLATES V—XIII.

ACUTILINGUES.

Div. II.—1ST JOINT OF LABIAL PALPI MANY TIMES LONGER THAN APICAL.

- | | | | |
|------|-----|---|-------------------|
| (2) | 1. | 2nd and 3rd joints of labial palpi subequal .. | <i>Panurgus.</i> |
| (1) | 2. | 3rd joint of labial palpi much shorter than 2nd. | |
| (28) | 3. | 2nd joint of labial palpi more than half as long as 1st. | |
| (15) | 4. | Basal joint of labial palpi longer than 2nd. | |
| (8) | 5. | Anterior wings with two submarginal cells. | |
| (7) | 6. | Species dull; tongue longer than the palpi; intermediate calcaria in ♀ very long and toothed like a saw | <i>Rophites.</i> |
| (6) | 7. | Species shining; tongue shorter than the palpi; intermediate calcaria in ♀ short and simple | <i>Dufourea.</i> |
| (5) | 8. | Anterior wings with three submarginal cells. | |
| (12) | 9. | Maxillary palpi 6-jointed. | |
| (11) | 10. | Abdomen short and subclavate, blue or metallic | <i>Ceratina.</i> |
| (10) | 11. | Abdomen subovate, pointed at the apex, brown or black with yellow markings | <i>Nomada.</i> |
| (9) | 12. | Maxillary palpi with one or five joints. | |
| (14) | 13. | Maxillary palpi with one joint only | <i>Epeolus.</i> |
| (13) | 14. | Maxillary palpi with five joints | <i>Melecta.</i> |
| (4) | 15. | Basal joint of labial palpi shorter than 2nd. | |
| (17) | 16. | Scutellum spined at the sides | <i>Calioxyys.</i> |
| (16) | 17. | Scutellum not spined. | |
| (23) | 18. | Maxillary palpi 2-jointed. | |
| (20) | 19. | ♂ with the apex of the abdomen not denticulated or emarginate; ♀ without a ventral brush .. | <i>Stelis.</i> |
| (19) | 20. | ♂ with the apex of the abdomen denticulated or emarginate; ♀ with a ventral pollen brush. | |
| (22) | 21. | Abdomen with yellow markings | <i>Anthidium.</i> |
| (21) | 22. | Abdomen without yellow markings | <i>Megachile.</i> |
| (18) | 23. | Maxillary palpi 3- or 4-jointed. | |
| (25) | 24. | Maxillary palpi 4-jointed | <i>Osmia.</i> |

- (24) 25. Maxillary palpi 3-jointed.
- (27) 26. Apical joint of labial palpi much shorter than 3rd; 1st segment of abdomen not carinated at the base *Chelostoma*.
- (26) 27. Apical and 3rd joints of labial palpi subequal; 1st segment of abdomen carinated at the base *Heriades*.
- (3) 28. 2nd joint of labial palpi not half so long as 1st.
- (30) 29. Anterior wings with two submarginal cells .. *Eucera*.
- (29) 30. Anterior wings with three submarginal cells.
- (32) 31. Maxillary palpi 6-jointed *Anthophora*.
- (31) 32. Maxillary palpi with one, two, or four joints.
- (34) 33. Maxillary palpi with four joints *Saropoda*.
- (33) 34. Maxillary palpi with one or two joints.
- (38) 35. Maxillary palpi 2-jointed.
- (37) 36. Mandibles of ♂ fringed with stiff curled hairs; posterior tibiæ of ♀ and ♂ concave and shining externally *Bombus*.
- (36) 37. Mandibles of ♂ not fringed with stiff curled hairs; posterior tibiæ of ♀ convex and hairy *Psithyrus*.
- (35) 38. Maxillary palpi with one joint *Apis*.

PANURGUS, *Panz.*

Panz., *Krit. Revision*, Band ii., p. 209 (1806).

Wings with two submarginal cells; labial palpi 4-jointed; maxillary palpi 6-jointed; 2nd and 3rd joints of labial palpi subequal; ♂ with all the eight ventral segments of the abdomen exposed, the 7th largely emarginate, the 3rd narrow and andreniform; species black, shining, clothed with black hairs. Antennæ in the ♂ scarcely longer than in the ♀; base of the posterior tibiæ with a patella.

- (2) 1. Smaller; ♂ with a large blunt spine on the posterior femora; ♀ with the surface of the abdomen above nearly naked, and the scopæ dull brownish yellow *calcaratus*.
- (1) 2. Larger; ♂ with the posterior femora simple; ♀ with the surface of the abdomen above rather densely clothed with upright hairs; scopæ bright golden *ursinus*.

1. *Panurgus calcaratus*, Scop. (Pl. V., fig. 2—2 b).

Scop., *Ent. Carn.*, p. 301; Smith, *Cat. Brit. Hym.*, 2nd ed., p. 106.

Black, shining; antennæ fulvous towards the apex, rarely entirely black; posterior femora with a large blunt tooth beneath; ♀ with the scopæ dull ochreous yellow.

♂. Head somewhat round, wider than the thorax, shining, punctured, densely clothed with sooty black hairs; clypeus very deeply emarginate in front; labrum depressed in the centre and very highly polished, its sides hairy; antennæ slightly thickened towards the apex. Thorax shining, finely, remotely, and irregularly punctured, sparingly clothed with erect sooty black hairs; metathorax with its basal area finely and longitudinally wrinkled at the base. Abdomen subovate, shining, sparingly clothed with short suberect hairs; segments depressed at the apex, punctured at the base, apical fringe sooty brown; beneath with the 6th segment narrowly emarginate in the centre, the 7th scarcely visible, 8th produced, narrow, with its apex widened (for genitalia see Pl. V., figs. 2—2*b*). Legs clothed with pale hairs; posterior femora with a large truncate spine beneath; posterior tibiæ curved, thickened at the apex, with a tuft of long hairs above the middle, on their inner side.

♀. Very like the ♂, but with the head smaller, scarcely wider than the thorax. Metathorax with the basal area finely wrinkled and depressed; beyond it with the surface smooth, but not very shining. Abdomen oval, convex, very finely punctured, anal fimbria sooty brown, apical dorsal valve rugosely punctured, narrowly raised down the middle; beneath punctured, legs clothed with sooty brown hairs, posterior tibiæ with the scopæ greyish brown, although often covered with bright yellow pollen. Length, 7—8 mm.

Hab. Wandsworth, Blackheath, Chobham, Bourne-mouth, Hastings, Isle of Wight, S. Devon, Penzance, &c. Burrows in the ground on sandy and gravelly commons, &c.

2. *Panurgus ursinus*, Gmel. (Pl. V., fig. 1—1*b*).

Gmel., Linn. Syst. Nat., ed. xiii., p. 2790 = *Banksianus*, Kirb., Smith, Cat. Brit. Hym., 2nd ed. p. 107.

Larger than the preceding; ♂ with the coxæ, femora, and tibiæ simple; ♀ with the scopæ bright golden.

♂. Black, clothed with black hairs. Head scarcely wider than the thorax, covered with sooty black hairs. Thorax shining, finely and remotely punctured; metathorax with its basal area bounded by a wide, smooth, and shining line. Abdomen clothed with black hairs; segments deeply impressed and glabrous at the apex and more or less piceous; apical fringe sooty black; genitalia testaceous (see Pl. V., figs. 1—1*b*); beneath with the 6th segment deeply emarginate; 7th foveated at the base, narrowed and slightly emarginate at the apex; 8th narrow and rounded at

the apex. Legs clothed with fulvous hairs; tarsi pale piceous, except the basal joint.

♀. Black, shining; head densely, thorax somewhat sparsely, clothed with black hairs; mesothorax finely and remotely punctured; metathorax smooth, with the basal area undefined. Abdomen subelliptic, sparsely clothed with rather long fine brown hairs, the apex of each segment impressed and somewhat piceous; apical fringe brown; beneath rather densely clothed with brown hairs, 5th segment largely emarginate at the apex. Legs clothed with golden hairs; posterior tibiæ and metatarsi, and the apices of all the tarsi, testaceous. Scopæ bright golden. Length, 9—10 mm.

Hab. A common species in many localities. London District; Chobham; Hastings; Bournemouth; Sidmouth; Barmouth, N. Wales; Norwich; &c. Burrows in the ground, and is chiefly found in sandy localities. Smith records *dentipes* as British on a single specimen in the collection of the British Museum. Should this species occur in this country it can easily be recognised by the spinose or dentate posterior trochanters and simple femora of the ♂, and by the highly polished surface of the metathorax of the ♀, the basal area of which is not longitudinally striate. It is of the same size as *calcaratus*.

ROPHITES, *Spin.*

Spin., *Ins. Lig.*, ii., p. 9.

Species dull and pubescent, halictiform, but wings with two submarginal cells; labial palpi 4-jointed; maxillary palpi 6-jointed; tongue narrow and elongate, much longer than the palpi, reaching to the abdomen; ♂ with the 7th segment hidden, produced at each side into a long process; the 8th very narrow and long, widened and spoon-shaped at the apex, which is just visible beyond the 6th; posterior tibiæ with a patella at the base. Antennæ of ♂ considerably longer than those of the ♀.

1. *Rophites quinquespinosus*, *Spin.* (*Pl. V.*, fig. 3—3*d.*)

Spin., *Ins. Lig.*, ii., p. 72.

♀. Head black, clothed with brown hairs, very finely and closely punctured; face longer than wide. Antennæ reaching to the prothorax. Thorax black, very finely and closely punctured, and densely clothed with short brown hairs; tegulæ piceous; wings subhyaline, darker at the apex; metathorax dull, radiately striate at the base, closely punctured posteriorly. Abdomen dull, closely, finely, and evenly punctured, black, clothed with very

short hairs, the apical margin of each segment narrowly piceous, and clothed with a band of pale ochreous decumbent hairs, that of the basal segment interrupted, that of the 5th and 6th segments golden; 5th segment simple; 6th with the dorsal valve triangular, its margins narrowly raised; beneath punctured, apical margin of the segments pale and clothed with pale hairs. Legs clothed with golden hairs; intermediate calcaria very long and pale, inwardly serrate; apical joints of the tarsi testaceous. Length, 9 mm.

The ♂ has not yet occurred in this country, but may be at once recognised by its pale antennæ and the spines on its 6th ventral segment (for genitalia, &c., see Pl. V., figs. 3—3*d*).

Hab. Guestling, near Hastings. Two specimens taken by the Rev. E. N. Bloomfield, to whom I am greatly indebted for the specimen from which this description is drawn up. The ♀ very closely resembles an *Halictus*, but its wings, which have only two submarginal cells, its long narrow tongue, and simple 5th dorsal segment, *i.e.*, without the central rima, will at once distinguish it.

DUFOUREA, *Lep.*

Lepeletier, *Hist. Nat. des Ins., Hym. ii.*, p. 226.

Very like a small *Panurgus*, but with the ♂ narrower than the ♀, and with longer antennæ; 3rd joint of labial palpi much shorter than 2nd; wings with two submarginal cells; six ventral segments and the tip of the 8th visible in the ♂; 7th ventral segment of the ♂ deeply cleft; 8th very narrow and elongate; species black and shining; posterior tibiæ with a patella.

1. *Dufourea vulgaris*, Schenck. (Pl. V., fig. 4—4*c*).

Schenck, *Jahr. Ver. Nat. Herz. Nassau, xiv.*, p. 206.

Both sexes black and shining, calcaria pale, tarsi more or less piceous.

♂. Head shining, rugosely punctured, clothed with ochreous hairs; face nearly round. Antennæ reaching not quite to the tegulæ, entirely black; mandibles pitchy red. Thorax smooth and shining, remotely and irregularly punctured, sparingly clothed with ochreous hairs; wings subhyaline, nervures dark piceous; metathorax radiately wrinkled at the base, its brow semicircular. Abdomen elongate, shining, the segments remotely punctured at the base and sparsely clothed with ochreous hairs, glabrous and impunctate, and more or less impressed at the apex; apical dorsal

valve narrow and pale at the apex; beneath shining, punctured (for genitalia see Pl. V., figs. 4—4c). Legs clothed with pale hairs; calcaria pale.

♀. Something like a very small *Panurgus* in shape. Head rather closely punctured; clypeus with a few very large shallow punctures, fringed in front with golden hairs; mandibles pitchy red. Thorax above very shining and almost glabrous, very remotely punctured, more hairy round the sides; wings as in the ♂; metathorax finely rugose. Abdomen somewhat depressed and sub-elliptic, the segments sparsely punctured and clothed with pale hairs at the base, very shining and glabrous, and somewhat piceous and impressed at the apex; apical fringe brown; 6th dorsal valve piceous; beneath with the segments punctured at their apex, and clothed with pale hairs, their apical margins pale; 5th with a transverse carina; 6th testaceous. Legs with pale hairs. Length, 6—7 mm.

Hab. Undercliff near Chewton, Hants. One ♂, Aug. 12th, 1879, Sir S. S. Saunders; Woking, Aug. 1st, 1881, one ♀, Mr. T. R. Billups, who has very generously presented me with the specimen. These are the only recorded captures of this species in England.

NOMADA, *Fabr.*

Fabr., *Syst. Ent.*, p. 388.

Wings with three submarginal cells; labial palpi 4-jointed; maxillary palpi 6-jointed; ♂ with the clypeus densely hairy, and with the 8th abdominal ventral segment produced at the apex into a somewhat elongate curved process, spinose or hairy at the sides, and generally terminating in two recurved teeth or spines; 7th ventral, shaped like the 6th; only six ventral segments exposed; genital armature with the cardo very large, and with the apices of the laciniae generally very densely tufted with hairs; ♀ with the 6th ventral segment flat and truncate, armed at each side of the truncature with several thick curved spines.

A genus of elegantly-shaped bees, generally banded on the abdomen with yellow and brown or black, so as somewhat to resemble a wasp. The species, so far as we know, are all parasitic on other Hymenoptera.

(32) 1. Labrum pale, or with only slightly darker spots;
species not very small.

(3) 2. Metathorax posteriorly bright and shining at the
sides *Roberjeotiana*.

- (2) 3. Metathorax posteriorly not bright and shining at the sides.
- (7) 4. Scutellum not raised, entirely flavous, or with a single flavous spot in the middle.
- (6) 5. Abdomen with lateral spots; antennæ dark .. *solidaginis*.
- (5) 6. Abdomen with continuous bands; antennæ pale *fucata*.
- (4) 7. Scutellum more or less raised, with two reddish or flavous spots; or entirely immaculate.
- (17) 8. Markings of 2nd and following abdominal segments black and yellow, sharply defined.
- (10) 9. Head somewhat rostrate; the portion in front of the eyes, viewed sideways, much longer than that behind them *6-fasciata*.
- (9) 10. Head not rostrate; viewed sideways, with its anterior portion not longer than the posterior.
- (12) 11. Abdominal bands, with the exception of the 1st, entire; apex of the posterior tibæ in the ♀ armed outwardly with two thick curved spines *succincta*.
- (11) 12. One or more of the abdominal bands, besides the 1st, interrupted; posterior tibæ in the ♀ at the apex outwardly unarmed or with several fine spines.
- (14) 13. ♂, antennæ short, almost entirely black; 2nd and 3rd joints of flagellum subequal; scutellum with two large conspicuous yellow spots; ♀, antennæ dark; posterior tibæ unarmed .. *jacobææ*.
- (13) 14. ♂, antennæ long, only dark above at the base; 2nd joint of flagellum not so long as 3rd; spots of scutellum small, if any; ♀, antennæ pale; posterior tibæ armed outwardly with fine spines.
- (16) 15. Tegulæ flavous; 3rd joint of the antennæ in the ♂, looked at from beneath, not half so long as the 4th; 3rd joint of the antennæ in the ♀ much shorter than the 4th *lineola*.
- (15) 16. Tegulæ almost always ferruginous; 3rd joint of antennæ in the ♂ beneath more than half the length of the 4th; 3rd in the ♀ almost as long as the 4th *alternata*.
- (8) 17. Markings of abdomen brown and yellow, or, if black, then with the black margined with brown.
- (19) 18. ♂ with the joints of the antennæ tuberculated beneath; ♀ with the tubercles of the prothorax and two spots on the scutellum flavous; the pubescence of the thorax bright fulvous-red *Lathburiana*.
- (18) 19. ♂ with the antennæ simple; ♀ with the spots on the scutellum not flavous; pubescence of the thorax not bright fulvous-red.
- (29) 20. Mandibles acute at the apex.
- (22) 21. Markings of abdomen cream-coloured or nearly white on a clear brownish red ground; posterior tibæ in both sexes with five long equal spines, pale in the ♂, black in the ♀ .. *alloguttata*

- (21) 22. Markings of abdomen yellow on a brown ground ; posterior tibiæ often spined, but the spines unequal and irregular, or short and stout.
- (24) 23. Apex of posterior tibiæ in the ♀ with three short thick spines *guttulata*.
- (23) 24. Apex of posterior tibiæ in ♀ with long irregular pale spines.
- (28) 25. Scape of the antennæ entirely black in the ♂ : mesothorax entirely black in the ♀ .
- (27) 26. Prothoracic tubercles entirely flavous in the ♀ ; margined with flavous in the ♂ *lateralis*.
- (26) 27. Prothoracic tubercles ferruginous in both sexes *borealis*.
- (25) 28. Scape of antennæ flavous beneath in the ♂ ; mesothorax in the ♀ more or less striped with red *ruficornis*.
- (20) 29. Mandibles bifid or truncate at the apex.
- (31) 30. Mandibles bifid *bifida*.
- (30) 31. Mandibles simply truncate *ochrostoma*.
- (1) 32. Labrum black, or species very small (*furva*).
- (34) 33. Head without a sharp keel between the antennæ *obtusifrons*.
- (33) 34. Head with a sharp keel between the antennæ.
- (36) 35. ♂, anterior femora flattened and dilated ; ♀ with an elevated tooth on the labrum ; species large *armata*.
- (35) 36. ♂ anterior femora simple ; ♀ labrum simple.
- (42) 37. Labrum black.
- (39) 38. ♂ with the 3rd, 4th, and 5th joints of the flagellum somewhat swollen, the 5th to the 9th with a small tubercle beneath ; ♀ antennæ short ; 2nd and 3rd joints of flagellum subequal *ferruginata*.
- (38) 39. ♂ antennæ simple ; ♀ antennæ long ; 3rd joint of flagellum much longer than 2nd.
- (41) 40. ♂ face entirely black ; ♀ antennæ with a wide black band below the apex *Fabriciana*.
- (40) 41. ♂ face at the sides above the mandibles, clypeus, and mandibles, flavous ; ♀ antennæ entirely pale *flavoguttata*.
- (37) 42. Very small species ; labrum pale *furva*.

1. *Nomada fucata*, Panz. (Pl. VI., figs. 3—3b).

Panz., Faun. Germ., 55, 19 = *varia*, Panz., Smith, Cat. Brit. Hym., 2nd ed., p. 119.

Black. Antennæ clear rufo-testaceous, those of the ♂ with a black spot on the 7th and 8th joints above. Thorax with flavous markings ; scutellum with a single central spot. Abdomen banded with yellow ; basal segment brownish red on the disk.

♂. Head and thorax black, clothed with pale hairs, dull, largely and rugosely punctured ; mandibles, labrum and clypeus, clothed with silvery hairs, the sides of the face above the mandibles

yellow; mandibles short, curved, and pointed, their apices piceous. Antennæ clear rufo-testaceous; scape flavous in front; 2nd joint of the flagellum slightly shorter than the 3rd; 6th and 7th joints of the flagellum, and sometimes the 8th, with a black spot above. Thorax with two spots on the collar; the tubercles, tegulæ, and a spot on the mesopleuræ in front, flavous; wings with the nervures testaceous; scutellum entirely, or with a central spot, flavous. Abdomen finely punctured, black; basal segment with a brownish red central band; each of the others with a yellow band, slightly narrowed in the middle; apical dorsal valve deeply incised; beneath punctured and banded with yellow; 6th segment densely ciliated with hairs at the apex; 7th flattened and narrowed towards the apex, which is truncate; 8th narrow and recurved at the apex, with several spines pointing backwards from the apex, and a few smaller ones on the sides pointing forwards towards it (for genitalia, &c., see Pl. VI., figs. 3—3 b). Legs testaceous; femora at the base black.

♀. Very like the ♂, but with the antennæ of a deeper colour, and not spotted above; the scape concolorous; markings of the face of a deeper colour, more inclining to testaceous, clypeus not hairy; markings of the thorax and abdomen as in the ♂; 5th segment beneath with an apical fringe of thick stiff recurved hairs; 6th flat and truncate at the apex, the sides near the apex with thick curved testaceous spines. Legs as in the ♂. Length, 10—12 mm.

Hab. Darenth; Hastings, parasitic on *Andrena fulvicrus*, August, 1879; Eastbourne; Sandown Bay, Isle of Wight. F. Smith says that it is parasitic on *Halictus rubicundus* and *leucozonius*.

This species may be at once recognised by the brown basal segment of its abdomen and the single spot on the scutellum.

2. *Nomada solidaginis*, Panz. (Pl. VI., figs. 2—2 b).

Panz., Faun. Germ., 72, 21; Smith, Cat. Brit. Hym., 2nd ed., p. 127.

Black. Abdomen sometimes brown. Thorax with yellow markings; scutellum with a single yellow spot; abdomen with yellow lateral spots on the 2nd and 3rd segments, and entire bands on the following.

♂. Head and thorax black, largely and closely punctured, clothed with short pale hairs; mandibles, labrum, clypeus, and face at the sides of the clypeus, flavous; mandibles short and pointed, piceous towards the apex. Antennæ short; scape flavous beneath; flagellum piceous beneath, black above, its 2nd joint as

long or longer than the 3rd and following joints, transverse. Thorax with two spots on the collar, the tubercles, tegulæ, and an oval spot on the mesopleuræ, flavous; wings dusky, nervures pitchy; scutellum with a single flavous spot. Abdomen black or rarely brown, shining, finely punctured, except at the extreme apex of each segment; 1st segment immaculate, 2nd and 3rd with a large yellow spot on each side, 4th with an entire yellow band, and 5th and 6th almost entirely yellow; 7th black, rounded at the apex; beneath black, shining, and punctured, except at the apex of each segment; 7th segment smooth and convex, and narrowly rounded at the apex; 8th shaped much like the 7th, but flatter, and armed at the apex on each side with a long upcurved spine and several shorter ones along the sides of the segment (for genitalia, &c., see Pl. VI., figs. 2—2*b*). Legs testaceous-red, flavous at the knees; posterior femora black at the base; posterior coxæ with a yellow spot.

♀. Very like the ♂, but with the ground colour of the abdomen often brown, the labrum and scape of the antennæ ferruginous, the clypeus not hairy and of a more ferruginous colour, the mandibles flavous only at the base, the thorax and abdomen coloured as in the ♂; 5th ventral segment with a fringe of strong black curved hairs on each side at the apex; 6th flat and impressed in the centre, truncate at the apex, with three or four curved spines at each side of the truncature. Legs coloured much as in the ♂, but posterior femora with only a black stripe on their inner surface. Length, 8—9 mm.

Hab. Common on *Senecio*, &c., in July and August, and widely distributed. F. Smith says that it is parasitic on *Halictus leucozonius*, and probably also on *H. cylindricus*.

This little species can hardly be confounded with any other; it is most like *Jacobææ*, but its single spotted scutellum will distinguish it at once.

3. *Nomada sexfasciata*, Panz. (Pl. VI., figs. 4—4*b*).

Panz., Faun. Germ., 62, 18; Smith, Cat. Brit. Hym., 2nd ed., p. 130.

Black; clypeus produced so as to give the head a rostrate appearance; mouth, tegulæ, and two spots on the scutellum, an interrupted band on the first three segments of the abdomen, and an entire band on the others, yellow; legs yellow in the ♂, testaceous in the ♀.

♂. Head and thorax dull, closely and rugosely punctured, rather densely clothed with brownish grey hairs; the portion in

front of the eyes more produced than in the other species of the genus; this is caused partly by the greater length of the cheeks from the eye to the clypeus, and partly by the length of the clypeus itself; mandibles pointed at the apex, not nearly touching the eyes, flavous, with their apices piceous; labrum and clypeus flavous, the latter with a triangular black patch at the base; sides of the face below the antennæ flavous; face below the antennæ densely clothed with silvery hairs. Antennæ fulvous, the scape beneath flavous, above black; the flagellum black above as far as the 6th joint; 3rd joint only a trifle shorter than the 2nd. Thorax entirely black, except the yellow margins of the tegulæ; wings with piceous nervures; scutellum with two small yellow spots or spotless. Abdomen black, finely punctured; 1st, 2nd, and 3rd segments each with a large lateral yellow spot; 4th, 5th, and 6th with a continuous band; apical dorsal valve almost entire; 6th and 7th segments clothed with golden hairs; beneath with the segments densely fringed at the apex with golden hairs; 3rd, 4th, and 5th segments yellow at the base; 6th at the apex, and densely clothed with golden hairs on the yellow portion; 7th segment narrowly rounded; 8th with a long apical projection, strongly curved, and with a few long hairs on each side of the apex; also with its basal portion clothed with long hairs in front (for genitalia, &c., see Pl. VI., figs. 4—4b). Legs yellow; posterior and intermediate femora black beneath.

♀. Very like the ♂, but more shining, and with brighter markings. Head and thorax clothed with fulvous golden hairs; markings of the face as in the ♂, but of a deeper yellow; scape of the antennæ fulvous in front; flagellum fulvous, slightly darker towards the apex. Thorax as in the ♂, but the tegulæ nearly entirely yellow; scutellum with two large yellow spots. Abdomen spotted and banded as in the ♂; segments beneath not fringed at the apex; 5th with a tuft of golden hairs on each side; 6th smooth and truncate at the apex, with several curved spines on each side of the truncature. Legs fulvous; femora black at the base. Length, 13—15 mm.

Hab. Parasitic on *Eucera longicornis*, and not rare in many localities in May and June; near Highgate; Southgate; Southend; Norwich; Chobham; Hastings, one ♀ in August, 1879.

Easily recognised by its large size and subrostrate head.

4. *Nomada succincta*, Panz. (Pl. VI., figs. 9—9 b).

Panz., Faun. Germ., 55, 21; Smith, Cat. Brit. Hym., 2nd ed., p. 132.

Tegulæ and tubercles, and two spots on the scutellum (often absent in the ♂), flavous; abdomen with entire flavous bands on all the segments, except the basal one; posterior tibiæ in the ♀ armed outwardly with two thick curved pale spines.

♂. Black; head and thorax densely and rugosely punctured, densely clothed with brownish grey hairs; mandibles flavous, thick, pointed, and carinated down the middle, flavous, with the apex piceous; labrum, clypeus, except the extreme base, sides of the face below the antennæ, and scape of the antennæ in front, flavous. Antennæ fulvous, black above as far as the 8th joint. Thorax with two spots on the collar; the tubercles and tegulæ citron-yellow; mesopleuræ with a yellow anterior margin; wings with testaceous nervures; scutellum with two small yellow spots. Abdomen finely punctured; basal segment with an interrupted yellow band; the following five each with a continuous band of the same colour; apical dorsal segment sharply emarginate, sparingly clothed with golden hairs; beneath shining, punctured, except at the apex of each segment; 2nd, 3rd, 4th, and 5th with a central yellow band; 6th segment yellow at the apex; 7th smooth, narrowly rounded at the apex; 8th with a long narrow apical production, its extremity curved upwards, and armed on each side with many long spines, those towards the apex longest (for genitalia, &c., see Pl. VI., figs. 9—9 b). Legs fulvous-yellow, with paler markings; femora posteriorly black; posterior tibiæ somewhat truncate at the apex and unarmed, with a slight tubercle on the inner angle of the truncature; posterior trochanters densely hairy beneath.

♀. Very like the ♂, but with the mandibles pale piceous; the labrum piceous, black on the disk; clypeus black, piceous at the extreme apical margin. Antennæ entirely fulvous. Thorax as in the ♂, but less hairy; the spots of the scutellum larger, and the metathorax often with a spot on each side. Abdomen coloured as in the ♂; 5th segment beneath with a tuft of long brownish hairs on each side; 6th somewhat truncate, with curved spines on each side. Legs fulvous; femora black at the base; posterior tibiæ outwardly armed with two or three thick, much curved, piceous spines. Length, 11—13 mm.

Hab. Generally distributed and common in April. I have taken it as late as June.

5. *Nomada lineola*, Panz. (Pl. VI., figs. 5—5 b).

Panz., Faun. Germ., 53, 23; Smith, Cat. Brit. Hym., 2nd ed., p. 129.

Antennæ rufo-testaceous, dark at the base above in the ♂, their joints longer than wide; 2nd joint of the flagellum in the ♂ not nearly half as long as the 3rd; in the ♀ about half as long as the 3rd; tegulæ, tubercles, and two spots on the scutellum (often absent in the ♂), citron-yellow. Abdomen with interrupted flavous bands.

♂. Very like the preceding species in colour, except as regards the interruption of the 2nd and 3rd abdominal bands, and, although this character will always serve to distinguish it, the following points of structure can be more safely relied upon: the 2nd joint of the flagellum is much shorter in proportion to the 3rd, and, looked at from beneath, is not nearly half its length; the apical portion of the 8th abdominal segment is slenderer, and the sides near the apex are armed with finer paler spines (for genitalia, &c., see Pl. VI., figs. 5—5 b); the posterior coxæ are less densely hairy, and the tibiæ are armed at the apex with fine long spines.

♀. Differs from that of *succincta* in the same points of coloration as the ♂, but it wants the yellow line at the sides of the face so characteristic of ♀ *succincta*; structurally it may be distinguished at once by the 2nd joint of the flagellum of the antennæ being scarcely more than half so long as the 3rd, and by the posterior tibiæ being armed at the apex outwardly with numerous dark spines. Length, 10—13 mm.

Hab. Generally distributed, and not uncommon in April and May. Parasitic on various spring species of *Andrena*.

This species is very variable in the extent of the yellow colour; sometimes the basal segment of the abdomen is banded with yellow, sometimes with red; sometimes the bands of the 2nd and 3rd segments are widely interrupted, sometimes almost entire; in fact very little dependence can be placed on the coloration for specific characters; still, in all its varieties, the species may be recognised without failure by careful observation of the points of structure enumerated above.

6. *Nomada alternata*, Kirb. (Pl. VI., figs. 6—6 b).

Kirb., Mon. Ap. Angl., ii., p. 182 = *Marshamella*, Kirb.;
Smith, Cat. Brit. Hym., 2nd ed., p. 131.

Antennæ coloured as in the last species, its joints longer than wide; 2nd joint of flagellum in the ♂ half or more than half the length of the 3rd; in the ♀ about the same length as the 3rd; tegulæ testaceous-brown; tubercles generally more or less flavous; two spots on the scutellum (often wanting in the ♂) flavous. Abdomen with interrupted flavous bands; apical spines of the posterior tibiæ in the ♀ pale.

♂. Only differs from the preceding by the longer 2nd joint of the flagellum and the shorter 3rd, and by the testaceous, not flavous, tegulæ, and by usually having a black streak on the tibiæ posteriorly (for genitalia, &c., see Pl. VI., figs. 6—6 b).

♀. Differs from the preceding by the longer 2nd joint of the flagellum, the testaceous tegulæ, and the pale spines of the posterior tibiæ. Length, 10—13 mm.

Very variable, like the preceding species, in the extent of the yellow markings.

Hab. Generally distributed, and common in April and May. Parasitic on *Andrena nigroænea* and *atriceps*; and F. Smith says he has observed it in the burrows of *Eucera*.

7. *Nomada jacobææ*, Panz. (Pl. VI., figs. 8—8 b).

Panz., Faun. Germ., 72, 20; Smith, Cat. Brit. Hym.,
2nd ed., p. 128.

A shorter and more compact insect than either of the preceding. Antennæ with the flagellum almost entirely black in both sexes, its joints as wide, or nearly as wide, as long; 2nd and 3rd joints in the ♂ subequal; 3rd in the ♀ distinctly shorter than the 2nd; tegulæ, tubercles, and scutellar spots very prominent and flavous. Abdomen with interrupted bands; posterior tibiæ outwardly unarmed.

♂. Head and thorax black, almost glabrous, largely and densely punctured; mandibles, except the piceous apices, labrum, clypeus, except the extreme base, and face at the sides of the clypeus, flavous; face below the antennæ clothed with silvery hairs. Antennæ short, black above throughout their length; scape flavous beneath; flagellum piceous beneath, its 2nd and 3rd joints subequal; prothorax with the collar and tubercles, mesothorax with the tegulæ, and a round spot on each of the mesopleuræ

beneath, flavous; wings smoky; 1st transverse median nervure uniting with the cubital at the base of the furcature; scutellum with two large yellow spots. Abdomen finely punctured, somewhat shining, with an almost entire band on the 1st segment, a widely interrupted band on the 2nd and 3rd, and an entire band on the 4th, 5th, and 6th flavous; apical dorsal valve black: beneath black; 3rd, 4th, and 5th segments widely flavous at the base, their apical margins shining and impunctate; 6th densely hairy in the centre; 7th smooth and shining; 8th with the central process very long, not widened at the apex, armed on each side just below the apex with a very large strong spine, the sides of the process below it fringed with hairs (for genitalia see Pl. VI., figs. 8—8*b*). Legs clear orange-testaceous; coxæ, trochanters, and the posterior femora at the base, black; posterior tibiæ outwardly unarmed.

♀. Very like the ♂ in colour, but with the mandibles, labrum, clypeus, and scape testaceous, not flavous; the antennæ with the 2nd joint of the flagellum longer than the 3rd; the metathorax with a small flavous spot on each side; apical dorsal valve testaceous-brown; 5th segment beneath densely clothed with hairs at the sides of the apex; 6th with lateral spines. Legs as in the ♂; posterior tibiæ unarmed. Length, 10—12 mm.

Hab. On *Senecio* in July and August; not very common, but widely distributed.

8. *Nomada Lathburiana*, Kirb. (Pl. VII., figs. 5—5*b*).

Kirb., Mon. Ap. Angl., ii., p. 183; Smith, Cat. Brit. Hym., 2nd ed., p. 117.

Abdomen in both sexes with continuous yellow bands, its base brown; ♂ with the joints of the antennæ, except the four at the base, with a small grain-like tubercle beneath on each; ♀ with the pubescence of the thorax red.

♂. Head and thorax black, clothed with ochreous hairs; mandibles yellow, simple, their apices brown; labrum, clypeus, a spot above it, sides of the face, and scape of the antennæ in front, yellow. Antennæ fulvous, with the first six or seven joints black above; the 5th to the 13th bearing beneath a small grain-like tubercle on each. Thorax largely and very closely punctured; tubercles yellow; tegulæ testaceous; wings slightly brownish, nervures testaceous. Abdomen brownish black; the basal segment with a paler brown band across the middle; the remaining segments with a wide yellow basal band on each; 8th segment with the central process only slightly widened at the apex, the sides with rather long somewhat reflexed hairs (for genitalia, &c., see Pl. VII., figs. 5—5*b*). Legs fulvous; femora black beneath.

♀. Larger than the ♂, with the parts of the face which are yellow in the ♂ fulvous-red. Antennæ simple, entirely fulvous, except the basal joint, which is black above. Thorax clothed with short reddish hairs; tubercles yellow; tegulæ testaceous; scutellum with two yellow tubercles. Abdomen coloured as in the ♂; legs fulvous-red; posterior femora black; posterior tibiæ armed at the apex with a short blunt tooth, and two or three short thick pale spines. Length, 11—13 mm.

Hab. Hampstead, Highgate, Scotland, Devonshire.

F. Smith says it has been observed about the burrows of *Andrena labialis*, and also those of "*A. rufa*" (? *A. fulva*). Schmiedeknecht, in his 'Apidæ Europææ,' says it is parasitic on *Andrena pratensis*; so that probably, as Smith remarks, it is one of those bees that are parasitic on several species.

9. *Nomada alboguttata*, H.-Schäff. (Pl. VI., figs. 7.—7b).

H.-Schäff., Germ. Zeitsch., i., p. 282 = *baccata*, Smith, Cat. Brit. Hym., 2nd ed., p. 120.

2nd joint of the flagellum in the ♂ much shorter than the 3rd; 2nd and 3rd in the ♀ subequal. Mesothorax entirely black in the ♂, in the ♀ with red vittæ. Abdomen bright rufo-testaceous, with cream-coloured lateral spots; posterior tibiæ in the ♂ with five long pale spines; in the ♀ with five black ones, all of about equal length.

♂. Head and thorax black, largely and rugosely punctured, clothed with long grey hairs; mandibles rather stout, flavous, and pointed, their points piceous; labrum pale flavous, densely clothed with long silvery hairs, its sides and the clypeus flavous. Antennæ with the scape flavous in front; flagellum rufo-testaceous, its first four or five joints black above; 3rd joint of flagellum much longer than the 2nd. Thorax with the tubercles, at least in front, flavous; tegulæ testaceous; mesopleuræ clothed with long white hairs, with a small yellow spot on each in front; wings slightly dusky; scutellum with two yellow spots more or less bordered with orange. Abdomen bright rufo-testaceous, each segment more or less black at the apex laterally; base of the 1st segment black; disk generally with two yellow spots; 2nd with a large lateral cream-coloured spot on each side at the base; 3rd, 4th, and 5th with smaller spots; 6th with a central spot; apical dorsal valve clothed with long pale hairs, its apex narrowly emarginate; beneath entirely rufo-testaceous, shining; 5th segment densely hairy; 3rd and 4th segments sometimes with a pale line in the middle; 8th segment

with the apical process winged on each side nearly to its apex, which is widened and armed on each side with fine pale spines (for genitalia see Pl. VI., figs. 7—7*b*). Legs rufo-testaceous; intermediate and posterior femora black at the extreme base; posterior tibiæ armed outwardly at the apex with five long nearly equal pale spines.

♀. Rather darker than the ♂; mandibles, clypeus, sides of the face, and antennæ rufo-testaceous; 2nd and 3rd joints of flagellum subequal; prothorax and tubercles testaceous; mesothorax with a rufo-testaceous vitta at each side, and two others down its disk; mesopleuræ with a large rufo-testaceous spot; tegulæ testaceous; scutellum testaceous; metathorax with two small rufo-testaceous spots at the base in the basal enclosure, and two larger ones below, its sides clothed with shining silvery hairs. Abdomen bright rufo-testaceous, black at the extreme base; each segment slightly darker towards the apex; a large spot on each side of the 2nd segment, a smaller one on each side of the 3rd, a transverse narrow spot on each side of the 4th, almost extending to the centre, and a square spot on the 5th, cream-coloured; beneath rufo-testaceous. Legs rufo-testaceous; femora at the extreme base more or less black; posterior tibiæ armed at the apex outwardly with five equally long curved black spines. Length, 7—9 mm.

Hab. On heaths, and parasitic on *Andrena argentata*. Woking, Sandhurst, Farnborough, Bournemouth, &c.

This species varies considerably in the extent of the testaceous colour. On the Continent a large form of it is known, the *5-spinosa* of Thomson; but, so far as I know, the small form only has hitherto occurred in this country.

10. *Nomada guttulata*, Schenck.

Schenck, Jahr. Ver. Herz. Nassau, xiv., p. 388 = *rufilabris*, Thoms.

I have only a single ♀ of this species without locality, and therefore I introduce it with some hesitation; it would naturally pass as a small *ochrostoma*, but the mandibles are sharp at the apex, and the posterior tibiæ have outwardly three very short blunt spines, a character quite peculiar to itself; the 2nd and 3rd joints of the flagellum of the antennæ are subequal.

Thomson finds this species in Sweden, and has described it under the name of *rufilabris*.

11. *Nomada lateralis*, Panz. (Pl. VI., figs. 10—10*b*).

Panz., Faun. Germ., 96, 20, 21 = *xanthosticta*, Kirb., Smith, Cat. Brit. Hym., 1st ed. (nec 2nd) = *Bridgmaniana*, Smith, Cat. Brit. Hym., 2nd ed., p. 115.

Black; thorax without red vittæ in either sex; tubercles entirely flavous, or flavous in front only; scape of the antennæ in the ♂ entirely black. Abdomen brown, with yellow lateral spots or transverse bands, in the ♀ with a round yellow spot on each side of the 2nd segment.

♂. Head and thorax black, closely and rugosely punctured, clothed with short grey hairs; mandibles, except the extreme piceous apex, labrum, clypeus in front, and the sides of the face, flavous; face below the antennæ clothed with long silvery hairs. Antennæ with the scape entirely black; the flagellum piceous beneath, black above; 3rd joint much longer than 2nd. Prothorax with the tubercles widely bordered with yellow in front; mesothorax with the tegulæ testaceous; wings very slightly dusky. Abdomen testaceous-brown, shining, extreme base black; 1st segment unspotted, or with a yellow band; 2nd and 3rd segments with large lateral yellow spots, sometimes united into transverse bands; 5th and 6th segments each with a narrow basal yellow band, sometimes interrupted in the middle; 7th segment truncate at the apex, the truncature slightly emarginate; beneath brown, sometimes banded with yellow; 8th segment very narrowly produced, and curved upwards at the apex, the sides of the process finely fringed with hairs; apex with two strong reflexed spines (for genitalia see Pl. VI., figs. 10—10*b*). Legs black; femora and tibiæ in front pale; tarsi piceous; 1st joint more or less black above.

♀. Head and thorax black, rugosely punctured, clothed with short greyish brown hairs; mandibles, labrum, and clypeus in front testaceous, the labrum with a darker spot on each side; face below the antennæ with scattered bristly hairs. Antennæ with the scape black, the flagellum ferruginous, black above at the base; 2nd joint much shorter than 3rd. Prothorax with the tubercles flavous; mesothorax with the tegulæ piceous; scutellum with two obscure ferruginous spots. Abdomen pitchy brown, the extreme base black; apical margin of the basal segment narrowly dark, an ovate yellow spot on each side of the 2nd segment, and often with a smaller one on each side of the 3rd; sometimes also with a spot on the 5th. Legs with the femora black, except at their extreme apices; tibiæ ferruginous, with a black vitta posteriorly; posterior tibiæ armed outwardly with five rather short piceous spines; tarsi

ferruginous, their basal joints more or less black above. Length, 8—9 mm.

Hab. Norwich; Yorkshire; Newcastle.

The yellow tubercles distinguish this species at once from *ruficornis* and its allies; the male may be known besides by its black scape.

12. *Nomada ruficornis*, Linn. (Pl. VII., figs. 2—2 b).

Linn., Syst. Nat., ed. x., i., p. 578; Smith, Cat. Brit. Hym., 2nd ed., p. 110 = *lateralis*, Sm. pars ?

Var. = *signata*, Jur., Smith, &c.

Mandibles acute; scape of antennæ in the ♂ flavous in front. Thorax with red lines in the ♀, the tegulæ and tubercles piceous, sometimes ochraceous in the ♂. Abdomen bright brown, with yellow lateral spots or continuous bands; femora scarcely hairy outwardly in the ♀; posterior tibiæ armed outwardly with pale spines of uneven length.

♂. Head and thorax black, closely punctured, and densely clothed with brownish grey hairs; mandibles, labrum, clypeus, and face at its sides, flavous; mandibles acute, their tips piceous; face in front of the antennæ clothed with silvery hairs. Antennæ with the scape black, flavous in front; flagellum narrowly black above, beneath fulvous; 2nd joint about half as long as the 3rd. Thorax with the tubercles testaceous or ochraceous; tegulæ testaceous or piceous; wings slightly clouded, especially at the apical margin; scutellum with two red spots, or unspotted. Abdomen shining and finely punctured, black at the extreme base; basal segment beyond the black base generally entirely brown or with two black spots on the disk; the remaining segments brown, either with lateral yellow spots or with continuous yellow bands, the brown colour often deepened almost into black along the margins of the segments; beneath brown, with yellow bands; 8th segment with the apical process much curved, not widened at the apex, and finely fringed at the sides with hairs, and with two strong reflexed apical spines (for genitalia see Pl. VII., figs. 2—2 b). Legs ferruginous, the base of the femora more or less black; posterior tibiæ armed at the apex outwardly with fine spines of uneven length.

♀. Head and thorax black, clothed with short brownish hairs, the former with the mandibles, clypeus, labrum, and sides of the face fulvous. Antennæ fulvous, with the 2nd joint of the flagellum about three-fourths the length of the 3rd. Thorax almost entirely black, or black with narrow or broad red longitudinal stripes, or red with only indications of the darker lines; tubercles and tegulæ

testaceous; scutellum fulvous; mesopleuræ with a large red spot; metathorax unspotted, or with red spots, or (var. *signata*) with two large yellow spots. Abdomen shining, brown, spotted or banded with yellow, the extreme base of the 1st segment black, and often with the margins of all the segments more or less black; the extent of the yellow colour varies from a single round spot on each side of the 2nd segment, and a square spot on the 5th, to a complete yellow band on each segment; beneath the colour varies from uniform brown to brown with an entire band on each segment; 5th ventral segment with a tuft of black hairs on each side; 6th flat, truncate at the apex, the sides of the truncature with curved spines. Legs fulvous, the base of the femora black; posterior tibiæ armed outwardly with pale spines of irregular length. Length, 7—13 mm.

Hab. Common and generally distributed, April to July.

I have only described this species in general terms, not specifying all the varieties, as, with the exception of the var. with the entire bands, "*signata*," they are in no way constant, and merge into one another almost imperceptibly. One of the prettiest varieties is that where the apex of each segment is bordered with black, and the yellow spots well defined.

13. *Nomada borealis*, Zett.

Zett., *Ins. Lapp.*, p. 470; Smith, *Cat. Brit. Hym.*, 2nd ed., p. 112.

Closely allied to *ruficornis*. Mandibles acute; scape of the antennæ and mesothorax entirely black in both sexes; tubercles and tegulæ piceous. Abdomen dark brown, with yellow lateral spots, the brown colour much suffused with black; femora in the ♀ clothed with prominent black hairs outwardly.

♂. Differs from that of *ruficornis* in having the scape of the antennæ entirely black, the clypeus with only the margin pale, and the pubescence generally composed of thicker hairs, and in having the posterior femora outwardly more densely hairy.

♀. Differs from *ruficornis* in having the mesothorax without red lines, the brown colour of the abdomen darker and more suffused with black, and the posterior femora outwardly clothed with bristly black hairs. Length, 9—11 mm.

Hab. Parasitic on *Andrena Clarkella*; rare. Hampstead; Hastings; Glanvilles Wootton, Dorset; Fordlands, Devon; Leominster; Carlisle; Colchester.

14. *Nomada bifida*, Thoms. (Pl. VII., figs. 7—7b).

Thoms., Hym. Scand., ii., p. 196.

This species is very closely allied to *ruficornis*, but the bifid mandibles and the following characters will distinguish it easily.

♂. Mandibles bifid at the apex, the pubescence of the thorax denser, and the spines at the apex of the posterior tibiæ hidden in a dense tuft of very fine silvery hairs (for genitalia see Pl. VII., figs. 7—7b).

♀. Mandibles bifid; metathorax with a conspicuous patch of silvery hairs on each side below the basal triangle; posterior tibiæ with the spines of equal length, and the apex clothed with a fine close silvery white pubescence.

In colour both sexes resemble *ruficornis* in almost every particular, *i. e.*, certain of its varieties, as *bifida* does not vary to such an extent as *ruficornis*; in the ♂ the pale bands of the abdomen are generally continuous or nearly so, and the ♀ has generally two very large lateral spots on the 2nd segment, a small one on each side of the 3rd, and a transverse line across the middle of the 4th and 5th at the base. Length, 8—11 mm.

Hab. The only localities I know for this species at present are Canterbury, May; Chobham, June; and near Norwich, J. B. Bridgman; but I have no doubt that it is mixed in many collections, as it was in my own till quite lately, with *ruficornis*. F. Smith evidently recognised the characters of *bifida*, but apparently doubted if they were of specific value, as I find, in some MS. notes of his, kindly lent to me by Dr. Mason, the following remarks under *ruficornis*:—"The types in Kirby's collection are all the dark-coloured vars. I am not satisfied of the dark vars. being identical with the pale examples which are described by Kirby under the name *flava*; the differences which present themselves are a general darker shade of red on the abdomen, and in the markings of the head and thorax. The ocelli are usually enclosed in a red ring. The wings are clouded with dark stains, and the mandibles are shorter, stouter, and usually bidentate, the teeth more or less developed; in *flava* the mandibles are sensibly more slender, longer, and not bidentate, but terminate in an acute point."

15. *Nomada ochrostoma*, Kirb. (Pl. VI., figs. 11—11 b).

Kirb., Mon. Ap. Angl., ii., p. 209; Smith, Cat. Brit. Hym., 2nd ed., p. 116 = *lateralis*, Smith, pars ? = *punctiscuta*, Thoms.

Very like the variety of *ruficornis* with small lateral spots on the abdomen; mandibles truncate at the apex; mesothorax and scutellum very coarsely and rugosely punctured; ♂ with the scape of the antennæ ferruginous; ♀ with the mesothorax with red longitudinal lines; 2nd segment of the abdomen with a small round yellow spot on each side.

♂. Head and thorax black, coarsely and deeply punctured, clothed with pale ochreous hairs, face below the antennæ with silvery ones; mandibles, except their piceous apices, labrum, clypeus in front, and the face at the sides of the clypeus, flavous; mandibles simply truncate; clypeus truncate, the angles of the truncature more or less prominent. Antennæ with the scape beneath and the flagellum fulvous; scape above and the first five or six joints of the flagellum above black; 3rd joint much longer than 2nd. Thorax with the tubercles and tegulæ testaceous: wings smoky; scutellum raised, very largely punctured, with two red spots, or entirely red; metathorax hairy and rugosely punctured at the sides. Abdomen ferruginous, black at the extreme base; 2nd, 3rd, and 4th segments with a small lateral pale yellow spot on each side; 5th with a transverse discal spot on each side; 6th with a single transverse discal spot; 7th narrowly emarginate at the apex; in some varieties there is a black line at the base of the segments, and in some the spots are larger, and the surface of the abdomen clothed with a fine white pubescence; beneath with the segments more or less darker at the base and apex; 6th segment densely hairy at the apex, and with a small pale spot,—in some varieties some of the other segments are occasionally spotted with yellow; 8th segment with the apical process short, much curved, widened at the apex; sides fringed with spines near the apex and hairs towards the base (for genitalia, see Pl. VI., figs. 11—11 b). Legs ferruginous; femora at the base and often a spot on the tibiæ black; apex of the tibiæ armed outwardly with irregular spines and clothed with fine white hairs.

♀. Very like that sex of *ruficornis*, but with the mandibles truncate; the 2nd segment of the abdomen with only a small round lateral spot; the antennæ shorter, and the puncturation of the thorax, and especially of the scutellum, much larger. Length, 7—8 mm.

Hab. London District, Chobham, Norwich, Plymouth,

Penzance, Yorkshire, &c.; not generally common. F. Smith says that it is a parasite of *Andrena labialis*. It occurs from May to August.

16. *Nomada Roberjeotiana*, Panz. (Pl. VI., figs. 1—1 b).

Panz., Faun. Germ., 72, 18—19; Smith, Cat. Brit. Hym., 2nd ed., p. 124.

Head and thorax smooth, clearly punctured; metathorax with the sides below the basal area bright and shining. Abdomen bright ferruginous, much suffused with black, especially towards the apex; 2nd and 3rd segments with yellowish white lateral spots; 4th and 5th in the ♂ with indications of bands; 5th in the ♀ with a quadrate spot.

♂. Head and thorax very slightly shining, black, sparingly clothed with short greyish hairs, the intervals between the punctures wider than the punctures themselves, especially on the disk of the latter; mandibles, except the extreme piceous apex, labrum, clypeus, and face at the sides below the antennæ, flavous; clypeus densely clothed with erect hairs. Antennæ with scape in front flavous; flagellum rufescent, with an obscure line along its back; 1st joint unusually large and visible; 2nd and 3rd subequal. Thorax with two spots on the collar, the tubercles and the tegulæ flavous; wings slightly smoky; 1st transverse median nervure uniting with the cubital before the base of the furcature; scutellum scarcely raised, ferruginous; metathorax with the basal area dull, finely rugose, its sides beyond it polished and remotely punctured. Abdomen shining, distinctly punctured; 1st segment black at the base, ferruginous at the apex; 2nd ferruginous, the sides narrowly black at the base, and each with an oval yellowish white spot; 3rd widely black at the base, with a pale lateral oval spot; 4th, 5th, and 6th only ferruginous at the apex, and with irregular pale basal bands; 7th segment somewhat truncate at the apex; beneath with the basal segments ferruginous; the apical segments black; 2nd and 3rd often with a yellow spot on each side; 6th segment densely clothed with somewhat curled pale hairs; 8th with the apical process very short and broad, widely rounded at the apex, fringed with pale fine spines at the sides, and a long thick piceous spine at each side of the apex (for genitalia see Pl. VI., figs. 1—1 b). Legs: femora black at the base, tibiæ and tarsi ferruginous, the posterior tibiæ clouded across the middle.

♀. Very like the ♂, but with the mandibles and labrum ferruginous, the clypeus black, with the extreme apical margin ferruginous. Antennæ entirely ferruginous, darker above; collar, tubercles, and tegulæ of thorax ferruginous; wings as in the ♂

metathorax as in the ♂. Abdomen rather more brightly coloured, but similarly marked; the 5th segment with a large quadrate white spot; beneath with the basal segments ferruginous, the apical black. Legs as in the ♂. Length, 6—7 mm.

Hab. Rare. Blackwater, Hants; Chobham, Surrey; Carlisle; on *Senecio* and other yellow Composite flowers in June and July.

17. *Nomada obtusifrons*, Nyl. (Pl. VII., fig. 8).

Nyl., Not. Sallsk., pro Faun. Flor. Fenn., Forh., i., p. 184 = *xanthosticta*, Smith, Cat. Brit. Hym., 2nd ed., p. 124 (not *xanthosticta*, Smith, 1st ed.) = *mistura*, Smith.

Small; labrum black; both sexes without a sharp carina between the antennæ; ♂ with the abdomen piceous, with a yellowish white spot at each side of the 2nd and 3rd segments; ♀ with the abdomen ferruginous, spotted as in the ♂, but with a large quadrate spot on the 5th segment; the spots are sometimes obsolete.

♂. Head and thorax black, clothed with greyish brown hairs, largely and closely punctured; mandibles short and thick, testaceous, piceous at the apex; labrum black; clypeus with the extreme margin piceous. Antennæ black; face between the antennæ with an obtuse elongate tubercle; flagellum testaceous beneath, its 2nd joint longer than the 3rd. Thorax with the tubercles pale, the tegulæ piceous; wings slightly dusky; 1st transverse median nervure uniting with the cubital before the furcature; scutellum entirely black; metathorax nearly smooth on its basal area. Abdomen punctured, piceous-black, the apices of the segments paler, the 2nd and 3rd with a yellowish white lateral spot; the 4th and 5th with white transverse lines, that on the 4th often obsolete; apical segment rounded at the extremity; beneath pitchy black, the apices of the segments paler; 6th segment with a small pale apical spot, but not densely hairy as in most of the species (for genitalia see Pl. VII., fig. 8). Legs piceous; base of the femora and a cloud across the tibiæ black or nearly so.

♀. Like the ♂ as to the head and thorax, both in colour and puncturation, but with a much shorter, hardly conspicuous, pubescence. Abdomen ferruginous; 2nd and 3rd segments with a yellowish white spot on each side; 5th with a square white central spot, the spots are sometimes wanting; 3rd and 4th segments piceous towards the apex; beneath ferruginous. Legs as in the ♂, but paler. Length, 6 mm.

Hab. Rare. Norwich; Ilfracombe; Yarm, Yorkshire; Scotland.

Easily recognised by the blunt tubercle between the antennæ, where in the other species there is a sharp carina.

18. *Nomada armata*, H.-Sch.

H.-Sch., Germ. Zeitsch., i, p. 279; Smith, Cat. Brit. Hym., 2nd ed., p. 118.

Large; labrum black; anterior femora in the ♂ dilated and excavated in front; labrum of the ♀ produced into a tooth anteriorly. Abdomen ferruginous, with yellow lateral spots.

♂. Head and thorax black, densely and rugosely punctured, clothed with grey hairs, the hairs on the face below the antennæ silvery white; mandibles ferruginous, flavous at the base and piceous at the apex; labrum black, with a tooth at the apex; clypeus black; sides of the face just above the mandibles yellow. Antennæ with the scape black, the flagellum pale ferruginous, its 2nd joint longer than the 3rd. Thorax black; tegulæ and tubercles testaceous; wings with a dark apical border. Abdomen bright ferruginous, the extreme base black; 2nd, 3rd, and 4th segments each with a spot on each side; 5th and 6th with an apical dorsal spot; base of the 5th and 6th segments black; 7th segment narrow, deeply emarginate at the apex; beneath ferruginous, apex of the segments fringed with silvery hairs at the sides. Legs with the femora black, except at the extreme apex; tibiæ and tarsi ferruginous, the basal joint of the posterior tarsi black above; anterior femora dilated at the base, excavated, and very shining in front.

♀. Like the ♂ in general colour, but larger; mandibles ferruginous, pitchy black at the apex; labrum black, with a well-developed apical tooth; face clothed with silvery hairs below the antennæ, with brownish on the vertex. Antennæ ferruginous; 8th to 11th joints darker; scape black in front and behind; flagellum with the 2nd joint much longer than 3rd. Thorax clothed with short brown hairs; collar, tubercles, and tegulæ testaceous; wings clouded, with a distinct apical band, as in the ♂; mesopleuræ with a tuft of silvery hairs; scutellum red; post-scutellum with a red line; metathorax densely clothed at the sides with silvery hairs. Abdomen wider than in the ♂, but similarly coloured. Legs ferruginous; femora black at the base and beneath; posterior tibiæ with a black mark within; posterior metatarsi black; posterior coxæ densely clothed with silvery hairs. Length, 11—12 mm.

Hab. Norwich; Deal; Exeter; Penzance; Morthoe, N. Devon. Very rare; parasitic on *Andrena Hattorfiana*.

19. *Nomada ferruginata*, Kirb. (Pl. VII., figs. 6—6 b).

Kirb., Mon. Ap. Angl., ii., p. 218 = *germanica*, Smith, Cat. Brit. Hym., 2nd ed., p. 126 (nec Panz.).

Head and thorax black, clothed with greyish brown hairs; labrum black; 3rd, 4th, and 5th joints of flagellum dilated in the ♂, and black above. Abdomen ferruginous in both sexes, spotted with black.

♂. Head and thorax black, closely and largely punctured, rather densely clothed with greyish brown hairs; hairs of the face below the antennæ and of the thorax below the wings, silvery; mandibles ferruginous, flavous at the base, somewhat rounded at the apex, which is piceous; labrum black, armed with a strong central tooth; cheeks between the eyes and the mandibles flavous; clypeus testaceous at the apex. Antennæ with the scape very wide, black; 1st joint of the flagellum hidden; 2nd much shorter than 3rd; 3rd, 4th, and 5th swollen; 6th, 7th, 8th, and 9th with a small tubercular elevation at the side; terminal joint nearly as long as the two preceding together. Thorax with the tubercles and tegulæ testaceous; wings with a dark apical border, otherwise but little clouded; scutellum with two dull red spots. Abdomen finely punctured, ferruginous-red, its base black, with a black basal spot on each side of the 2nd and 3rd segments, and a black line at the base of the 4th, 5th, and 6th; apical segment narrowly rounded, sides and apex of the abdomen with silvery hairs; beneath punctured, the base of each segment black in the middle, and the apical margins fringed with white hairs at the sides; 8th segment with its apical process short and dilated at the apex, which is sinuated and armed on each side with two strong reflexed spines, the sides of the process fringed with hairs (for genitalia see Pl. VII., figs. 6—6 b). Legs ferruginous; femora at their base, especially beneath, black; posterior femora densely hairy beneath; tibiæ with a black spot near the apex.

♀. Very like the ♂, but with the mandibles piceous, the labrum with a central tubercle, face below the antennæ without silvery hairs, cheeks between the eyes and mandibles testaceous. Antennæ simple, flagellum ferruginous, slightly darker above; wings clouded. Abdomen and legs marked as in the ♂, but the former with less silvery pubescence at the sides, and the latter with the posterior metatarsi black. Length, 7—8 mm.

Hab. London District, rarely; Deal; Reigate; Chobham; Blackwater, Hants; Bournemouth; Exeter; Penzance; Yorkshire. Parasitic on *Andrena fulvescens*; appears in July and August.

The coloration of this species varies very much, especially in the ♂, some specimens being almost entirely black (var. *atrata*, Smith).

20. *Nomada Fabriciana*, Linn. (Pl. VII., figs. 1—1 b).

Linn., Syst. Nat., ed. xii., p. 955; Smith, Cat. Brit. Hym., 2nd ed., p. 125.

Very like the preceding in some varieties, but at once distinguished by the simple antennæ of the ♂, and the longer antennæ of the ♀, which have a broad black band extending across the 8th, 9th, 10th, and 11th joints.

♂. Head and thorax deep black, closely and deeply punctured, clothed with greyish hairs; mandibles black, or very dark piceous; labrum and clypeus black; cheeks between the eyes and mandibles flavous; face below the antennæ clothed with silvery hairs. Antennæ with the scape black; flagellum piceous, black above, its 2nd joint scarcely half the length of the 3rd. Thorax with the tubercles and tegulæ black; wings clouded; scutellum entirely black; metathorax with the basal area finely rugose. Abdomen ferruginous; base of the 1st segment black, and often also the bases and apices of the other segments; the 2nd and 3rd segments generally with a yellow lateral spot; sometimes, however, the whole abdomen is ferruginous, with the exception of the black base; 7th segment sharply emarginate at the apex; beneath ferruginous, largely and remotely punctured; 8th segment with a very long apical process, fringed with fine hairs at the sides, scarcely dilated at the apex, which has a fine somewhat reflexed spine on each side (for genitalia see Pl. VII., figs. 1—1 b).

♀. Larger and stouter than the ♂; face entirely black, clothed with black and grey hairs. Antennæ rather long, scape black; 2nd joint of flagellum ferruginous-red beneath, black above, rather more than half as long as the 3rd; 3rd, 4th, 5th, and 6th ferruginous-red; 7th to 11th black; apical joint ferruginous. Thorax with the tubercles black, tegulæ testaceous; wings as in the ♂. Abdomen dark ferruginous-red, base black; the 2nd and 3rd segments often with a round yellow spot on each side; margins of the segments generally more or less black, beneath ferruginous, sides of the segments with a few prominent hairs. Legs black; knees and the anterior femora and tibiæ in front testaceous. Length, 7—9 mm.

Hab. Not rare, and generally distributed; I have taken it on Wandsworth Common as early as May, and at Hastings as late as August 16th. F. Smith says

"parasitic on *Panurgus Banksianus*," but in the localities where I have taken it, it certainly was not attached to that species, but probably to some *Andrena*. As *A. Gwynana* occurs at Wandsworth in the spring, where I have taken *Fabriciana* in April, and *Gwynana (bicolor)* occurs at Hastings close to the spot where I took *Fabriciana* in August, I think it is very probable that it is also parasitic on that species, and double-brooded like its host.

21. *Nomada flavoguttata*, Kirb. (Pl. VII., figs. 4—4 b).

Kirb., Mon. Ap. Angl., ii., p. 215; Smith, Cat. Brit. Hym., 2nd ed., p. 123.

Small; antennæ long, ferruginous, darker above, scape black; 3rd joint of flagellum much longer than 2nd; labrum black; mesothorax in the ♀ with red lines. Abdomen ferruginous, banded in the ♂ with slightly darker bands; 2nd and 3rd segments with a small round spot on each side.

♂. Head and thorax black, closely and largely punctured, clothed with greyish hairs; mandibles flavous, their apices piceous; labrum black; clypeus, except at the base, and cheeks at its side, flavous. Antennæ with the scape black; flagellum ferruginous, dark above; 3rd joint twice as long as the 2nd or more. Thorax with the tubercles and tegulæ piceous; wings smoky; metathorax more or less shining in the centre. Abdomen ferruginous; 1st segment black at the base; the other segments rather paler towards the base, the 2nd and 3rd with a flavous spot on each side; 7th segment slightly emarginate, beneath ferruginous; 8th segment with the apical process long, rather widened at the apex, with long reflexed apical spines (for genitalia see Pl. VII., figs. 4—4 b). Legs piceous, knees and tibiæ and femora in front paler.

♀. The labrum black, the mandibles, clypeus, and antennæ ferruginous; the 3rd joint of the flagellum not quite twice as long as the 2nd; prothorax ferruginous-red, tubercles testaceous; mesothorax with red lines, tegulæ testaceous; mesopleuræ each with a large red spot; wings smoky; scutellum and post-scutellum red; metathorax with a tuft of silvery white hairs on each side above the insertion of the body. Abdomen shining, ferruginous; 1st segment black at the base; 2nd and 3rd with a very small flavous spot on each side,—these spots are not well defined, and are often scarcely noticeable or entirely absent; 3rd and 4th segments darker towards the apex, and 5th towards the base; apex of the 5th densely fringed with very fine silvery hairs; beneath ferruginous;

5th segment with a tuft of dark hairs on each side. Legs ferruginous; femora slightly darker beneath; posterior tibiæ with two short uneven spines near the outer angle. Length, 6—7 mm.

Hab. Generally distributed. London District, Tunbridge Wells, Worthing, Hastings, Exeter, Penzance, Yorkshire, Norwich, &c.

This little species is easily known from the others which have the labrum black, by its long pale antennæ and the great length of the 3rd joint of the flagellum.

22. *Nomada furva*, Panz. (Pl. VII., figs. 3—3 b).

Panz., Faun. Germ., 55, 33; Smith, Cat. Brit. Hym., 2nd ed., p. 122.

Dark pitchy brown, very small; apical joint of antennæ pale; ♂ with a yellow lateral spot on the 2nd and 3rd segments; ♀ with the sides of the segments only slightly paler, or with paler transverse bands.

♂. Pitchy brown; head and thorax closely punctured, clothed sparingly with pale ochreous hairs; mandibles pale in the centre; labrum with a pale spot on each side of the base; face almost entirely black; clypeus at the extreme sides pale, as also the cheeks between the eyes and mandibles; face below the antennæ clothed with silvery hairs. Antennæ with the scape black, flagellum testaceous beneath, and with the whole of the apical joint pale testaceous; 2nd and 3rd joints subequal. Thorax with the tegulæ and tubercles piceous; wings clouded, with a dark apical margin. Abdomen with a yellow spot on each side of the 2nd, and sometimes of the 3rd segment, and occasionally with a basal line of the same colour on the other segments; 8th segment armed with two very strong recurved spines at the apex (for genitalia see Pl. VII., figs. 3—3 b). Legs with the knees and the femora and tibiæ in front paler.

♀. Rather paler than the ♂; labrum testaceous, as also the mandibles, apex of clypeus, and cheeks between the eyes and mandibles. Antennæ with the 2nd joint of the flagellum shorter than the 3rd. Thorax as in the ♂, but with a rufescent spot on the mesopleuræ. Abdomen without yellow spots, but with paler lateral spots or with transverse paler bands; 5th segment with a dense fringe of very fine white hairs. Legs as in the ♂. Length, 4—5 mm.

Hab. Common; parasitic on small species of *Halictus*.

EPEOLUS, *Latr.*

Hist. Nat., iii., p. 375.

Wings with three submarginal cells; labial palpi 4-jointed maxillary palpi 1-jointed; ♂ with six ventral segments exposed; 7th truncate; 8th narrow and tongue-like.

A small genus of short stout bees, the abdomen banded or spotted with white pubescence.

- (2) 1. Femora black in both sexes; labrum 3-dentate; the discal tubercles placed near its centre *productus*.
 (1) 2. Femora red in ♀; labrum simple; discal tubercles nearer the anterior margin *rufipes*.

1. *Epeolus productus*, Thoms. (Pl. VII., fig. 10—10 b).

Thoms., *Opusc. Ent.*, p. 91; *Hym. Scand.*, vol. ii., p. 211.

Black; labrum bidentate at the apex, and with two small tubercular teeth situated near the middle. Thorax with the tubercles and tegulæ in the ♂ and also the scutellum in the ♀ rufous; collar in the ♀ ferruginous. Abdomen with white pubescent spots or bands; beneath somewhat shining; 2nd segment largely and clearly punctured. Legs ferruginous; femora more or less black.

♂. Head and thorax black, largely and rugosely punctured; face clothed with silvery hairs; labrum tridentate at the apex, and with two small teeth near the middle; mandibles pitchy red in the centre. Antennæ short, its joints transverse; 2nd joint of the flagellum considerably longer than the 3rd. Thorax with the prothorax, the mesothorax in front and under the wings, and the metathorax at the sides, clothed with brownish white hairs; tubercles black; tegulæ rufous; wings slightly dusky, with a darker apical margin; nervures testaceous at the base; scutellum very rugose, subdentate at the sides, much produced over the metathorax, its central lobe slightly depressed in the centre; metathorax shining. Abdomen black, closely punctured; 1st segment with a lateral band of white pubescence at the apex, and at the base united at the sides, but not meeting on the disk, the following segments each with four spots along the posterior margin, the discal ones of the 2nd segment connected with the lateral; apical dorsal valve narrow, its sides parallel, rounded at the extremity; beneath black; 2nd and 3rd segments paler at the apex, and clothed with silvery hairs; 4th and 5th widely emarginate at the apex, and densely fringed with curved brown hairs; 6th rounded; 7th sharply truncate, the

angles of the truncature slightly produced; 8th narrow and tongue-like (for genitalia see Pl. VII., figs. 10—10 b). Legs ferruginous; femora black.

♀. Slightly larger, less pubescent, and with the central lobe of the scutellum and the tubercles rufous. Abdomen generally with the four spots distinct on the 2nd segment, as well as on the following; abdomen beneath black, somewhat shining; 2nd segment largely and distinctly punctured; apical segment rather narrowly rounded; 3rd and 4th with a pubescent apical band. Legs red; posterior and intermediate femora black above. Length, 8—10 mm.

Hab. Sandy places; Norwich, Littlehampton, Hayling Island, and probably in many other places, but confused with the following under the old name *variegatus*.

2. *Epeolus rufipes*, Thoms. (Pl. VII., figs. 9—9 a).

Thoms., Opusc. Ent., p. 91; Hym. Scand., vol. ii., p. 212 = *variegatus*, Sm. nec Linn.?

Extremely like the preceding, but differs in the following characters, which I think are certainly of specific value:—

The labrum has its apical margin simple, not tridentate, and the two teeth on the disk situated considerably below the middle; the spots on the 3rd and following segments of the abdomen are more transverse, and tend more to form bands; the apical dorsal valve of the ♂ is not parallel-sided as in *productus*, but is slightly narrowed towards the apex; beneath, the abdomen is dull and often rufescent, and the 2nd segment is closely and finely punctured; the apical segment of the ♀ is very largely and widely rounded, and the legs in that sex entirely red. Length, 5—8 mm.

Hab. Deal; Falmouth.

The confusion of the two species makes it impossible to quote localities, except where the actual specimens have been seen.

MELECTA, Latr.

Hist. Nat., xiv., p. 48.

Labial palpi 4-jointed, maxillary palpi 5-jointed; 1st joint of the former much more than twice the length of the 2nd; wings with three submarginal cells; ♂ with six ventral segments exposed; the 7th somewhat bifurcate at the apex; the 8th subtriangular, with a few apical setæ; armature stout; cardo small.

A genus of parasitic bees found with *Anthophora*.

- (2) 1. Pubescence of head and thorax ashy grey; lateral spots of the 3rd and 4th abdominal segments large and quadrate *luctuosa*.
- (1) 2. Pubescence of head and thorax brownish or greenish grey; spots of 3rd and 4th segments small and punctiform *armata*.

1. *Melecta luctuosa*, Scop. (Pl. VIII., figs. 2—2 b).

Scop., Ann. Hist. Nat., iv., p. 9; Smith, Cat. Brit. Hym., 2nd ed., p. 136.

Black, shining. Thorax in front densely clothed with grey hairs; segments of the abdomen with transverse lateral spots of white pubescence; tibiae with a white basal spot.

♂. Head rugosely punctured; vertex clothed with grey and black hairs intermixed; face in front of the antennae clothed with white hairs, bordered with black hairs at the side; labrum clothed with black hairs; scape of the antennae with long white hairs beneath. Thorax covered with greyish white hairs in front as far as the scutellum; scutellum with black hairs; metathorax with black hairs in the centre, and with a tuft of silvery white hairs on each side; wings rather smoky, with darker spots in some of the cells; mesopleurae with a dense white pubescence. Abdomen shining, very finely punctured; basal segment clothed, except at the apex, with silvery grey hairs; 2nd to 5th segments clothed with very short black hairs, and each with a lateral apical spot of silvery white hairs,—these spots on all the segments of a more or less transverse form; 7th segment shining and emarginate at the apex; beneath entirely black, clothed with short black hairs; 6th segment slightly foveated in the middle; 7th produced at the apex, and deeply cleft, each point with a few bristly hairs; 8th with a very short wide apical process, which is truncate at its extremity (for genitalia see Pl. VIII., figs. 2—2 b). Legs black; a spot on each tibia at the base, and all the tarsi in front, clothed with white hairs.

♀. Like the ♂, but has the hairs on the face below the antennae black, except those on the base of the clypeus; the basal segment of the abdomen with only a few scattered white hairs at the base, and a tuft of white hairs on each side at the apex; 2nd, 3rd, and 4th segments each with a transverse lateral spot near the apical margin; dorsal valve of the 6th segment narrow and rounded at the apex. Length, 13 mm.

Hab. Not rare; parasitic on *Anthophora retusa*.

2. *Melecta armata*, Panz. (Pl. VIII., figs. 1—1 b).

Panz., Faun. Germ., 70, 22; Smith, Cat. Brit. Hym., 2nd ed., p. 137.

Black, shining. Thorax clothed with brownish grey hairs; 1st and 2nd segments of the abdomen with a tuft of greyish hairs, 4th and 5th with a small round spot of silvery white hairs; these spots are variable in size, and sometimes entirely absent in the ♀.

Very like the preceding species, but differing in the following particulars:—

♂. With the pubescence of a generally browner hue; face entirely clothed with ochreous white hairs. Thorax clothed with brownish grey hairs as far as the scutellum; scutellum and metathorax with black hairs, a tuft of greyish brown hairs on each side of the latter. Abdomen rather more coarsely punctured; 1st segment sparingly clothed with brownish grey hairs, and with a tuft of hairs on each side; 2nd and following segments clothed with short black hairs, the 2nd with a tuft of brownish grey hairs on each side, the 3rd, 4th, and sometimes the 5th with a small round lateral spot of white hairs; 7th widely emarginate at the apex, dull, clothed with black hairs; beneath entirely black, 8th segment produced at the apex into two small hairy tubercles (for genitalia, &c., see Pl. VIII., figs. 1—1 b). Legs with the tibiæ clothed with ochreous hairs externally, except at the apex; posterior metatarsi slightly curved, narrow at the base, and then slightly dilated on their external margin; tarsi clothed with pale hairs above.

♀. Only differs from the ♂ in having the pubescence of a paler grey, and in having the tibiæ with only a spot of white hairs at the base. It may be known from that of *luctuosa* by its having the spots on the 3rd and 4th segments of the abdomen punctiform, and by the curved posterior metatarsi. In some varieties the abdomen is entirely black. Length, 13 mm.

Parasitic on *Anthophora pilipes*, and not uncommon where that species occurs.

CÆLIOXYS, Latr.

Latr., Gen. Crust. et Ins., iv., p. 166.

Wings with two submarginal cells. Maxillary palpi 3-jointed; labial palpi 4-jointed. Eyes hairy; scutellum dentate at each side; ♂, apex of abdomen blunt, multispinose; four ventral segments exposed, the 5th only just visible at its apex; 8th segment tongue-shaped; armature with the stipites long and straight, hairy

at the apex; sagittæ covered with a membranous skin; ♀, apex of abdomen more or less acute; ventral 6th segment projecting beyond the dorsal. Anterior coxæ of ♂ with stout blunt spines.

A genus of parasitic bees generally to be found near the burrows of *Megachile*.

- (2) 1. External spur of hind tibiæ blunt *vectis*.
 (1) 2. External spur of hind tibiæ sharp.
 (6) 3. ♂ with the 4th abdominal segment deeply emarginate beneath; ♀ with the 5th segment beneath rounded at the apex; calcaria black or piceous.
 (5) 4. ♂ with the 5th segment above not toothed at the side; ♀ with the apical ventral valve elongate and lanceolate *4-dentata*.
 (4) 5. ♂ with the 5th segment above toothed at the sides; ♀ with the ventral valve shorter and angularly truncate at the apex *rufescens*.
 (3) 6. ♂ 4th segment of abdomen entire beneath; ♀ 5th segment truncate or emarginate at the apex; calcaria pale.
 (8) 7. ♂ with the puncturation of the 4th segment beneath as coarse and scattered as that of the 2nd and 3rd; ♀ 4th segment beneath largely and remotely punctured, 6th segment above without a white pilose band *acuminata*.
 (7) 8. ♂ puncturation of 4th segment beneath distinctly finer and closer than that of the 2nd and 3rd; ♀ 4th segment beneath closely and finely punctured, 5th segment above with a white pilose band at the base *simplex*.

1. *Cœlioxys vectis*, Curt. (Pl. VIII., fig. 7).

Curt., Brit. Ent., viii., p. 349, pl. 349; Smith, Cat. Brit. Hym., 2nd ed., p. 146.

Black, rugosely punctured; abdominal segments with triangular lateral spots of white pubescence; ♂ with the 6th segment armed with two sharp basal teeth, its apex bifid and produced into four teeth, the two upper ones short and blunt, and the lower ones long and acute; ♀ with the 6th ventral valve widely lanceolate, simple; external spur of posterior tibiæ blunt in both sexes.

♂. Head very largely and rugosely punctured; face densely clothed with long ochreous hairs; mandibles bifid. Thorax densely and rugosely punctured, sparingly clothed on the disk and rather densely at the sides, and on the metathorax with pale ochreous hairs; wings smoky; scutellum with a blunt spine on each side. Abdomen subconical, deeply and largely punctured, scarcely shining; puncturation of the 1st segment very close; 2nd and following segments with a diagonal impression on each side, almost meeting

in the centre; apex of each segment with a triangular lateral spot of pale pubescence; 5th segment above with a slightly prominent lateral angle; 6th with a rather long lateral basal spine, apex with two blunt teeth above, which are produced below into two longer sharp spine-like teeth; beneath strongly punctured, the puncturation of each succeeding segment finer than that of its predecessor; each segment at the apex with a lateral patch of white hairs; 4th segment bidentate at the apex; 6th at the apex with a corneous, rounded, central lobe (for genitalia see Pl. VIII., fig. 7). Legs clothed with short whitish hairs; outer calcar of posterior tibiæ blunt.

♀. Like the ♂, but with the pubescence of the face shorter; the abdomen in the shape of an elongate triangle; segments sculptured and spotted at the sides, as in the ♂; 6th segment finely punctured, narrowed to the apex, which is somewhat rounded, its centre with a longitudinal raised line, and each side with a carina running parallel to its margin; beneath with the 5th segment very finely punctured and clothed with a fine brownish pubescence near its apex; 6th widely lanceolate, with a slight indication of a constriction near the apex. Length, 13—15 mm.

Hab. Isle of Wight, Sandown, flowers of bramble; Shirley; Wimbledon; Lowestoft; Morthoe, N. Devon.

Easily recognised by the spots of the abdomen, and the blunt spine on the tibiæ.

2. *Cælioxys quadridentata*, Linn. (Pl. VIII., fig. 4).

Linn., Syst. Nat., ed. x., i., p. 577; Smith, Cat. Brit. Hym., 2nd ed., p. 141.

Black, rugosely punctured; abdominal segments with entire bands of pale pubescence; 6th segment of the ♂ armed with six teeth, arranged as in *vectis*, but the upper pair of apical ones sharper and more spiniform; 5th segment not spinose at the apex laterally; ♀ with the 6th ventral segment elongate-lanceolate, constricted before the apex; calcaria sharp in both sexes.

♂. Head and thorax, in fresh specimens, densely clothed with golden brown hairs, largely and rugosely punctured; wings clouded; scutellum with a tooth on each side. Abdomen subconical, largely punctured; 1st segment clothed with long golden brown hairs; 2nd segment widely impressed across the middle, and clothed at the apex with a fringe of golden brown hairs; 3rd, 4th, and 5th segments like the 2nd, but less impressed; 5th without a lateral spine or tooth at the apex; 6th with a narrow spiniform tooth on each side at the base, and with two apical processes, each of which,

looked at laterally, is bidentate, the upper tooth narrowly triangular, the lower one longer and spiniform; beneath largely punctured, each segment fringed with pale hairs at the apex; apex of the 4th narrowly emarginate in the centre, with a slightly projecting angle on each side of the emargination; 6th just visible in the middle, where it is produced into a corneous lobe (for genitalia see Pl. VIII., fig. 4). Legs clothed with brownish grey hairs; all the calcaria sharp and black.

♀. Very like the ♂, but with the abdomen conical and narrowly pointed at the apex, shining, with the exception of the apical segment, its basal segment with a tuft of pale whitish hairs on each side; 2nd to 5th segments each with an apical fringe of pale hairs; 2nd and 3rd deeply impressed across the middle; basal segment and 2nd segment, above the central impression, closely and largely punctured, the rest very remotely; apical segment longitudinally carinated, dull, finely punctured, constricted towards the middle, then narrower to the apex; beneath with the 4th segment much more finely punctured than the 3rd; 5th entire at the apex, with the puncturation hardly visible; 6th longer than the dorsal valve, carinated down the centre, constricted near the apex, with its sides simply sinuate. Length, 12—13 mm.

Hab. Local. Chobham; Wakefield, Yorkshire; North Devon; Norwich; Yarmouth; &c.

3. *Cœlixys rufescens*, Lep. (Pl. VIII., fig. 3).

Lep., *Encycl. Méth.*, x., p. 109; Smith, *Cat. Brit. Hym.*, 2nd ed., p. 145; var. = *umbrina*, Smith.

Black, rugosely punctured; abdominal segments with continuous bands in the ♂, subcontinuous in the ♀, that of the 2nd and 3rd in this sex being very narrowly interrupted in the centre; 5th segment in the ♂ with a lateral tooth at the apex; ♀ with the 6th ventral segment triangularly truncate; calcaria piceous in both sexes.

Very like the preceding, but generally larger in the typical form; the smaller form, however, which was called by F. Smith *umbrina*, can only be distinguished by structural characters.

♂. Rather less densely pubescent than the preceding; basal segment of the abdomen clothed with hairs only on the sides; 5th segment without an apical band, and with a lateral tooth at the apex; 4th ventral segment emarginate in the centre, the emargination slightly wider than in *quadridentata* (for genitalia see Pl. VIII., fig. 3).

♀. With the puncturation of the abdomen more even and close than in the preceding, with the 6th segment more shining and more strongly punctured, somewhat inclined upwards towards its apex, and less finely attenuated; beneath the 5th segment is much longer and more pointed and strongly punctured; the 6th segment is short, its sides subparallel, its apex obtusely angulated. Length, 10—15 mm.

Hab. Common in some localities, and very variable in size. The small variety *umbrina* can be distinguished by no structural character from the large *rufescens*. It has occurred at Chobham, Hants, Isle of Wight, Devonshire, Yorkshire, Loch Rannoch, Norwich, and in Kent.

4. *Cælioxys elongata*, Lep. (Pl. VIII., fig. 6).

Lep., Hym., ii., p. 522; Smith, Cat. Brit. Hym., 2nd ed., p. 142 = *simplex*, Nyl., Smith, 1st ed., &c.

Another species almost exactly like the two preceding in general shape and sculpture, but differing in the following particulars:—

♂. With the 5th dorsal segment toothed at the apex laterally; 6th with the two upper apical teeth slightly divergent, so that the two lower ones, which are nearly parallel, can be seen from above lying between them; the pubescent bands of the segments are wider at the sides, and narrowed towards the centre, where they are generally interrupted; beneath largely punctured; 4th segment more finely and closely punctured than the 3rd, entire at its apex, which has in its centre a smooth corneous lobe (for genitalia see Pl. VIII., fig. 6). Calcaria pale.

♀. With the abdomen irregularly and remotely punctured, as in *quadridentata*; the 2nd, 3rd, 4th, and 5th segments fringed at the apex with pale hairs, forming a band widening to the sides; 6th segment dull, narrowly rounded at the apex; beneath with the 4th and 5th segments very finely punctured, the 5th narrowly emarginate at the apex; 6th very long, constricted, and with a very minute tooth on each side before the apex. Calcaria pale. Length, 12 mm.

Hab. Widely distributed and common in many places. F. Smith says it is parasitic on *Megachile ligniseca*, *Willughbiella*, and *circumcincta*. I have taken it pretty freely at Chobham in places where the last-named species of *Megachile* occurs.

5. *Cœlixys acuminata*, Nyl. (Pl. VIII., fig. 5).

Nyl., (Revisio) Not. Salls. Faun. Flor. Fenn., Förh., ii., p. 279.

Differs from *elongata* in the following particulars:—

♂. Has the apical teeth of the 5th segment rather more spiniform, the upper apical spines of the 6th segment more divergent, the 4th segment beneath as largely and remotely punctured as the 3rd (for genitalia see Pl. VIII., fig. 5).

♀. Has the 5th abdominal segment without an apical fringe, and the 6th rather longer and more pointed, the bands of the other segments more widely interrupted; beneath the 4th segment is largely and clearly punctured, although less coarsely than the 3rd; the 6th segment is rather longer, the constriction less marked, and nearer the apex in proportion to the entire length of the segment. Length, 12 mm.

Hab. Hastings, Deal, Norwich, and Colchester, and probably common, but mixed with *elongata*.

N.B. *Mandibularis*, Nyl., which F. Smith refers to *elongata*, is a distinct species, with black calcaria and geniculated mandibles; but I do not know of its occurrence in this country.

MEGACHILE, Latr.

Latr., Hist. Nat. Ins., xiv., p. 51.

Eyes not hairy; ♂ with the mandibles angularly produced at the base; anterior coxæ generally with a long blunt spine on each. Wings with two submarginal cells; maxillary palpi 2-jointed; labial palpi 4-jointed.

♂. With the 6th dorsal segment terminating the abdomen like a sort of cap, and bearing a well-marked apical crest, its posterior margin inferior; 7th dorsal segment inferior, and 8th dorsal inclosed in the 7th; four ventral segments only visible; 5th with an apical, central, more or less rugose, patch; 6th very narrow, and clothed across the middle with spine-like hairs, often recurved, or widened at the apex; apex of the segment often produced into a membranous wing; 7th so fragile and membranous that I have been unable to extract it entire; 8th narrow and tongue-like; genital armature very large at the base, the stipites more or less divergent, the sagittæ narrow and pointed (for figures of armature, see Pl. IX). Anterior coxæ each with a long, thick, blunt spine.

♀. With a dense ventral pollen-brush composed of beautifully straight spirally-grooved hairs.

- (6) 1. ♂ front tarsi dilated; ♀ mandibles largely flattened in front, the flattened portion wide at the base and deeply furrowed, the groove extending almost to the clypeus.
- (3) 2. ♂ posterior tibiæ dilated, thicker than the femora; ♀ scopa orange-red, pale whitish at the base, extreme apex darker *maritima.*
- (2) 3. ♂ posterior tibiæ not dilated, scarcely so thick as the femora; scopa of ♀ dark, fulvous in the middle.
- (5) 4. Basal segments of abdomen covered with long fulvous hairs; apical segments with black hairs; ♂ with basal joint of anterior tarsi much longer than wide, its sides straight; ♀ without pale apical bands to the abdominal segments *circumcincta.*
- (4) 5. Basal segments of abdomen with scattered hairs; ♂ with the basal joint of the anterior tarsi as wide as long, its sides slightly curved; ♀ with pale apical bands to the segments *Willughbiella.*
- (1) 6. ♂ front tarsi simple; ♀ mandibles only flattened and grooved towards the apex.
- (12) 7. 6th segment of abdomen in ♂ not covered with pale hairs; scopa of ♀ not white; the apical margins of the segments naked.
- (9) 8. ♂ 6th segment entire or nearly so; ♀ scopa bright orange-fulvous *centuncularis.*
- (8) 9. ♂ with crest of 6th segment distinctly emarginate; ♀ scopa not bright orange.
- (11) 10. ♂ tarsi pale; 7th segment spined; ♀ scopa entirely pale *pyrina.*
- (10) 11. ♂ tarsi black; 7th segment not spined; ♀ scopa black on the two apical segments *ligniseca.*
- (7) 12. ♂ 6th segment clothed above with a short adpressed pale pubescence; ♀ scopa white or nearly so; apical margins of the segments beneath fringed *argentata.*

1. *Megachile maritima*, Kirb. (Pl. IX., figs. 2—2 b).

Kirb., Mon. Ap. Angl., ii., p. 242; Smith, Cat. Brit. Hym., 2nd ed., p. 179.

Black, clothed with brown or golden brown hairs; ♂ with the anterior tarsi white, dilated; posterior tibiæ curved, dilated, thicker than the femora; basal joint of tarsi very wide at the base, narrow at the apex; ♀ with the mandibles largely flattened in front, with a deep groove extending almost to the clypeus; scopa pale whitish at the base, orange-red in the middle, and dark at the extreme apex.

♂. Head closely and largely punctured; face densely clothed with pale ochreous hairs; mandibles whitish or pale towards the apex on their inferior margin. Antennæ with the apical joint more or less dilated and flattened. Thorax closely punctured, densely clothed with fulvous-brown hairs, those of the metathorax rather paler; wings with a slight apical cloud. Abdomen closely and finely punctured, each segment densely clothed with erect fulvous hairs, and with a narrow apical band of shorter, paler, decumbent hairs, the pubescence of the apical segments darker and browner; apical crest of 6th segment emarginate, and with a deep fovea in the emargination both on the dorsal and ventral sides; actual apex of the segment largely and semicircularly emarginate, angles of the emargination slightly prominent; 7th segment rarely visible, its apex truncate; ventral segments finely punctured, only four visible; 1st, 2nd, and 3rd densely clothed at the apex and sides with long pale hairs; 4th produced at the apex and truncate, its apical margin pale and submembranous; 5th with a suboval, pale, rugose, scale-like patch in the middle, extending from the base and projecting to slightly beyond what would appear to be the natural apex of the segment; 6th segment narrow, membranous, except at the sides; apex produced into a narrow truncate wing, the angles of the truncature considerably produced at the sides; on each side of the segment, above this membranous wing, is a tuft of hairs or spines, with their apices reflexed at an acute angle (this segment, under a microscope, is a most beautiful object); 7th segment, except at the sides, so thinly membranous that I have been unable to remove it, and cannot describe its form; 8th tongue-like, small, its base with a projecting tooth on each side (for genitalia, &c., see Pl. IX., figs. 2—2 b). Legs black, covered with golden brown hairs; front coxæ with a long blunt spine on each, terminating in a sharp pencil of hairs; anterior femora and tibiæ pale in front and beneath, the former densely clothed with long hairs; tarsi largely dilated, white, fringed beneath with long white hairs; 2nd joint with an oblong brown spot near its lower margin; posterior femora slightly thickened, and the tibiæ of the same pair of legs much thickened and curved; tarsi dilated at the base.

♀. Head and thorax closely punctured, clothed with golden brown hairs; mandibles largely flattened in front, with a long deep groove terminating between the apical tooth and the next one to it. Antennæ with the apical joint slightly compressed, but not dilated, Abdomen punctured, clothed on the basal segments with pale golden brown hairs, on the remainder with erect black hairs; each segment at the apex with a line of short decumbent pale hairs; 6th segment slightly carinated in the middle towards the apex; beneath with the scopa composed of nearly white hairs on the 2nd segment,

of hairs of a somewhat orange-red colour on the 3rd and 4th, and of nearly black hairs on the 5th and 6th. Legs black, clothed with golden brown hairs; coxæ, femora, tibiæ, and tarsi simple, except that the basal joint of the posterior tarsi is enlarged and flattened, as in most of the *Anthophila*. Length, 14—15 mm.

Hab. Common in most places along our coasts; also at Norwich, Weybridge, &c.; but I do not know if it occurs frequently in the north.

Thomson says, 6th segment "acute 4-dentato."

2. *Megachile Willughbiella*, Kirb. (Pl. IX., figs. 1—1 a).

Kirb., Mon. Ap. Angl., ii., p. 233; Smith, Cat. Brit. Hym., 2nd ed., p. 178.

Very like the preceding, but smaller, and differing in the following particulars:—

♂. With the pubescence less brightly coloured, and that of the abdomen less dense; 6th segment with the emargination of the apical crest wider and deeper, its real apex deeply emarginate, the sides of the emargination angularly produced; 7th segment just visible, with a central tooth, which is visible through the emargination of the 6th (this gives the appearance of the 7th segment being tridentate, as recorded by Smith); 6th ventral segment with the apical wing angularly produced in the middle of its anterior margin, besides being angulated at the sides (for genitalia, &c., see Pl. IX., figs. 1—1 a). Front legs with the tibiæ pale in front only at the apex; tarsi largely dilated and fringed; 1st joint nearly as broad as long; 2nd joint not spotted beneath; posterior tibiæ not thicker than the femora; basal joint of the tarsi not unusually dilated, nearly three times as long as wide.

♀. Very like that of *maritima*, but rather smaller, with the mandibles more rugose and less shining, and the groove less strongly marked and shorter; puncturation of the thorax rather less close, giving the surface a slightly less dull appearance. Abdomen with the 1st, 2nd, and 3rd segments clothed with short pale hairs, the remainder with black, the 4th and 5th having a pale apical fringe; segments deeply impressed at the base; beneath with the scopa orange-red, the hairs of the 5th and 6th segments black; legs with pale hairs. Length, 12—14 mm.

Hab. Generally common and widely distributed.

3. *Megachile circumcincta*, Lep. (Pl. IX., figs. 4—4 a).

Lep., Hym., ii., p. 335; Smith, Cat. Brit. Hym., 2nd ed., p. 177.

Face in the ♂ clothed with bright ochreous hairs, in the ♀ with black. Thorax in both sexes with bright brown hairs. Abdomen with ochreous-brown hairs on the 1st, 2nd, and 3rd segments, and with black on the rest; ♀ without pale apical bands, as in the preceding; ♂ with the front tarsi dilated, its 1st joint much longer than wide, its sides straight and subparallel.

♂. Head and thorax strongly punctured; face clothed with pale ochreous hairs; mandibles beneath produced into a rather more prominent triangular tooth at the base than in the other allied species, tridentate at the apex, the external tooth much the longest. Antennæ with the apical joint slightly dilated and flattened. Thorax clothed with bright brown hairs, punctured, the hairs on the metathorax and under the wings paler; wings slightly dusky. Abdomen somewhat shining, punctured, clothed on the three basal segments with hairs of the same colour as those on the metathorax, and with black hairs on the remaining segments; 6th segment with its apical crest deeply and narrowly emarginate, and its real apex (beneath) semicircularly emarginate, the angles of the emargination prominent and somewhat reflexed; 7th segment with a strong central tooth, visible ventral segments clothed with pale hairs; 6th segment (hidden) with the membranous wing at its apex less developed, and not angulated at its sides, and the spines at the sides differently shaped to those of either of the preceding (for genitalia, &c., see Pl. IX., figs. 4—4 a). Legs clothed with brown hairs; anterior coxæ with blunt spines, with scarcely any apical pencil of hairs; anterior femora pale and concave in front, densely clothed with hairs behind; tibiæ pale at the apex; tarsi dilated, pale, densely fringed, 1st joint elongate, nearly parallel-sided, 2nd joint with a black spot beneath; posterior tarsi with the basal joint rather shorter than in *Willughbiella*.

♀. Hairs of the face black; mandibles shining, largely punctured, groove very deep and long; thorax and first three segments of the abdomen densely clothed with pale but rather bright brown hairs, as in the ♂; last three segments entirely clothed with black hairs, without any pale fringe at the apex; segments not impressed at the base; segments beneath with the scopa dark orange, that of the two apical segments black. Legs with brown hairs. Length, 12—14 mm.

Hab. Not uncommon but local, burrowing in sandy banks, &c. F. Smith says that it usually lines its burrows with rose leaves. I have taken it freely at Chob-

ham, and Mr. Bridgman takes it at Norwich; it is very like *Willughbiella*, but the long straight basal joint of the anterior tarsi in the ♂ and the entirely black apical segments of the abdomen in the ♀, as well as the want of the basal impressions observable in *Willughbiella*, will easily distinguish it.

4. *Megachile ligniseca*, Kirb. (Pl. IX., figs. 3—3 a).

Kirb., Mon. Ap. Angl., ii., p. 243; Smith, Cat. Brit. Hym., 2nd ed., p. 173.

Black, clothed with dull brownish hairs; pubescence of the face brighter; ♂ front tarsi simple; 6th segment with its apical crest emarginate, 7th with its apex emarginate; ♀ large, with the scopa beneath pale ochreous.

♂. Head punctured; face clothed with bright brown and golden hairs; mandibles shining, rugose, tridentate. Antennæ rather long; apical joint not dilated, but flattened. - Thorax punctured rather more closely than the head and duller, clothed with ochreous-brown hairs, those of the metathorax and under side paler; wings with a darker apical margin. Abdomen punctured, segments much impressed at the base; 1st, 2nd, and base of the 3rd clothed with pale hairs like the metathorax, the remainder with black; 6th segment with its dorsal surface slightly carinated down the middle, its apical crest emarginate, the real apical margin of the segment (on its ventral surface) semicircularly excised; 7th segment with its apex emarginate; ventral segments clothed with pale greyish hairs; 5th with a large pale hairy central patch; 6th with the apical membranous portion reflexed, and slightly produced in the centre; the segment above the apical membrane is clothed with long bristly hairs, which are simple, not hooked, at the apex; 8th segment shaped much as in the other species (for genitalia, &c., see Pl. IX., figs. 3—3 a).

♀. As large or larger than that of *maritima*, clothed as the ♂; mandibles deeply punctured, only narrowly flattened in front, groove short, but deep and wide. Abdomen clothed with hairs of the same colour as that on the metathorax on the first three segments, and with short black hairs on the rest; the hairs of the 6th segment adpressed; all the segments with a fringe of pale hairs on each side at the apex; beneath with the scopa of a dull ochreous colour, paler at the sides and darker at the apex. Legs clothed with pale short ochreous hairs. Length, 12—18 mm.

Hab. Not a common species generally, but widely distributed. Dartford, Richmond, Hampton Court, Windsor, Chobham, Norfolk, Colchester, &c.

5. *Megachile ericetorum*, Lep. (Pl. IX., figs. 6—6 a).

Lep., Hist. Nat. Hym., ii., p. 341 = *pyrina*, Sm. (nec Lep.), Cat. Brit. Hym., 2nd ed. p. 174.

“♀. Length, 5—6 lines. Black; the face with bright golden yellow pubescence; on the vertex it is usually more or less fuscous. Thorax, the pubescence on the disk short and fuscous, on the sides and beneath pale fulvous, frequently inclining to cinereous; the apical joints of the tarsi ferruginous; the pubescence beneath the tarsi fulvous; the calcaria pale rufo-testaceous. Abdomen oblong, the two basal segments with thin pale pubescence, the following with fuscous; the apical margin of all the segments with entire fasciæ of pale fulvous pubescence, and beneath densely clothed with pale fulvous.

“♂. Length, 5 lines. The pubescence similar to that of the ♀, but longer and more dense on the face, the apical segment of the abdomen deeply emarginate in the middle, and denticulate at the sides; the 7th segment has a longish spine in the middle; the anterior coxæ have a blunt spine.”

I have not seen the British exponents of this species, so have copied Smith's description; but it is very distinct, and easily recognised by the pale tarsi of the male and the prominent tooth or spine on the 7th segment, and by the long banded abdomen of the ♀ (for genitalia see Pl. IX., figs. 6—6 a).

Hab. “This species has been captured at and near to Weybridge, Bristol, and Southampton. It must be very local. No one has been ascertained to have taken it for some years past.”

Smith is, I think, clearly wrong in referring this to *pyrina*, Lep., who says of the latter ♂ “les 4 premiers articles des tarses dilatés, blancs en dessus.”

6. *Megachile centuncularis*, Linn. (Pl. IX., figs. 5—5 a).

Linn., Syst. Nat., ed. x., i., p. 575; Smith, Cat. Brit. Hym., 2nd ed., p. 172.

Smaller than any of the preceding; ♂ front tarsi simple; apical crest of 6th abdominal segment almost entire; 7th segment entire, with a slight central tubercle; ♀ with the scopa bright orange-red.

♂. Head punctured; face clothed with bright brownish golden hairs; mandibles tridentate. Thorax very closely punctured, clothed on the disk with sooty brown hairs and round the sides

with brighter brown; wings slightly dusky, and with a rather darker apical margin. Abdomen rather shining, punctured, segments deeply impressed across the base; 1st and 2nd segments clothed with pale hairs, the rest clothed with black hairs at the base, but with an apical fringe on each side of pale brown hairs; apical crest of 6th segment very slightly emarginate; 7th with a triangular apical tubercle; beneath clothed with pale hairs; 5th segment shining, with a semicircular hairy patch in the middle of the apical margin; 6th very narrow, with scarcely any apical wing, and with the surface above the apex clothed with long simple hairs laterally adpressed (for genitalia, &c., see Pl. IX., figs. 5—5 a). Legs clothed with pale hairs.

♀. With the mandibles largely and rugosely punctured, only slightly flattened in front. Thorax clothed as in the ♂, but rather less densely, and with the hairs rather shorter. Abdomen rather strongly punctured; the base of the 2nd and 3rd segments deeply and narrowly impressed, the 1st and 2nd segments clothed with pale ochreous hairs; the remainder with short black hairs, upright on the apical as well as on the other segments; each segment with a narrow line of pale hairs on each side of the apex; scopa of the ventral segments bright orange. Legs clothed with pale hairs. Length, 10—12 mm.

Hab. The commonest species of the genus, and generally distributed.

7. *Megachile argentata*, Fab. (Pl. IX., figs. 7—7 a).

Fab., Ent. Syst., ii., p. 336; Smith, Cat. Brit. Hym., 2nd ed., p. 176.

Smaller than any of the preceding, black, clothed with ochreous-grey hairs; ♂ with the anterior tarsi simple, and the 6th segment of the abdomen densely clothed with adpressed whitish hairs, except a triangular spot at the apex; apical carina denticulate; ♀ with the ventral scopa silvery grey.

♂. Head and thorax closely punctured, the former broader or as broad as the latter; face densely clothed with silky golden grey hairs; mandibles shortly grooved at the apex, rugose and hairy at the base. Antennæ reaching to the scutellum, with the apical joint flattened, but scarcely dilated. Thorax densely clothed round its margins with ochreous-grey hairs, very closely punctured; wings slightly clouded. Abdomen finely punctured; 1st, 2nd, and 3rd segments densely clothed with rather long ochreous-grey hairs; 4th with shorter ones intermixed with black; 5th with black ones on its apical half; the 2nd, 3rd, and 4th with an apical fringe of

adpressed paler hairs, the 5th with a basal band of the same, and the 6th entirely so covered, except a small triangular region at the apex; apical crest of the 6th segment irregularly spined at each side and emarginate in the centre; 7th narrowly visible beneath; under side of the abdomen with the four basal ventral segments fringed with white hairs; 5th segment just visible at the sides, the rest hidden (for genitalia, &c., see Pl. IX., figs. 7—7 a). Legs clothed with ochreous-grey hairs; front femora slightly dilated, pale, and excavated beneath to receive the tibiæ; posterior tibiæ slightly swollen.

♀. Very like the ♂, but with the head narrower; the face clothed with short dull grey hairs. Antennæ shorter, not reaching the tegulæ. Abdomen with the two basal segments clothed with erect pale hairs, the remainder with very short black ones; the 2nd to 5th with apical bands of pale hairs, the 6th with a basal band; beneath with long greyish hairs, the extreme apical margins of the segments fringed with pale hairs, apical segment with black. Legs clothed with greyish hairs. Length, 9—11 mm.

Hab. A maritime species, and common in many places on the east and south coast.

OSMIA, *Panz.*

Panz., *Krit. Rev.*, ii., p. 230.

Wings with two submarginal cells. Maxillary palpi 4-jointed; labial palpi 4-jointed; ♂ with the antennæ considerably longer than in the ♀; the 3rd ventral abdominal segment sometimes only visible at the sides; five segments usually exposed; 7th very thin and membranous; 8th narrowly triangular; genital armature very narrow and elongate (see Pl. VIII). ♀ with a dense ventral pollen-brush composed of simple hairs.

A genus which contains a large number of species, although only a few occur in this country; it has been divided into several sections, depending in many cases mainly on the male characters. Although these sections are natural enough, and some have characteristics which may be considered of generic value, I have not employed them here, as in a small fauna like ours I think it is probably more convenient to keep the species all together.

The habits of the species of this genus are most interesting; some of them make their cells of mud, and are amongst what are called the "mason bees"; for a good account of their habits see Smith, *Cat. Brit. Hym.*, 2nd ed., p. 147.

- (2) 1. ♂ antennæ very long, not hairy, extending to beyond the scutellum; ♀ with two stout projecting horns on the face *rufa*.
- (1) 2. ♂ antennæ either pilose beneath, or else not nearly extending to the scutellum; ♀ face simple.
- (12) 3. Calcaria of posterior tibiæ black.
- (9) 4. Ground colour of body black.
- (8) 5. ♂ posterior metatarsi more or less dilated towards the apex inwardly; apex of abdomen bidentate; ♀ face with black hairs, and with fulvous on the two basal abdominal segments.
- (7) 6. ♂ antennæ pilose beneath; ♀ face sparingly clothed with black hairs; posterior metatarsi scarcely more than twice as long as broad .. *pilicornis*.
- (6) 7. ♂ antennæ not pilose; ♀ face densely clothed with black; posterior metatarsi much more than twice as long as broad. *xanthomelana*.
- (5) 8. ♂ posterior metatarsi simple, apex of abdomen entire; ♀ with face clothed with pale hairs, and basal segment only of abdomen with fulvous *parietina*.
- (4) 9. Body more or less metallic.
- (11) 10. ♂ 6th segment very slightly notched at the apex, and somewhat crenulate on each side of the notch; ♀ scopa black *cærulescens*.
- (10) 11. ♂ 6th segment rather widely notched at the apex, its sides simple; ♀ scopa red *fulviventris*.
- (3) 12. Calcaria of posterior tibiæ pale.
- (14) 13. ♂ margin of 6th segment entire; ♀ head and thorax densely clothed with black hairs .. *bicolor*.
- (13) 14. ♂ margin of 6th segment denticulate at the sides; ♀ head and thorax clothed with brown or pale hairs.
- (16) 15. Segments of abdomen fringed with golden hairs *aurulenta*.
- (15) 16. Segments of abdomen not fringed with golden hairs.
- (18) 17. ♂ with a sharp tooth on the basal segment beneath; ♀ scopa fulvous *spinulosa*.
- (17) 18. ♂ with a broadly-elevated tubercle on the 2nd segment beneath; ♀ scopa greyish *leucomelana*.

1. *Osmia rufa*, Linn. (Pl. VIII., fig. 9).

Linn., Syst. Nat., ed. x., i., p. 575; Smith, Cat. Brit. Hym., 2nd ed., p. 152.

Head and thorax clothed with greyish brown hairs, face of the ♀ with black. Abdomen entirely clothed with orange-red hairs; face of the ♀ with two thick, usually bifid, horns below the antennæ on each side of the clypeus.

♂. Head and thorax greenish black, closely and finely punctured; face clothed with whitish hairs below the antennæ, with

rather darker hairs above. Antennæ long, reaching to the scutellum. Thorax clothed with long brownish grey hairs; wings slightly clouded. Abdomen more or less æneous, closely punctured, densely clothed with long orange-coloured hairs; 7th segment narrowly truncate at the apex; beneath with the 2nd segment very long, punctured, rounded at the apex; 3rd segment visible only at the sides, its apical margin widely emarginate; 4th segment with its apical margin rounded and slightly reflexed; 5th segment just visible at the apex, shaped like the 4th; 6th entirely hidden, rather pointed at the apex; 7th corneous only at the sides, the centre entirely membranous; 8th narrowly pointed (for genitalia see Pl. VIII., fig. 9). Legs clothed with brownish grey hairs.

♀. Larger than the ♂. Head clothed with black hairs. Antennæ reaching to about the tegulæ; on each side of the clypeus is a thick horn, slightly bifid at the apex, the inner tooth produced and slightly bent towards the centre; mandibles deeply grooved and rugosely punctured. Thorax clothed with greyish brown hairs, its surface more or less greenish and closely and finely punctured. Abdomen æneous, punctured, clothed with dense orange-coloured hairs; beneath with the scopa almost of the same colour; femora clothed with greyish hairs, tibiæ and tarsi with orange. Length, 10—15 mm.

Hab. Very common; appears in May.

2. *Osmia pilicornis*, Smith. (Pl. XI., fig. 4).

Smith, Zool., iv., 1567; Cat. Brit. Hym., 2nd ed., p. 158 = *fuciformis*, Smith (nec Gerst.).

♂ clothed with pale hairs, its antennæ long, with fine projecting hairs beneath; ♀ with the face clothed with black hairs; metathoracic area dull; 1st and 2nd abdominal segments clothed with brown hairs, the rest with black.

♂. Head and thorax black, closely punctured, clothed with ochraceous grey hairs. Antennæ reaching to beyond the metathorax; each joint beneath with several fine silvery hairs; wings slightly dusky, nervures brown. Abdomen black, clothed with greyish hairs, shining, rugosely punctured at the base of the segments, impunctate and glabrous at the apex, apex of each more or less testaceous; 6th segment sharply emarginate; 7th very deeply so; beneath 2nd segment very long; 3rd visible only at the sides; 4th somewhat truncate at the apex, its centre clothed with hairs with their apices hooked; the rest hidden. Legs clothed with grey hairs; posterior tibiæ slightly incrassate; posterior metatarsi widened and produced inwardly at the apex (for genitalia see Pl. XI., fig. 4).

♀. Face clothed rather sparingly with black hairs, vertex with brown. Thorax with bright brown hairs; metathoracic area dull. Abdomen shining, rather more finely punctured than in the ♂; 1st and 2nd segments clothed with brown hairs like the thorax, the remainder with black; beneath with the scopa black. Legs clothed with black hairs; posterior metatarsi short, about three times as long as wide. Length, 9—10 mm.

Hab. Local. Bristol, Leigh Woods and Durdham Downs; Birchwood, Kent; Colchester.

3. *Osmia xanthomelana*, Kirb. (Pl. VIII., fig. 8).

Kirb., Mon. Ap. Angl., ii., p. 246; Smith, Cat. Brit. Hym., 2nd ed., p. 155 = *fuciformis*, Gerst. (nec Sm.).

Thorax and abdomen entirely clothed with fulvous hairs in the ♂. Antennæ reaching to about the tegulæ; apical segment of abdomen deeply notched; ♀ with the face densely clothed with black hairs; thorax and first two abdominal segments with fulvous; the other segments, as well as the scopa and legs, with black.

♂. Head and thorax black, closely punctured; face clothed with pale hairs; mandibles with a tooth on the inner margin. Antennæ reaching to about the tegulæ. Thorax clothed with bright fulvous hairs; wings clouded, especially over the radial cell; nervures piceous, paler at the base; metathoracic area shining. Abdomen finely punctured, densely clothed with fulvous hairs; the extreme apex of each segment impunctate, glabrous and shining; 7th segment deeply emarginate at the apex; beneath clothed with black hairs, 2nd segment angulated at the apex; the 3rd emarginate at the apex, the emargination fringed with golden hairs; 4th rounded at the apex, clothed with hairs recurved at the apex; 5th only visible at the extreme sides (for genitalia see Pl. VIII., fig. 8). Legs clothed with pale fulvous-grey hairs; posterior metatarsi inwardly produced into a slight tubercle.

♀. Rather stouter than the ♂, the head larger and more quadrate, the antennæ short, the face densely clothed with black hairs, the thorax with dark fulvous, paler below the wings; wings and metathorax as in the ♂. Abdomen clothed with fulvous hairs on the first two segments, slightly paler at the apex of each, and with black hairs on the other segments; beneath entirely clothed with black hairs, the hairs of the scopa in certain lights with a fulvous tinge. Legs clothed with black hairs, those of the tarsi fulvous beneath; posterior metatarsi rather longer than in the preceding species. Length, 12 mm.

Hab. Local; appears early in May. Somersham, near Ipswich; Darent Wood; near Liverpool; near Bristol, frequenting ground-ivy.

Easily distinguished from the preceding by the shining area of the metathorax.

4. *Osmia parietina*, Curt. (Pl. VIII., fig. 11).

Curt., Brit. Ent., v., p. 222, pl. 222, ♀; Smith, Cat. Brit. Hym., 2nd ed., p. 157 = *vulpecula*, Gerst. ?

Black; face in both sexes with pale hairs. Thorax and 1st segment of abdomen with fulvous hairs; ♂ with the 7th segment of the abdomen entire; calcaria black.

♂. Head and thorax closely punctured, the former clothed with whitish hairs below the antennæ and with dull fulvous hairs above. Antennæ reaching to the base of the scutellum. Thorax clothed with bright fulvous hairs; wings slightly clouded; metathoracic area dull, finely rugose. Abdomen shining, subglobose, finely punctured; basal segment clothed with long fulvous hairs, the rest with black and fulvous hairs intermixed; 6th and 7th segments entire at the apex; beneath punctured, 2nd segment narrowly emarginate in the centre; 3rd visible only at the sides; 4th hairy at the apex, rest hidden (for genitalia see Pl. VIII., fig. 11). Legs clothed with pale hairs; calcaria black; posterior metatarsi simple.

♀. Face clothed with pale fulvous hairs, thorax with bright fulvous; metathoracic area dull. Abdomen with the basal segment clothed with fulvous hairs, the rest with black; the apical segment with paler hairs intermixed; beneath with the scopa black. Legs clothed with black hairs, paler beneath. Length, 8 mm.

Hab. Ambleside, Westmoreland; Bridgend, Glamorgan; Loch Rannoch; Grampian Hills; F. Smith. I have never met with this species.

Very distinct by the simple apex of the abdomen of the ♂ and the coloration of the pubescence in the ♀.

5. *Osmia cærulescens*, Linn. (Pl. VIII., fig. 13).

Linn., Syst. Nat., ed. x., i., p. 576 = *ænea*, Smith, Cat. Brit. Hym., 2nd ed., p. 153.

Æneous or bluish. Abdomen of the ♂ short and subovate; 6th dorsal segment simple or very slightly emarginate; 7th bidentate; ♀ with the metathoracic area dull; scopa black.

♂. Head and thorax bronzy, or sometimes with bluish tints, closely punctured, clothed with pale brownish hairs. Antennæ reaching about to the tegulæ; wings slightly dusky; metathorax finely rugose at the base, with a smooth space below. Abdomen brassy or blue, fringed at the sides and ends of the segments with ochreous hairs, deeply and largely punctured; 6th segment entire or obsoletely emarginate; 7th bidentate; beneath with the 2nd segment almost entire; the 3rd largely emarginate, its emargination fringed with long hairs; 4th and 5th entire (for genitalia see Pl. VIII., fig. 13). Legs clothed with pale brownish hairs; calcaria black.

♀. Blue; head and thorax dull, clothed with greyish hairs; vertex subquadrate, as wide as the thorax; metathoracic area dull. Abdomen shining, strongly punctured; 2nd and following segments with a very narrow apical fringe of whitish hairs; beneath with the scopa black. Legs clothed with short pale hairs; calcaria black. Length, 7—10 mm.

Hab. Common, and generally distributed in May and June.

6. *Osmia fulviventris*, Panz. (Pl. VIII., fig. 15).

Panz., Faun. Germ., 56, 18; Smith, Cat. Brit. Hym., 2nd ed., p. 154.

♂ more or less bronzy, ♀ nearly black; thorax and head obscure greenish; ♂ abdomen subelongate; ♀ scopa bright orange; abdomen shining, without pubescent bands.

♂. Head and thorax bronzy green, densely punctured, and clothed with long pale brown hairs. Antennæ reaching not quite to the scutellum; wings rather dusky; metathorax rugose at the base, the triangular area shining towards the apex. Abdomen bronzy, subelongate, shining, largely punctured, sparsely clothed with long ochreous hairs, forming dense bands at the apex of each segment; 6th segment piceous and emarginate at the apex; 7th bidentate; beneath punctured, 2nd segment slightly emarginate, 3rd largely so, and the emargination fringed with long golden hairs; the others entire (for genitalia see Pl. VIII., fig. 15). Legs clothed with pale hairs; calcaria dark piceous.

♀. Head and thorax dull, greenish black, sparingly clothed with ochreous-grey hairs, and closely and deeply punctured; vertex subquadrate; clypeus emarginate at the apex; wings smoky brown. Abdomen shining, black, with a greenish tinge, largely punctured, almost glabrous above on the 2nd and 3rd segments; extreme sides of the segments fringed with orange-yellow hairs; 6th segment

dull and closely punctured; beneath with the scopa bright orange. Legs clothed with pale hairs. Length, 9—10 mm.

Hab. Generally distributed, and tolerably abundant in some localities; makes its nest in wooden posts, &c.

7. *Osmia aurulenta*, Panz. (Pl. VIII., fig. 10).

Panz., Faun. Germ., 63, 22; Smith, Cat. Brit. Hym., 2nd ed., p. 159.

♂ clothed with greyish hairs, and with bright golden fringes to the apical segments of the abdomen; ♀ clothed on the thorax with brownish red hairs; all the segments of the body fringed with the same; scopa red.

♂. Subelongate. Head and thorax black, with a slight metallic tinge, closely punctured; face clothed with long pale hairs. Thorax clothed with brownish grey hairs; metathoracic area dull. Abdomen slightly shining, punctured; basal segment clothed with long grey hairs, the remainder with their apical margins fringed with bright golden hairs, the fringes wider on the apical segments; 6th segment dentate and sinuate at the sides, slightly rounded at the apex; 7th sharply bidentate; beneath punctured, 3rd segment visible at the apex, emarginate, the emargination fringed with long golden hairs; 4th segment entire, rather angular at the apex; 5th sinuate at the apex; 6th entire (for genitalia see Pl. VIII., fig. 10). Legs clothed with greyish hairs.

♀. Stouter than the ♂, punctured as in that sex; head sparingly clothed with greyish brown hairs; thorax densely with fulvous-brown. Abdomen clothed with short fulvous hairs, sides and apices of the segments with longer, giving a distinct fringe to each; beneath, scopa red-brown. Legs clothed with pale fulvous hairs; calcaria pale. Length, 9—11 mm.

Hab. Common in many localities, and generally distributed, but, according to Smith, does not extend far north.

8. *Osmia bicolor*, Schrank. (Pl. VIII., fig. 14).

Schrank, Ins. Austr., p. 400; Smith, Cat. Brit. Hym., 2nd ed., p. 160.

Black; ♂ clothed with ochreous hairs; ♀ with black hairs on the head and thorax, and bright red hairs on the abdomen; ♂ with the 7th segment bidentate; the 4th segment beneath bearing a small pubescent tubercle on its disk.

♂. Head and thorax closely punctured; face clothed with pale ochreous-yellow hairs; antennæ reaching to the tegulæ, with the 3rd joint longer than the two following together. Thorax clothed with long ochreous hairs; wings slightly smoky; metathoracic area dull. Abdomen shining, finely punctured, the apical margins of the segments very narrowly piceous, their surface clothed with long pale ochreous hairs; 7th segment sharply bidentate; beneath punctured, clothed with long ochreous hairs, margins of the segments testaceous; 2nd segment rounded at the apex; 3rd emarginate; 4th truncate, with a small discal pubescent tubercle; 5th truncate; 6th shining, with a tuft of golden hairs on each side of its apex (for genitalia see Pl. VIII., fig. 14). Legs clothed with pale hairs; calcaria testaceous; tarsi testaceous, except the basal joint, and clothed with golden hairs.

♀. Head and thorax densely clothed with black hairs. Antennæ with the 3rd joint very long, as in the ♂, being nearly as long as the three following joints taken together. Abdomen densely clothed with bright red hairs above and beneath, rather darker towards the base. Legs clothed with black hairs on the femora, with brownish hairs on the tibiæ, and bright fulvous-red on the tarsi, which are clear rufo-testaceous; calcaria testaceous. Length, 10—12 mm.

Hab. Purfleet, Northfleet, Reigate, Bristol, Wotton-under-Edge, &c. Local, but not uncommon where it occurs.

9. *Osmia leucomelana*, Kirb. (Pl. VIII., fig. 16).

Kirb., Mon. Ap. Angl., ii., p. 260; Smith, Cat. Brit. Hym., 2nd ed., p. 161.

Deep black, shining; ♂ with the 7th segment pointed, deeply foveated at the base; 2nd segment beneath with a large transverse tubercular plate; ♀ with the 1st to 4th segments with an apical band of white hairs on each side.

♂. Head and thorax finely punctured, clothed with ochreous-grey hairs, those of the face below the antennæ paler and very dense. Antennæ piceous beneath, not reaching to the tegulæ. Thorax dull; wings very slightly smoky in colour; nervures and tegulæ piceous. Abdomen incurved at the apex, somewhat shining, punctured, clothed with a short grey pubescence, forming indistinct apical bands on the 2nd and following segments; 6th segment with an obtuse apical tooth on each side; 7th pointed, with a large deep round fovea at the base; beneath with the 2nd segment elevated into a large perpendicular tubercular plate, 3rd, 4th, and 5th

emarginate, and fringed with golden hairs (for genitalia see Pl. VIII., fig. 16). Legs clothed with pale hairs; tarsi piceous.

♀. Head and thorax closely punctured; face below the antennæ with white hairs at the sides, and with yellowish hairs on the apex of the clypeus, which is emarginate. Thorax somewhat shining, clothed round the margins, in fresh examples, with pale brownish hairs; scutellum with brownish hairs; metathoracic area dull. Abdomen shining, coal-black, strongly punctured; 1st to 4th segments with a lateral streak of silvery hairs at the apex; beneath with the scopa ochreous-grey. Legs clothed with pale hairs, tarsi internally with golden; calcaria pale. Length, 8—9 mm.

Hab. This pretty little species is rare, and has been recorded from Charlton, Kent; Hawley, Hants; Chobham, Weybridge, and Charlwood, Surrey; near Exeter; Leigh Woods, Bristol; Coddham, near Needham Market, Suffolk. It makes its nest in dead bramble-stems.

10. *Osmia spinulosa*, Kirb. (Pl. VIII., fig. 12).

Kirb., *Mon. Ap. Angl.*, ii., p. 261, pl. xvii., 1 & 2; Smith, *Cat. Brit. Hym.*, 2nd ed., p. 162.

Small, black, clothed with brownish hairs; ♂ with the 6th segment rounded and denticulate; beneath with a long spine on the disk of the 1st segment, and a smaller one on the 2nd near the apex; ♀ with a pale pubescent streak at the apex of the 4th, 5th, and 6th segments; scopa beneath orange.

♂. Head and thorax closely and largely punctured, densely clothed with brown hairs. Antennæ not quite reaching to the tegulæ; 3rd joint short, not much longer than the 4th; wings slightly clouded; nervures dark piceous; metathoracic area slightly shining towards the apex. Abdomen slightly shining, largely punctured; sides of the segments and an apical line on the 3rd, 4th, and 5th, clothed with pale ochreous hairs; 6th segment rounded at the apex, with numerous small spine-like teeth on its margin; 7th produced into a sharp point; beneath with the 1st segment bearing a strong upright central spine; 2nd with a narrow short subapical spine; 3rd visible only at the sides; 4th and 5th entire (for genitalia see Pl. VIII., fig. 12). Legs clothed with pale hairs; calcaria pale.

♀. Very like the ♂ in general appearance, but with the head and thorax less densely hairy, and the hairs shorter and greyish. Abdomen shorter, with an apical line of pale hairs on the 4th, 5th, and 6th segments; beneath with the scopa bright orange-red. Length, 7—8 mm.

Hab. Common in many places. Deal, Walmer, Dover, Reigate, Croydon, Hastings, Isle of Wight, Sidmouth, Norwich.

CHELOSTOMA, Latr.

Latr., Gen. Crust. et Ins., iv., p. 161.

Elongate, subparallel-sided; wings with two submarginal cells; labial palpi 4-jointed, the apical joint much shorter than 3rd; maxillary palpi 3-jointed. Abdomen with the 1st segment not carinated at the base, where the perpendicular portion meets the horizontal; five ventral segments exposed in the ♂, the 2nd bearing a well-defined tubercle or raised line; 5th segment with a long curved apical fringe; genital armature with the stipites long and straight, much thickened at the apex (see Pl. X.); ♀ with a dense ventral pollen-brush composed of hairs with very fine filamentary branches.

- (2) 1. ♂ thorax densely hairy; ♀ abdominal segments with white pubescent apical bands *florisomme*.
 (1) 2. ♂ thorax not densely hairy; ♀ abdominal segments not banded *campanularum*.

1. *Chelostoma florisomme*, Linn. (Pl. X., figs. 4—4a).

Linn., Syst. Nat., ed. x., i., p. 577; Smith, Cat. Brit. Hym., 2nd ed., p. 165.

Elongate, black; ♂ clothed with rather long grey hairs. Abdomen incurved at the apex; 2nd segment beneath with a large tubercle, flattened and shining on its ventral surface; ♀ with the head large and quadrate, the mandibles strong; segments of the abdomen posteriorly fringed with white hairs.

♂. Head and thorax closely punctured, clothed rather densely with long brownish grey hairs; mandibles grooved, simple at the apex. Antennæ with the 3rd to 7th joints produced beneath into prominent angles. Wings slightly clouded. Abdomen elongate, densely punctured, clothed with long grey hairs, and with shorter whitish ones on each side of the apex of the segments; 7th segment terminating in two somewhat quadrate teeth, with a strong impression between them; beneath with the 2nd segment produced into a large tubercle, flattened and somewhat excavated on its lower surface, and pointed towards the base of the abdomen; 3rd segment excavated and very shining; 4th densely clothed with pale hairs; 5th hairy at the base, its apex with a fringe of long bent hairs, each hair knotted at intervals, except at the base; 6th shining, slightly excavated, its apex rounded; 7th shining, with

only a very short horny portion at the apex; 8th pointed at the apex (for genitalia, &c., see Pl. X., figs. 4—4 a). Legs clothed with grey hairs.

♀. Head and thorax somewhat shining, punctured, the former very large and quadrate on the vertex; mandibles curved, deeply grooved and bidentate at the extremities, densely fringed with golden hairs on their inner margins; labrum prominent, shining. Antennæ short, subclavate. Abdomen elongate, deeply punctured; apical margin of each segment with a narrow band of white adpressed hairs; scopa beneath yellowish white. Legs clothed with pale hairs. Length, 10 mm.

Hab. Common in most places, making its nests in posts, &c.

2. *Chelostoma campanularum*, Kirb. (Pl. X., figs. 5—5 b).

Kirb., *Mon. Ap. Angl.*, ii., p. 256; Smith, *Cat. Brit. Hym.*, 2nd ed., p. 166.

Small, black, elongate. Antennæ simple in the ♂; 2nd segment of the abdomen beneath raised in the centre; ♀ with the abdominal segments entirely black, without apical pubescent bands.

♂. Entirely black; head and thorax largely punctured, sparingly clothed with brownish grey hairs, but more densely on the face below the antennæ; wings slightly clouded; metathorax radiately rugose at the base. Abdomen slightly incurved at the apex, largely punctured; 7th segment terminating in two blunt teeth; beneath shining, punctured, 2nd and following segments more or less pale and membranous at the apex; 5th with an apical fringe of long curved hairs; 6th shining and somewhat pointed at the apex; 7th almost entirely membranous in the centre, but hard and horny at the sides, and with a few scattered hairs; 8th subquadrate, with a few apical hairs (for genitalia, &c., see Pl. X., figs. 5—5 b). Legs clothed with short hairs.

♀. Very like the ♂, but with the antennæ shorter and subclavate, the vertex more quadrate, and the abdomen simple at the apex, its under side clothed with a dense yellowish red scopa. Length, 6—7 mm.

Hab. Common in many places, often frequenting *Campanula rotundifolia*, June and July.

HERIADES, *Spin.*

Spin., *Ins. Lig.*, fasc. ii., p. 7.

Very like the preceding genus, but differing in having the basal segment of the abdomen carinated at its base, and the 3rd joint of

the labial palpi about equal to the 4th in length; ♂ with five ventral segments generally more or less visible, the 5th with a lateral spinose process on each side; genitalia with the stipites long and slender, slightly curved, but scarcely thickened at the apex.

1. *Heriades truncorum*, Linn. (Pl. X., figs. 1—1 a).

Linn., Syst. Nat., ed. x., i., p. 575; Smith, Cat. Brit. Hym., 2nd ed., p. 163.

Small, black, very largely and rugosely punctured; 1st segment of the abdomen carinated semicircularly at its base; apex of the abdomen rounded in both sexes.

♂. Black; head and thorax very largely punctured, clothed sparingly with brownish hairs; face rather densely clothed with pale hairs; mandibles broad at the apex and bidentate; antennæ rather long; the apical joint of each slightly flattened; wings rather clouded; metathorax shining, crenulate at the base. Abdomen with the 1st segment transversely and sharply carinated, its base nearly perpendicular and shining, its dorsal surface deeply punctured and dull like the other segments; 1st and 2nd segments with a line of white hairs at the apex; apex of the abdomen incurved, simple; beneath with only two segments visible, the 2nd densely hairy; 3rd and 4th slightly emarginate at the apex; 5th denticulate at the sides, the centre of the apex submembranous; 6th pointed with a slightly projecting central process; 7th nearly entirely membranous; 8th long and tongue-like, more or less hairy (for genitalia, &c., see Pl. X., figs. 1—1 a). Legs clothed with silvery hairs.

♀. Very like the ♂. Abdomen not inflected at the apex, with the first five segments banded with white hairs at the apex; beneath with a dense reddish yellow scopa. Length, 6—7 mm.

Hab. Very rare; the only recorded localities are Brentford (*Kirby*), and Dulwich (*Ingall*).

STELIS, *Panz.*

Panz., Krit. Rev., ii., p. 246.

Wings with two submarginal cells; maxillary palpi 2-jointed; labial palpi 4-jointed; ♂ with the apex of the abdomen simple; five ventral segments exposed; 6th rounded at the apex; 7th very narrow and fragile; 8th broad and subquadrate, with a slight apical projection; genital armature with the stipites thickened at the apex and somewhat square (see Pl. X., fig. 2); ♀ without any observable pollen-brush.

- (4) 1. Abdomen unspotted.
 (3) 2. Posterior margins of the first four abdominal segments pale *aterrima*.
 (2) 3. Posterior margins of segments not pale *phæoptera*.
 (1) 4. Abdomen spotted at the sides *octomaculata*.

1. *Stelis aterrima*, Panz. (Pl. X., fig. 2).

Panz., Faun. Germ., 56, 15; Smith, Cat. Brit. Hym., 2nd ed., p. 138.

Black; head and thorax closely punctured, dull. Abdomen slightly shining, strongly punctured, the posterior margins of the segments narrowly pale testaceous.

♂. Black; head and thorax largely and rugosely punctured, and clothed sparingly with greyish hairs; tegulæ black; wings dusky, and with the anterior portion of the radial cell brown; scutellum with an angular tooth at the base on each side. Abdomen slightly shining, sparingly clothed with short greyish hairs, largely and deeply punctured, the posterior margins of the segments narrowly pale testaceous; 6th segment rounded at the apex; 7th only visible from the ventral side; beneath with only the basal four segments visible, the 2nd, 3rd, and 4th being densely fringed at the apex with long golden hairs; the 4th is visible only at its apex; the 5th and 6th are excavated on their ventral surface and clothed with golden hairs; the 8th is testaceous and produced at the apex into two little round processes (for genitalia see Pl. X., fig. 2). Legs clothed with short grey-brown hairs.

♀. Almost exactly like the ♂, but the abdomen beneath simple, showing the ordinary six segments, largely and irregularly punctured, and sparsely clothed with golden brown hairs. Length, 8—9 mm.

Hab. Not common. Hastings; Southwold; Deal; Weybridge; Birchwood, Kent; Ilfracombe; Sidmouth; Clifton, near Bristol; Norwich; Barham. F. Smith says it is parasitic on *Osmia fulviventris*, and probably also on *aurulenta*; is found sometimes in the flowers of the mallow.

2. *Stelis phæoptera*, Kirb.

Kirb., Mon. Ap. Angl., ii., p. 232; Smith, Cat. Brit. Hym., 2nd ed., p. 139.

Exceedingly like the preceding, but differs in both sexes by the rather more shining thorax, its puncturation not being quite so close on the disk as that of *aterrima*, and by the entirely black abdomen, the apices of the segments of which are not discoloured

as in that species; also by the teeth of the scutellum being scarcely observable. Length, 8—9 mm.

Hab. Rare. I have never had the good fortune to capture it myself, but F. Smith says it is local and parasitic on *Osmia fulviventris*, and that it appears in June, and may be taken in July and August. He gives Battersea, Hammersmith, and Fulham as ancient localities for it. It has also been taken at Exeter, Norwich, and in Hampshire.

Unfortunately I have been unable to procure a ♂ for dissection.

3. *Stelis octomaculata*, Smith.

Smith, Zool., iii., p. 1155; Cat. Brit. Hym., 2nd ed., p. 140.

Smaller than either of the preceding and less coarsely punctured, and at once distinguished by the yellow spots of the abdomen, of which there are two oval ones on the basal and 2nd segments, an elongate spot on each side of the 3rd and 4th in the ♀, those of the 4th divided into two spots on each side in the ♂, and there is a spot on the 5th in the latter sex. These spots are doubtless very variable, as I have a variety of the ♂ from Holland which has only a round spot on each side of the 2nd and 3rd segments. Length, 6—7 mm.

Hab. Very rare; parasitic on *Osmia leucomelana*. Hawley, Hants; Exeter and Sidmouth, Devon.

The species is so rare that I can give no dissections of the ♂.

ANTHIDIUM, *Fabr.*

Fabr., Syst. Piez., p. 364.

Wings with two submarginal cells; maxillary palpi 2-jointed; labial palpi 4-jointed. Abdomen with yellow spots; ♂ with the 7th dorsal abdominal segment more or less spinose; six ventral segments exposed; 7th rounded at the apex, the basal angles very much produced; 8th produced at the apex into a narrow central process; genital armature with the stipites short and curved (see Pl. X., fig. 3); ♀ with a ventral pollen-brush composed of simple hairs.

1. *Anthidium manicatum*, Linn. (Pl. X., figs. 3—3 a).

Linn., Syst. Nat., ed. x., i., p. 577 ; Smith, Cat. Brit. Hym., 2nd ed., p. 168.

Black ; clothed with yellowish grey hairs ; face and abdomen with yellow spots ; 6th and 7th segments in the ♂ with large lateral spines at the apex ; ♀ with the abdomen simple, the scopa beneath golden,

♂. Head and thorax black, closely punctured, clothed with short yellowish brown hairs ; mandibles, except at the apex, a bilobate spot on the clypeus, the cheeks below the antennæ, and a small spot behind each eye, yellow. Thorax with the tegulæ yellow in front ; wings slightly dusky. Abdomen black, clothed with erect greyish hairs, and with a rather denser band of browner hairs at the apex of each segment, and a tuft of the same along the lateral margins of each ; all the segments, except the 7th, with a yellow spot on each side ; the 4th and 5th often with a second pair of spots on the disk ; 6th and 7th segments spined on each side at the apex, the 7th with a third very fine spine in the centre. Abdomen beneath clothed with grey hairs (for 8th segment and genitalia see Pl. X., figs. 3—3 a). Legs variegated with yellow, and clothed with silvery grey hairs.

♀. Smaller than the ♂, but coloured almost similarly, the spots of the abdomen smaller, its apex simply rounded, and the under side bearing a dense golden scopa. Legs almost entirely black, with only very small yellow spots. Length, 11—16 mm.

Hab. Very common in many localities, frequenting labiate plants.

EUCERA, *Scop.*

Scop., Ann. Hist. Nat., iv., 8.

Wings with two submarginal cells ; labial palpi 4-jointed ; maxillary palpi 6-jointed ; 2nd joint of labial palpi not half so long as the 1st. Antennæ of the ♂ very long, reaching nearly to the apex of the abdomen. Thorax densely hairy ; metatarsi of ♀ dilated on their external margins ; ♂ with six ventral segments exposed ; genital armature stout, the stipites produced into long narrow bent processes (see Pl. X., fig. 6).

1. *Eucera longicornis*, Linn. (Pl. X., figs. 6—6 b).

Linn., Syst. Nat., ed. x., i., p. 574 ; Smith, Cat. Brit. Hym., 2nd ed., p. 183.

Black ; head and thorax densely clothed with brown hairs ; clypeus of the ♂ white. Antennæ very long, reaching to the 4th abdominal segment ; ♀ with the antennæ short, reaching to about

the tegulæ. Abdomen with a lateral spot of pale pubescence on the 2nd and 3rd segments, and an entire apical band on the remaining segments.

♂. Head and thorax punctured, densely clothed with bright brown hairs (when fresh); clypeus and labrum yellowish white. Antennæ very long, reaching to about the 4th abdominal segment; joints slightly curved. Thorax with the hairs of the disk rather darker than those of the sides beneath the wings; wings slightly clouded. Abdomen with the first two segments clothed with long brown hairs, the rest with short black ones, but occasionally with an apical band of pale hairs on each; apical segment narrow and truncate; beneath punctured, apical margins of the segments smooth and piceous; 6th segment with an elevated line running parallel to the margin on each side; 7th with a black projecting, somewhat quadrate tubercle at the apex on each side; 8th shining, its apex slightly emarginate, and with a few hairs on each side (for genitalia, &c., see Pl. X., figs. 6—6*b*). Legs clothed with pale hairs; calcaria pale.

♀. Quite unlike the ♂ in general appearance, and something like an *Anthophora* in shape. Head and thorax densely clothed with brown hairs, paler on the face and below the wings; labrum and clypeus black; mandibles piceous at the apex. Antennæ reaching to about the tegulæ; 3rd joint about as long as the 4th and 5th together; wings as in the ♂. Abdomen ovate, punctured; basal segment and base of 2nd clothed with erect pale brown hairs, the rest of the 2nd and the 3rd with very short black ones, having a lateral somewhat triangular spot of pale hairs on each side; 4th segment densely clothed with velvety brown hairs at the base (usually covered by the preceding segment), and with an apical band of pale hairs; 5th with an apical band of golden hairs; 6th with the central glabrous space transversely rugose; beneath clothed with pale hairs, becoming golden towards the apex. Legs clothed with pale brown hairs, tarsi inwardly with golden brown hairs. Length, 15—16 mm.

Hab. Abundant in some places, and generally distributed.

ANTHOPHORA, *Latr.*

Latr., *Nouv. Dict. d'Hist. Nat.*, ix., p. 167.

Wings with three submarginal cells; labial palpi 4-jointed; maxillary palpi 6-jointed. Antennæ of the ♂ scarcely longer than those of the ♀; clypeus and labrum in the ♂ white; posterior metatarsi of the ♀ outwardly dilated, and the posterior tibiæ in this sex with a dense pollen-brush. ♂ with six ventral segments exposed; 7th subquadrate, with long posterior branches; 8th short,

subtruncate at the apex; genital armature stout, the sagittæ strong and forcipate (see Pl. X., XI).

There are two distinct divisions in this genus: in one the males have the intermediate tarsi more or less produced, and densely clothed with hairs on one or more joints; in the other they have them simple: *retusa* and *pilipes* belong to the 1st division, *furcata* and *quadrimaculata* belong to the 2nd. *A. retusa*, ♂, is further distinguished from the males of our other species in having the posterior tibiæ furnished with a patella at the base.

1. *Anthophora retusa*, Linn. (Pl. X., figs. 7—7b).

Linn., Syst. Nat., ed. x., i., p. 575; Smith, Cat. Brit. Hym., 2nd ed., p. 189 = *Haworthana*, Kirb.

Head and thorax and first two segments of the abdomen in the ♂ clothed with fulvous-brown hairs, the rest of the abdomen with black; ♀ entirely clothed with black hairs; calcaria pale; intermediate tarsi in the ♂ with the 1st joint only, densely clothed with projecting black hairs.

♂. Face clothed with pale hairs; labrum and clypeus and sides of the face below the antennæ yellowish white, base of the clypeus with two dark spots, separated by a narrow intervening pale line. Antennæ with the scape pale in front; vertex of the head clothed with fulvous-brown hairs. Thorax rather closely punctured, densely clothed with fulvous-brown hairs, which are rather paler round its edges; wings very slightly dusky. Abdomen punctured, with the first two segments clothed as the thorax; the 3rd to the 7th clothed with black hairs, with a rather paler fringe of hairs at the apex; 7th narrow, truncate at the apex, and longitudinally rugose; beneath rather shining, clothed with grey and black hairs; 7th segment shining, dilated, thickened and truncate at the apex; 8th bidentate, with long apical hairs (for genitalia, &c., see Pl. X., figs. 7—7b). Legs with the femora and tibiæ clothed with pale brownish hairs; calcaria pale; tarsi testaceous, intermediate pair with the basal joint densely clothed with projecting black hairs, the remaining joints with only a few pale spinose hairs at the apex; posterior pair with the basal joint black and clothed with black hairs, except at the extreme apex, where the hairs are golden; the rest of the joints testaceous.

♀. Entirely black and clothed with black hairs, except the pale calcaria and the posterior tibiæ and tarsi, which have outwardly a dense golden scopa; mandibles bifid at the apex, the teeth rounded, the outer one not much longer than the inner; face transverse,

much wider across the eyes than long; surface of thorax and abdomen very finely punctured. Length, 15—16 mm.

Hab. Generally distributed, and common in many places.

2. *Anthophora pilipes*, Fab. (Pl. X., figs. 8—8 b).

Fab., Syst. Ent., p. 383 = *acervorum*, Smith, Cat. Brit. Hym., 2nd ed., p. 190 = *retusa*, Kirb. (nec Linn).

Very like the preceding, especially in the ♀, but differs in the following characters:—

♂. With the pubescence longer and of a less rich brown, more inclined, especially in faded examples, to a greenish grey tint; clypeus nearly entirely pale; alar hooks of posterior wings 20 to 22 instead of only about 15 to 16; intermediate tarsi with the 1st and 5th joints densely clothed with projecting black hairs; the 1st, 2nd, 3rd, and 4th also clothed with extremely long grey hairs; calcaria black; 7th ventral segment more rounded at the apex; 8th much wider, carinated down the centre; apical portion depressed, with a slight reflexed projection on its margin bearing a few hairs (for genitalia see Pl. X., figs. 8—8 b).

♀. Differs from that of *retusa* in having the pubescence longer, the face less transverse, the mandibles with the apical tooth long and sharp, and the calcaria of the posterior legs black.

Hab. Common in most places in the early spring.

3. *Anthophora furcata*, Panz. (Pl. XI., figs. 2—2 b).

Panz., Faun. Germ., 56, 8; Smith, Cat. Brit. Hym., 2nd ed., p. 193.

Black, clothed with brownish hairs; mesothorax with a band of darker hairs across the middle; ♂ with the clypeus white; legs simple. Abdomen without bands of paler hairs; 7th segment bidentate; ♀ with the 5th and 6th segments densely clothed with golden red hairs.

♂. Head closely punctured, clothed on the vertex with black and on the face with pale hairs; labrum and clypeus yellowish white, the apical margin of the latter pitchy black; scape of the antennæ in front with a white line. Thorax finely punctured, clothed with brown hairs, with a broad but rather ill-defined band of black hairs between the wings; wings slightly smoky in colour, the nervures dark brown. Abdomen shining, finely punctured, the first three segments clothed with pale brown hairs, the remainder with black; 7th segment bidentate; beneath with the 4th and 5th

segments clothed with brown velvety pubescence; 7th segment with two apical projections; 8th truncate, with a slight central emargination (for genitalia, &c., see Pl. XI., figs. 2—2*b*). Legs simple, clothed with brown hairs.

♀. Like the ♂ in general colour and shape, but with the labrum and clypeus black, the 4th segment of the abdomen only clothed with black hairs, the 5th and 6th with bright golden hairs; dorsal valve of the 6th segment very narrow and pointed, with the centre carinated and the sides reflexed; beneath with the apical margins of the segments piceous, and clothed with golden hairs. Length, 11—12 mm.

Hab. Not very common. London District, Norwich, Southwold, Deal, Littlehampton, Hastings, Chobham, Devonshire, &c.; July and August.

4. *Anthophora quadrimaculata*, Panz. (Pl. XI., figs. 3—3*b*).

Panz., *Faun. Germ.*, 55, 7; Smith, *Cat. Brit. Hym.*, 2nd ed., p. 192.

Black, clothed with pale hairs; ♂ with two large black spots at the base of the clypeus. Abdomen in both sexes with distinct continuous pale bands of hairs at the apex of the segments. Legs simple in both sexes, but the intermediate and posterior femora of the ♂ thickened.

♂. Shining black, clothed with ochreous-brown hairs, mixed with black on the thorax. Head punctured; clypeus, labrum, sides of the face, a spot near the base of each mandible, and a transverse line across the top of the clypeus, white; a large spot on each side of the clypeus at the base, and a small one on each side of the base of the labrum, also the apical margins of both clypeus and labrum, black; face clothed below the antennæ with silvery hairs, scape with a white line in front. Thorax rather remotely punctured on the disk, closely on the sides; wings scarcely clouded; scutellum shining, impunctate at the base. Abdomen shining; basal segment clothed with pale hairs, the others with black, each segment having an apical band of pale hairs; 7th largely punctured, bidentate at the apex; beneath clothed with pale hairs, finely punctured; 6th segment somewhat membranous at the apex, and with a central apical slit (for 7th and 8th segments and genitalia see Pl. XI., figs. 3—3*b*). Legs clothed with pale hairs; intermediate femora much dilated; posterior femora slightly so.

♀. Differs from the ♂ in being less shining and clothed with brighter pubescence; face entirely black; apical fringe of the 5th abdominal segment black; dorsal valve of the 6th segment narrow

and grooved round the margin; beneath with the head and thorax clothed with white hairs, abdomen with dull ochreous-grey hairs. Legs clothed with white hairs on their outer margins. Length, 10—12 mm.

Hab. Of this species F. Smith says:—"Appears about the end of June, and constructs its nest in banks, sandy cliffs, &c.; it frequents the dead-nettle (*Lamium purpureum*), and is not uncommon in the vicinity of London." I have never taken it myself, but have received it from Mr. Vincent R. Perkins from Gloucestershire; and Mr. Parfitt records it from Exmouth, Devon.

SAROPODA, Latr.

Latr., Gen. Crust. et Ins., iv., p. 177.

Differs from *Anthophora* in having only four joints to the maxillary palpi.

1. *Saropoda bimaculata*, Panz. (Pl. XI., figs. 1—1 b).

Panz., Faun. Germ., 55, 17; Smith, Cat. Brit. Hym., 2nd ed., p. 186.

Short and broad; head and thorax clothed with bright brown hairs in the ♂, sooty brown in the ♀; face of the ♂ white; labrum, apex of clypeus, and a central line, white in the ♀. Abdomen with continuous pale bands.

♂. Head clothed with bright pale brown hairs; vertex black, mandibles, except the piceous apices, labrum, clypeus, and face below the antennæ, white; scape of antennæ white in front, the rest black. Thorax black, densely clothed with rather darker hairs than the head; wings almost clear. Abdomen short and subrotundate, black; basal segment clothed with long pale hairs, the others with shorter erect black ones, the apex of each with a narrow band of adpressed pale hairs; 7th segment with a central carina, branching at the apex, and forming two teeth; segments beneath fringed with long hairs at the apex, 7th and 8th truncate at the apex (for which and genitalia see Pl. XI., figs. 1—1 b). Legs clothed with brown hairs; posterior femora and tibiæ slightly thickened; posterior metatarsi as long as the tibiæ; calcaria pale.

♀. Like the ♂ in shape, but duller in the colour of the pubescence; mandibles, labrum, apex of the clypeus, and a line down the middle of the base, white; antennæ entirely black. Disk of the thorax with sooty brown hairs, those round the margins brighter and paler. Abdomen as in the ♂; 5th and 6th segments

with dense fringes of black-brown hairs; apical dorsal valves very narrow and pointed; segments beneath with fringes of dull golden hairs. Legs clothed on their outer sides with pale, somewhat silvery, hairs. Length, 9—10 mm.

Hab. Common in many localities in July and August, and may generally be traced by the high pitched note of its flight. Frequents labiate plants.

CERATINA, Latr.

Latr., Hist. Nat. Ins., xiv., p. 50.

Wings with three submarginal cells; labial palpi 4-jointed; maxillary palpi 6-jointed; ♂ with six ventral segments of the abdomen exposed; anal opening inferior; genital armature rather stout; base of the sagittæ covered with a membrane; ♀ without apparent pollen-brush.

Of this small genus of glabrous, blue, or metallic-coloured bees we have only one species in England whose capture has been really well authenticated. It is closely allied to the large *Xylocopa*, so well known on the Continent; and therefore, although in our limited list it seems to be somewhat out of place near *Psithyrus*, that is where it comes naturally in the more extensive fauna. I think it is doubtful if *Xylocopa* should not itself be moved nearer the commencement of the *Apidæ*, but I have thought better to adopt the position usually assigned to it by continental writers.

1. *Ceratina cyanea*, Kirb. (Pl. XI., figs. 5—5 a).

Kirb., Mon. Ap. Angl., ii., p. 308, pl. 17, 7 and 8; Smith, Cat. Brit. Hym., 2nd ed., p. 180.

Small, blue, shining, almost glabrous, punctured; ♂ with the clypeus and labrum white; apical segment of the abdomen carinated in the ♀.

♂. Head blue, closely punctured; antennæ black or pitchy, clypeus and labrum white. Thorax shining, of a less bright blue than the head, more remotely punctured; wings with a brownish tinge; metathorax finely rugose at the base. Abdomen closely punctured; 6th segment carinated down the middle at the apex; 7th segment inflected, its apex bidentate; ventral segments one to six visible; 6th and 7th apparently soldered together, the apex bidentate; 8th nearly entirely membranous, with a narrow apical chitinous band (for genitalia see Pl. XI., figs. 5—5 a). Legs pitchy black; the extreme base of the tibiæ with a white spot.

♀. Very like the ♂, but with the face unspotted, and the apex of the abdomen simply pointed, not inflexed; the 6th segment above rugose and slightly carinated. Length, 6—7 mm.

Hab. Folkestone; Charlton; Birch and Darenth Woods; Weybridge; S. Devon. Hybernates in dead bramble-stems (*F. Smith*).

PSITHYRUS, *Lep.*

Lep., Ann. Soc. Ent. Fr., ii. (1832) = *Apathus*, Newman.

Wings with three submarginal cells; labial palpi 4-jointed, maxillary palpi 2-jointed; ♂ with the mandibles not fringed with curled hairs, as in the genus *Bombus*, and with the posterior tibiæ outwardly convex, dull, and hairy; ♀ without any corbicula to the posterior tibiæ, which are outwardly convex, dull, and hairy, like those of the ♂; basal joint of posterior tarsi simple.

A genus of parasitic bees living in the nests of species of *Bombus*, and often resembling them so closely in colour, &c., as to be distinguishable only by the generic characters given above.

- (2) 1. 4th and following segments of the abdomen red in both sexes *rupestris*.
- (1) 2. 4th and following segments of the abdomen either white or yellow, or of various colours, but not all red.
- (4) 3. ♂ with the abdomen subglobose, the extreme apex fulvous; ♀ with the extreme apex of the abdomen beneath armed with a pointed process .. *quadricolor*.
- (3) 4. ♂ with the abdomen subtriangular, its extreme apex black; ♀ with the apex simple.
- (6) 5. Both sexes with the posterior metatarsi almost as wide as the tibiæ, and generally with a line of yellow pubescence dividing the black of the base of the abdomen from the white of the apex; ♂ with the sagittæ of the genital armature not toothed beneath *vestalis*.
- (5) 6. Posterior metatarsi much narrower than the tibiæ, no yellow line of pubescence between the black and white; ♂ sagittæ dentate beneath.
- (8) 7. Apical segments of ♂ black or yellow, not white; 6th segment beneath simple, squamæ of the genital armature widely triangular; ♀ with the apex of the abdomen yellow at the sides, 6th segment shining at the base *campestris*.
- (7) 8. Apical segments of ♂ white, 6th segment beneath with a distinct callosity on each side, squamæ of genital armature narrowly triangular; ♀ with the apex white, the 6th segment rugosely punctured *Barbutellus*.

1. *Psithyrus rupestris*, Fab. (Pl. XI., fig. 8).

Fab., Ent. Syst., ii., p. 320; Smith, Cat. Brit. Hym., 2nd ed., p. 221.

Black, clothed with black hairs; hairs of the three apical segments in the ♀ and of the four in the ♂ red. Thorax and basal segments of the abdomen often more or less grey in the ♀; wings dark brown, with blue reflections in the ♀.

♂. Head clothed with black hairs; cheeks between the eyes and mandibles about as long as wide; mandibles bifid at the apex; antennæ with the 2nd and 4th joints of the flagellum subequal, the 3rd a little more than half the length of the 4th; 4th and 5th subequal. Thorax punctured, clothed with long black hairs, often with a band in front, and the sides below the wings and the metathorax posteriorly more or less grey; wings brownish. Abdomen clothed with black hairs on the 1st, 2nd, and 3rd segments, and with red on the rest; the hairs of the apical margins of the basal segments and their sides often grey; beneath punctured, genital armature with the sagittæ hamately toothed beneath; the squama with a long process on its inner margin; lacinia very long, and angularly produced inwards at the base, fringed with long hairs, as also the stipites on their inner margins (see Pl. XI., fig. 8); tibiæ and tarsi clothed with reddish hairs.

♀. Larger than the ♂, deep black; wings dark brown with bluish reflections; apical segments bright red. Legs clothed with black hairs; apex of the metatarsi and the apical joint of the tarsi clothed with short reddish hairs. Length, 16—22 mm.

Hab. Common in many localities, and widely distributed, living with *Bombus lapidarius*.

2. *Psithyrus vestalis*, Fourcr. (Pl. XI., fig. 7).

Fourcr., Ent. Par., ii., p. 450; Smith, Cat. Brit. Hym., 2nd ed., p. 221.

Black; thorax with a broad yellow band in front; both sexes with the apex of the abdomen white from the 4th segment, and with some yellow hairs on the 3rd, separating the black base from the white apex; posterior metatarsi almost as wide as the tibiæ; sagittæ of ♂ genital armature not toothed beneath.

♂. Head densely clothed with black hairs; antennæ with the 3rd joint of the flagellum rather shorter than the 2nd; 4th about as long as the 2nd and 3rd together; 5th slightly shorter than the 4th. Thorax densely clothed with black hairs, and with a broad bright yellow band in front; wings smoky brown. Abdomen

punctured; posterior margins of the segments smooth; 1st and 2nd segments clothed with black hairs; 1st often with yellow hairs intermixed or entirely yellow; 3rd with black hairs at the base and yellow hairs at the apex; 4th and 5th with white; 6th with white intermixed with black; 7th with black; beneath shining, largely punctured; genital armature with the lacinia short, triangular; the sagittæ not toothed beneath (see Pl. XI., fig. 7). Legs clothed with black hairs; apical joints of the tarsi piceous, with reddish hairs; posterior tibiæ rounded and punctured; posterior metatarsi long and as wide as the tibiæ.

♀. Larger and stouter than the ♂, but similarly coloured; pubescence of the 3rd segment of the abdomen widely yellow at the apex; 6th segment above shining, narrowly grooved towards the apex, sides and apex clothed with short velvety brown pubescence; beneath shining, largely punctured, clothed with black hairs; 6th segment with a longitudinal elevation on each side close to the apex; apex simple, clothed with brown velvety hairs; posterior metatarsi wide, as wide nearly as the tibiæ. Legs clothed with black hairs outwardly; posterior tibiæ and all the tarsi with brown hairs on the side towards the body. Length, 18—22 mm.

Hab. Common and generally distributed. Lives with *Bombus terrestris*.

3. *Psithyrus Barbutellus*, Kirb. (Pl. XI., figs. 6—6 b).

Kirb., Mon. Ap. Angl., ii., p. 343 (nec Smith).

Black, clothed with black hairs; both sexes with some of the hairs on the vertex of the head, a band across the front of the thorax, and a band behind the scutellum, yellow; ♂ with the 3rd joint of the flagellum much shorter than the 2nd; 4th and 5th subequal, 4th longer than the 2nd by about one-fourth of its length in both sexes. Abdomen with the basal segment more or less clothed with yellow hairs intermixed with the black, sometimes entirely yellow, rarely entirely black; 4th, 5th, and 6th segments with white hairs; no yellow hairs at the apex of the 3rd; 7th in the ♂ with black hairs; 6th in the ♀ rugosely punctured, with a raised dorsal line; 6th segment beneath in the ♂ with two slightly raised tubercles at the apex; 6th in the ♀ with its edges reflexed at the apex and somewhat thickened; posterior metatarsi distinctly narrower than the tibiæ; genital armature of the ♂ with the sagittæ beneath armed with a large triangular tooth (see Pl. XI., figs. 6—6 b). Length, 17—20 mm.

♂. Differs from that of *vestalis* in having the vertex clothed more or less with yellow hairs, in having a yellow band on the

thorax posteriorly, no yellow on the 3rd segment of the abdomen, and in having the 6th segment beneath raised into a small oval tubercle on each side at the apex, and in having the sagittæ of the armature toothed beneath.

♀. Differs from *vestalis* in being smaller, with the vertex and a band round the thorax posteriorly more or less yellow, in having the basal segment of the abdomen more or less clothed with pale hairs, the 3rd without any yellow at the apex; apical segment beneath more widely rounded, more shining, the edges more widely reflexed, and without any velvety pubescence within them; posterior metatarsi decidedly narrower than the tibiæ.

Hab. Chobham, Norfolk, &c.; probably widely distributed, but mixed with *campestris* in most collections.

4. *Psithyrus campestris*, Panz. (Pl. XII., fig. 1).

Panz., Faun. Germ., 74, 11; Smith, Cat. Brit. Hym., 2nd ed., p. 223.

A very variable species, especially in the ♂, which is sometimes entirely clothed with black hairs, sometimes almost entirely with yellowish hairs; but, as far as I know, the apical segments are never white. Perhaps the most ordinary variety is that with the basal segment of the abdomen clothed with yellowish hairs, the 2nd and the centre of the 3rd at its base with black, and the apical segments with yellow. The ♀ has a broad band across the front and posterior portion of the thorax yellow; abdomen with an apical fringe to the basal segment, and the sides of the apical segments, yellow. The following structural characters will serve to distinguish this species from its allies in all its varieties:—

♂. 3rd joint of the flagellum of the antennæ slightly shorter than the 2nd; 4th about two-thirds as long as the 2nd and 3rd together; 6th ventral segment simple, slightly channelled down the middle, without apical elevations, each side bearing a long tuft of black hairs; genital armature with the sagittæ largely dentate beneath, the lacinia very broad and triangular, their inner margins straight, meeting each other in parallel lines (see Pl. XII., fig. 1).

♀. Dorsal valve of 6th segment narrowly pointed at the apex; ventral valve narrow and widely reflexed, and thickened at the sides, causing a rather long apical sulcature between the elevations. Length, 17—20 mm.

Hab. Common and generally distributed. Lives with *Bombus hortorum* and vars.

5. *Psithyrus quadricolor*, Lep. (Pl. XII., fig. 2).

Lep., Ann. Soc. Ent. Fr., i., p. 376 = *Barbutellus*, ♂, Smith (nec Kirby), Cat. Brit. Hym., 2nd ed., p. 222.

Black; thorax with a wide yellow band in front, and some pale hairs posteriorly round the scutellum; apex of the abdomen in the ♀ clothed with white hairs, extreme apex of the ♂ with reddish hairs.

Very like the three preceding, but differing in the following particulars:—

♂. 2nd and 4th joints of the flagellum of the antennæ subequal; 3rd about two-thirds as long as the 4th. Abdomen shorter; 5th segment clothed with black hairs, 6th and 7th with rufescent hairs; 7th segment beneath simple; genital armature very different from that of any other species, the lacinia produced into a long, narrow, horny process (see Pl. XII., fig. 2).

♀. Differs from any of the preceding in being smaller, with the abdomen (looked at from above) more rounded; the 7th dorsal segment shining, finely and irregularly punctured; 6th ventral segment armed at the extreme apex with a reflexed triangular spine or tooth, which projects amongst the dense pubescence which clothes the apex of the segment. Length, 15—20 mm.

Hab. Common in many localities, and generally distributed. Lives with *Bombus pratorum* and *Schrimshiranus*.

BOMBUS, *Latr.*

Latr., Hist. Nat. Ins., xiv., p. 63.

Wings with three submarginal cells; labial palpi 4-jointed; maxillary palpi 2-jointed; mandibles of ♂ fringed with curled hairs; posterior tibiæ outwardly shining, generally with a more or less distinct impression down the centre; ♀ with the posterior tibiæ dilated and concave outwardly, very shining, with a fringe of long hairs on each side of the concavity (this arrangement is called the "corbicula"); ♂ with six ventral segments exposed; 7th subtransparent, shaped much as the 6th; 8th narrower, somewhat truncate, hairy at the apex; genital armature stout, very variable in form (see Pl. XII.).

A genus of social bees. Communities consisting of males, females, and workers.

- (6) 1. Thorax clothed with yellow or brownish hairs, unbanded.
- (3) 2. Under side of thorax and abdomen clothed with black hairs *Smithianus*.
- (2) 3. Under side of thorax and abdomen clothed with pale hairs.
- (5) 4. ♂, joints of antennæ very slightly rounded beneath, sagittæ of the genital armature hamate at the apex; ♀ and ♂, abdomen without black hairs, tibiæ with pale hairs.. *cognatus*.
- (4) 5. ♂, joints of antennæ much rounded beneath, sagittæ of armature not hamate; ♀ and ♂, abdomen with black hairs intermixed with the yellow, tibiæ with black hairs *muscorum*.
- (1) 6. Thorax banded with black, or entirely black.
- (18) 7. Abdomen clothed with white or tawny or black hairs at the apex, not red.
- (9) 8. ♂, sagittæ of the genital armature denticulate beneath; ♀ and ♂ with the tongue very long, often longer than the entire insect *hortorum*.
- (8) 9. ♂, sagittæ not denticulate; ♀ and ♂ with the tongue not so long, seldom extending beyond the metathorax.
- (11) 10. Abdomen entirely tawny yellow *distinguendus*.
- (10) 11. Abdomen with black markings.
- (13) 12. Face very long, cheeks nearly half as long as the eyes; extreme apex of the abdomen in the ♂ clothed with black hairs; ♀ and ♂, abdomen black at the base, 2nd segment not flavous or tawny *Latreillellus*.
- (12) 13. Face not very long, cheeks not nearly half the length of the eyes; apex of the abdomen in the ♂ white; ♀ and ♂ with the basal or 2nd segment yellow or tawny.
- (17) 14. ♂, metatarsi clothed with long hairs along the upper margin; ♀ and ♂ with yellow hairs on the basal segment, at least at the apex laterally.
- (16) 15. ♂, face with yellow hairs; ♀ and ♂, basal segment only of abdomen with yellow hairs *Schrimshiranus*.
- (15) 16. ♂, face black; ♀ and ♂, 2nd segment of abdomen yellow *soroensis*.
- (14) 17. ♂, metatarsi clothed with very short hairs along the upper margin; ♀ and ♂, 2nd segment only yellow or tawny *terrestris*.
- (7) 18. Abdomen with the terminal segments clothed with red hairs.
- (24) 19. ♂, posterior metatarsi clothed with very short hairs along the upper margin; ♀ and ♂, intermediate metatarsi produced at the external apical angle into an angular spine.
- (21) 20. ♂, face clothed with pale hairs; ♀ and ♂, abdomen with the first two segments clothed with pale hairs, the 3rd and 4th with black, and the apex with red *sylvarum*.

- (20) 21. ♂, face clothed with black hairs; ♀ and ♂, abdomen clothed with black at the base and red at the apex, or with pale, but in the latter case with no black on the 3rd and 4th segments.
- (23) 22. Red on the apical segments in sharp contrast with the black of the preceding; ♀ and ♂ with the hairs of posterior tibiæ red .. *Derhamellus*.
- (22) 23. Black of the base of the abdomen gradually shading into the red of the apex; or the abdomen entirely greyish with the apex red, and without a black central band *ponorum*.
- (19) 24. ♂, posterior metatarsi outwardly fringed with long hairs; ♀ and ♂, intermediate metatarsi not produced at the external apical angle.
- (26) 25. Abdomen with the 3rd and following segments red in all the sexes *lapponicus*.
- (25) 26. Abdomen never with more than the 4th and following segments red.
- (28) 27. Basal segments of the abdomen entirely black in the ♂; thorax entirely black in ♀ and ♂ *lapidarius*.
- (27) 28. Basal segments of the abdomen not black in the ♂; thorax with a pale band in front in the ♀ and ♂.
- (30) 29. ♂, genital armature with the sagittæ curved outwards at the apex, posterior metatarsi much narrowed at the base; ♀ and ♂, face wider across the eyes than long, somewhat square, very little narrowed to the apex .. *soroensis*, var.
- (29) 30. ♂, genital armature with the sagittæ curved at the apex inwardly, and forming a semi-circular hook; ♀ and ♂, face narrow, longer than wide across the eyes, considerably narrowed to the apex *pratorum*.

1. *Bombus Smithianus*, White. (Pl. XII., fig. 3).

White, Proc. Linn. Soc. (1851); Smith, Cat. Brit. Hym., 2nd ed., p. 202.

Head clothed with black hairs; thorax above with bright, rather dark, fulvous hairs, abdomen with paler; beneath entirely clothed with black hairs, except the apical segments of the abdomen.

♂. Head clothed with black hairs; face with a little pale pubescence below the antennæ; cheeks shining, about as long as their apex is wide; labrum impressed across the middle, clothed with black hairs; antennæ with the joints slightly rounded in front; 3rd joint of the flagellum considerably shorter than the 2nd. Thorax clothed with bright fulvous hairs of a richer darker colour than those of any of our other species; wings smoky brown. Abdomen with paler, yellower hairs, its base rather darker, and 7th

segment with black hairs; beneath entirely clothed with black hairs, except the apical segments of the abdomen, which are clothed with pale ochreous; genital armature with the sagittæ curved downwards, and slightly hamate at the apex, angulated beneath behind the middle; squama large, produced inwards at the apex of the stipes, and forming a flat somewhat triangular process, sharply pointed at its apical angle; the rest of the squama somewhat quadrangular; lacinia projecting slightly beyond the squama, sinuate at the apex, and densely clothed with brown hairs (see Pl. XII., fig. 3). Legs clothed with black hairs.

♀ and ♂. Coloured like the ♂, and easily distinguished from any of the other species of this section by the dense black hairs of the face and under side, and by the rather longer less pointed abdomen. Length, 15—20 mm.

Hab. This beautiful species has at present only been found in the extreme north, and is recorded from Shetland and the Hebrides.

2. *Bombus cognatus*, Steph. (Pl. XII., figs. 4—4 a).

Steph., Brit. Ent., Suppl., vii., 17, pl. 43, f. 3 = *venustus*, Smith, Cat. Brit. Hym., 2nd ed., p. 201 = *senilis*, do., 1st ed. = *variabilis*, Schmied.

Entirely clothed with tawny yellow hairs, varying to dark brown, those on the thorax and 2nd segment of the abdomen brighter and darker; ♂ with the joints of the antennæ only very slightly rounded on their anterior margins; genital armature with the sagittæ hamate at the apex; legs of both sexes with pale hairs.

♂. Head subelongate, clothed with pale ochreous hairs; cheeks shining, vaguely punctured, about as long as their apex is wide. Antennæ with the 3rd joint of the flagellum almost equal to the 2nd, the remaining joints slightly curved on their anterior margins and sinuate on their posterior margins. Thorax clothed with bright orange-yellow hairs, paler below the wings; wings slightly tinged with brown. Abdomen clothed with pale ochreous hairs; the 2nd, 3rd, and 4th segments with a wide band of orange-coloured hairs at the base; 7th segment clothed with black hairs; genital armature with the sagittæ hamate at the apex; the squama with its inner margin reflexed, sinuate, produced at both base and apex, especially at the base, where the process forms a cartilaginous plate, perpendicular to the dorsal surface of the armature; in the sinus is a small sharp tooth or spine; lacinia rather long, projecting considerably beyond the squama, sharply falcate (see Pl., XII., figs. 4—4 a). Legs clothed with pale hairs, mixed with black on the tibiæ and also on the anterior femora.

♀ and ♂. Like the ♂ in colour, though generally darker; the abdomen without black hairs; the 2nd, 3rd, and 4th segments with a basal band of brighter and darker brown hairs; corbicula of posterior legs with pale hairs; beneath clothed with pale hairs. Length, 10—18 mm.

Hab. Not uncommon in many places, and generally distributed.

This species, called by Dr. Schmiedeknecht *variabilis*, is the true *cognatus*, Stephens, of which I have had the opportunity of examining the type in the British Museum. In this country I do not think it varies to the extent that it does on the Continent. Some old specimens, long exposed to the weather, are nearly grey, and some dark varieties of the ♀ and ♂ are brown, not yellow; but I have never seen anything like the very dark varieties mentioned by Schmiedeknecht. It is at once known from *Smithianus* by the pale under side, &c.; from *muscorum* by the characters given in the note to that species.

3. *Bombus muscorum*, Linn. (Pl. XII., fig. 7).

Linn., Syst. Nat., ed. x., i., p. 579; Smith, Cat. Brit. Hym., 2nd ed., p. 199 = *agrorum*, Schmied., &c.

Thorax clothed with tawny yellow hairs; abdomen with yellow hairs, more or less mixed with black, sometimes almost entirely black; legs clothed with black hairs; under side with pale ochreous; antennæ of the ♂ with each joint of the flagellum produced and rounded on its anterior margin.

♂. Head clothed with black hairs, intermixed in some varieties with paler ones, especially on the face; cheeks shining, rather longer than their apex is wide. Antennæ with the 3rd joint of the flagellum considerably shorter than the 2nd, its 4th and following joints produced and rounded on their anterior margin. Thorax densely clothed with tawny yellow hairs, in some varieties with a few black hairs intermixed. Abdomen clothed with tawny or ochreous hairs, more or less intermixed with black (in some varieties the black appears only on the sides of the 1st and 2nd segments, in others the black hairs extend nearly all over the segments, leaving only a paler ochreous fringe at the apex of each); beneath clothed with greyish hairs; genital armature with the squama deeply emarginate on its inner margin, and with an apical somewhat rounded production beyond the emargination; at the base of the squama is a short spine projecting forwards; lacinia

densely clothed with hairs beneath, only just showing above the squama as a short falcate tooth; a second sharp tooth of the lacinia may be seen just underneath the anterior process of the squama (see Pl. XII., fig. 7). Legs clothed with black hairs, sometimes intermixed with pale.

♀ and ♂. Very like the ♂ in colour, varying from bright orange-yellow, with only a few black hairs on the sides of the 1st and 2nd segments and legs, to almost black, with the exception of the disk of the thorax and the under side; in structure the ♀ and ♂ approach so closely to *cognatus* as to be scarcely recognisable; the cheeks between the eyes and mandibles are slightly shorter and broader at the apex; the apex of the abdomen beneath has a more distinct carina. In colour all the sexes may be known from *cognatus* by the black hairs on the abdomen and posterior legs, and the less regular style of the pubescence itself, which is in this species longer and more ragged. Length, 10—18 mm.

Hab. Generally distributed and very common. The ♂ varies extremely in size.

4. *Bombus distinguendus*, Mor.

Mor., Hor. Soc. Ent. Ross., vi., p. 32 = *elegans*, Smith (nec Seidl.), Cat. Brit. Hym., 2nd ed., p. 202 = *fragrans*, Auct. (nec Pallas).

Head, thorax, and abdomen clothed with yellow hairs, a transverse band across the thorax between the wings black; legs clothed with black hairs.

♂. Face clothed with yellow hairs, intermixed with black on the sides and vertex; cheeks long and shining; beard of the mandibles black. Antennæ with the 2nd joint of the flagellum considerably longer than the 3rd, and considerably shorter than the 4th; 3rd about half as long as the 4th; the rest of the joints slender, scarcely bent, their sides subparallel. Thorax clothed with yellow hairs, with a well-marked band of black hairs between the wings; wings slightly dusky. Abdomen clothed with yellow hairs, the hairs at the base of each segment slightly darker and brighter than those at the apex; beneath punctured; 8th segment narrow, parallel-sided, densely hairy at the apex, which is rounded; genital armature with the sagittæ wide at the base, then narrow, with an inferior process just beyond the constriction, the apex widened out triangularly; stipites longitudinally carinated; squamæ transverse, produced at their interno-anterior angles into a sharp point; lacinia produced on their inner margin into a narrow blunt tooth (see Pl. XII., figs. 12—12 b). Legs clothed with black hairs.

♀ and ♂. Like the ♂ in colour, and differing only in the ordinary sexual characters; apex of the abdomen beneath with a long central keel extending to about the half of the segment. Length, 15—20 mm.

Hab. Hampstead, Shirley, Norwood, Norwich, Lowestoft, Yarmouth, Yorkshire, Scotland; rare in the South of England.

5. *Bombus Latreillellus*, Kirb. (Pl. XII., figs. 12—12 b).

Kirb., Mon. Ap. Angl., ii., p. 330; Smith, Cat. Brit. Hym., 2nd ed., p. 216 = *subterraneus*, Thoms.

Head clothed with black hairs in both sexes, more or less mixed with yellowish on the face in the ♂; tongue scarcely reaching beyond the anterior coxæ. Thorax clothed with yellowish hairs in the ♂, with a broad black band between the wings; with black in the ♀ and ♀, with a narrow yellow band in front and a few yellow hairs on the metathorax. Abdomen black at the base; the 4th and following segments dirty white or yellowish; the apical margins of the basal segments fringed with the same colour.

♂. Differs from the preceding, besides in the colour characters given above, in having the 2nd and 4th joints of the flagellum subequal, the 8th ventral segment of the abdomen emarginate at the apex, and the genital armature with the inferior process of the sagittæ sharply pointed above in front (see Pl. XII., figs. 12—12 b).

♀ and ♂. Differ from *distinguendus*, so far as I have been able to make out, only in colour. Length, 16—20 mm.

Hab. Generally distributed in the South of England, and abundant in some localities.

I have little doubt that Morawitz is right in considering this as a variety of the preceding; the structural characters are so slight as to be scarcely worth considering apart from the colour; and in the ♂ we find varieties which run almost as pale as the typical *distinguendus*. *Subterraneus*, *hortorum*, and *ligusticus* are now considered as forms of one species, the ♀ of each being distinguishable in colour, but the ♂ identical; and I think this species and the last should be united on the same principle.

The ♀ and ♂ resemble *hortorum* and *subterraneus* in colour, but the shorter face and the short tongue will separate them at once from that species.

6. *Bombus hortorum*, Linn. (Pl. XII., fig. 6).

Linn., Faun. Suec., ed. alt., p. 424; Smith, Cat. Brit. Hym., 2nd ed., p. 214.

Var. = *subterraneus*, Auct. (nec Thoms.).

Var. = *Harrisellus*. Kirb.

Head black; cheeks very long, two-thirds as long as the eyes. Thorax black, widely yellow anteriorly and posteriorly; abdomen with the basal segment yellow, the 2nd and 3rd black, the remainder white, or the whole insect entirely black (*Harrisellus*); colour varying to almost any extent between the two extremes; tongue very long, almost as long as the body in the ♀ and ♂; sagittæ in the ♂ denticulate exteriorly.

♂. Head clothed with black hairs; face very long and parallel-sided; cheeks shining, very long, more than twice the length of their apex. Antennæ with the 2nd and 4th joints of the flagellum subequal, the 3rd very short; tongue reaching to the posterior coxæ. Thorax clothed with black hairs, with a wide yellow band in front, and another across the metathorax; wings more or less brownish. Abdomen with the basal segment yellow-haired; the 2nd and 3rd black; the 4th, 5th, and 6th white, and the apical segment black; beneath clothed with white hairs, 6th segment with black; 7th with a few bristly black hairs; 8th somewhat rounded at the apex, with a very small central emargination; genital armature with the sagittæ finely and sharply serrate beneath; squama wide in front, narrowed behind, and produced along the stipes towards its base, then turned back and armed with a recurved spine at its apex (see Pl. XII., fig. 6). Legs clothed with black or reddish black hairs; posterior tibiæ shining.

Var. *Harrisellus*.—Entire insect clothed with black hairs.

♂ and ♀. Like the ♂ in colour, but more subject to variation; in the ♂ intermediate varieties between the typical form and the black one are rare, in the ♂ and ♀ they are common; head shaped as in the ♂; tongue very long, often as long as the body; cheeks two-thirds as long as the eye; posterior tibiæ with black hairs. Length. and ♀ 16—22 mm., ♂ 12—15 mm.

Hab. Very common, and generally distributed.

This species has usually been considered as constituting two, but there is no satisfactory structural character to separate them apart, and the male armature in all the varieties is identical: to *subterraneus* have been referred the large females of a less bright coloration, with the abdomen rather broader at the apex, and with its

pubescence slightly shorter. The ♂ of *subterraneus* has been distinguished as having the beard of the mandibles red; but there is much variation amongst the males in this respect, and that therefore seems to be a useless character. The black variety, *Harrisellus*, is rarer than the typical form.

7. *Bombus nivalis*, Smith.

Smith, Cat. Brit. Hym., 2nd ed., p. 210 = *nivalis*, Dahlb. ? ?.

“♀, 8—9 lines. The pubescence on the head black; that on the thorax above yellow, more or less inclining to fulvous, with a band of black pubescence between the wings; that on the sides, on the legs, and on the thorax beneath, black; wings subhyaline. Abdomen: the pubescence on the two basal segments yellow, on the 3rd it is black, and on the three apical segments of a fulvous-yellow.”

“♂, 6—7 lines. Only differs from the ♀ in having the pubescence at the apex of the abdomen paler, inclining to white.”

“♂, 6—6½ lines. The face before the antennæ clothed with yellow pubescence, with a black band between the wings; beneath and on the femora it is of a very pale yellow, on the tibiæ it is black. Abdomen: the two basal segments with yellow pubescence, the 3rd and 4th with black, and the apical ones with pale yellowish white; beneath the pubescence is also yellowish white.”

I have quoted Smith's description verbatim, because, after a careful examination of the specimens in the British Museum, I do not feel sure that they have been correctly referred to *nivalis*, Dahlb.; and yet they do not agree exactly with any other British species; they most closely resemble *Schrimshiranus* both in form and colour, but the ♀ has the hairs of the tibiæ black, and the ♂ has the posterior metatarsi less gradually constricted at the base, although clothed with long hairs as in that species. Unfortunately the genital armature is not exposed, so that the species cannot be determined for certain; but continental *nivalis* is such a much larger and more brightly coloured insect that I cannot imagine ours can be identical with it. The species was taken in Shetland in 1852. More specimens are wanted to decide if it be only a variety of *Schrimshiranus* or a distinct species.

8. *Bombus Schrimshiranus*, Kirb.

Kirb., Mon. Ap. Angl., ii., p. 342 = *Jonellus*, Smith, Cat. Brit. Hym., 2nd ed., p. 209.

In coloration almost similar to typical *hortorum*, but smaller, and easily recognised by the following characters:—

♂. Face clothed with yellow hairs; 3rd joint of the flagellum more than half the length of the 2nd; cheeks not one-third of the length of the eyes; genital armature with the sagittæ not serrate beneath, each terminating in a sickle-like hook; the squama and lacinia very short and simple (the figure of the armature of *pratorum* will serve equally for this species). Tibiæ and tarsi clothed with reddish hairs.

♀ and ♂. Smaller than in *hortorum*; the yellow colour less bright, the face much shorter, the cheeks not being one-third of the length of the eyes, the tongue not reaching beyond the basal segment of the abdomen, and the hairs on the posterior tibiæ red instead of black. Length, ♂ and ♀ 15—18 mm., ♂ 10—12 mm.

Hab. Rare. Coombe Wood; Purley Downs; Shirley Common; Chobham; Hayling Island; Bournemouth; Barmouth, N. Wales.

The ♀ of this species is one of our smallest Bombi.

9. *Bombus pratorum*, Linn. (Pl. XII., figs. 5—5 b).

Linn., Faun. Suec., ed. alt., p. 424; Smith, Cat. Brit. Hym., 2nd ed., p. 207.

Thorax clothed with black hairs, with a wide yellow band in front; face with yellow in the ♂. Abdomen: 1st segment clothed with black hairs at the base, generally with yellow at the apex; 2nd segment with bright yellow hairs; 3rd and 4th in both sexes, or sometimes 3rd only in the ♂, black; the remainder red; the yellow on the 2nd segment of the ♀ and ♂ sometimes nearly absent.

♂. Face clothed with yellow hairs, subelongate; cheeks converging considerably towards the mandibles, shining, about one-third as long as the eyes. Antennæ with the 2nd and 4th joints of the flagellum subequal, the 3rd two-thirds the length of the 4th. Thorax clothed with black hairs, with a wide sulphur-yellow band in front, entirely black posteriorly. Abdomen clothed with black hairs at the extreme base of the 1st segment, with bright yellow on the apex of the 1st and on the 2nd, with black on the 3rd and sometimes also on the 4th, and with red on the remainder; beneath

clothed with black hairs on the first three segments, and with red on the last three; genital armature in the ♂ shaped as in the preceding (see Pl. XII., figs. 5—5*b*). Legs clothed with pale hairs intermixed with black.

♀ and ♂. Differing from the ♂, besides in the usual sexual characters, in having the yellow colour of the hairs rather less bright, the black abdominal band wider, sometimes nearly covering the whole body. Length, ♂ and ♀ 15—18 mm., ♀ 10—12 mm.

Hab. Very common and generally distributed.

10. *Bombus lapponicus*, Fabr.

Fabr., Ent. Syst., ii., p. 318; Smith, Cat. Brit. Hym., 2nd ed., p. 204.

Head and thorax clothed with black hairs; the face below the antennæ in the ♂, the thorax widely in front and very narrowly behind, in both sexes, yellow. Abdomen black at the extreme base in the ♀, on the first three segments in the ♂; the rest of the abdomen in both sexes clothed with red hairs.

♂. Clothed with rather shaggy hairs. Head clothed with pale hairs on the vertex, and with yellow on the face below the antennæ; face shorter and wider than in *pratorem*, the distance between the eyes on the vertex being more nearly the length of the eye; cheeks rugosely punctured, shining, as short as their apical width. Antennæ with the 2nd and 4th joints of the flagellum subequal, the 3rd about two-thirds the length of the 2nd. Thorax clothed with black hairs, with a wide yellowish band in front, and a very narrow one round the metathorax posteriorly; wings slightly dusky. Abdomen clothed on the first two segments with black hairs, and on the 3rd and following segments with red, the hairs of the basal segments sometimes intermixed with yellow; beneath entirely clothed with ochreous-yellow hairs.

♀ and ♂. Coloured much as the ♂, but the colours brighter, and the abdomen black only on the 1st segment and the extreme base of the 2nd, the remainder red or orange-red. Abdomen beneath clothed with fine black hairs; hairs of the tibiæ black. Length, ♂ and ♀ 15—17 mm., ♀ 12—14 mm.

Hab. Mountainous districts; Black Mountain, Brecknockshire; Snowdon; Herefordshire; Monmouthshire; Halifax Moor, Yorkshire; Loch Rannoch, Perthshire.

11. *Bombus sylvarum*, Linn. (Pl. XII., fig. 11).

Linn., Faun. Suec., ed. alt., p. 425; Smith, Cat. Brit. Hym., 2nd ed., p. 203.

Black, clothed with greyish hairs, an indefinite band across the thorax between the wings, and a very narrow band at the base of the 3rd segment of the abdomen, clothed with black, the 4th and following segments with red or yellowish red.

♂. Head clothed with greyish hairs, intermixed with black on the vertex and at the sides; cheeks shining, remotely punctured, about as long as their apical margin; mandibles piceous at the apex. Antennæ with the 4th joint of the flagellum equal to the 2nd and 3rd taken together, the 2nd slightly longer than the 3rd, the remaining joints subarcuate. Thorax clothed with grey hairs, with a wide indefinite band of black hairs across the centre; wings slightly dusky. Abdomen clothed with greyish hairs at the base, the 2nd segment with ochreous hairs at the base and with grey at the apex, the 3rd with black hairs at the base and grey at the apex, and the following segments with yellowish red hairs; each with a narrow apical band of grey hairs; beneath entirely clothed with grey; genital armature with the sagittæ curved at the base, the apex hamate beneath; squama produced at the base inwardly into a long curved spine; lacinia triangularly produced beyond the squama, obliquely truncate on its inner margin, which is armed with a small square tooth, and produced slightly at both angles (see Pl. XII., fig. 11). Legs clothed with grey hairs; tarsi piceous at the apex, clothed with ferruginous hairs.

♀ and ♂. Like the ♂ in colour, but differing in the usual sexual characters, and also in having the 2nd segment of the abdomen often with black hairs intermixed with the grey. Length, ♂ and ♀ 14—16 mm., 12—14 mm.

Hab. Generally distributed.

The coloration of this species, which varies very little, will distinguish it from any other, except perhaps the ♂ of the rare *pomorum*; but from that, its ♂ may be known at once by the shorter face, the form of the genital armature, and the narrow black band at the base of the 3rd segment of the abdomen. On the Continent a nearly black form occurs, var. *nigrescens*, Perez, but I have seen nothing of the kind from this country.

12. *Bombus Derhamellus*, Kirb. (Pl. XII., fig. 10).

Kirb., Mon. Ap. Angl., ii., p. 263; Smith, Cat. Brit. Hym., 2nd ed., p. 205.

Black, clothed with black pubescence; the 4th and following segments of the abdomen clothed with red; in the ♂ the thorax is banded with ochreous-grey hairs anteriorly and posteriorly in bright varieties, and the basal segments of the abdomen are also clothed with hairs of the same colour; but in dark varieties the band across the metathorax is wanting, and the base of the abdomen is black; posterior femora clothed with red hairs in both sexes.

♂. Head clothed with black hairs; cheeks longer than their apical width, shining, irregularly punctured. Antennæ with the 2nd joint of the flagellum considerably longer than the 3rd, the 4th as long as the 2nd and 3rd together, the following joints subarcuate. Thorax clothed with black hairs, with a band of paler hairs in front, and also behind in bright varieties; wings slightly dusky. Abdomen with brownish grey hairs on the two basal segments, with black on the 3rd, and with red on the remainder, or with the three basal segments entirely black; beneath clothed with reddish hairs; genital armature with the squama produced at the base inwardly into a long somewhat bent process; the lacinia produced at the base inwardly into a narrow spine, and sharply pointed at the apex (see Pl. XII., fig. 10). Legs clothed with reddish hairs.

♀ and ♂. Entirely clothed with black hairs, with the exception of the three apical segments of the body, which are bright red. Abdomen short and almost as wide as long; hairs of the posterior tibiæ red. Length, ♂ and ♀ 15—18 mm., ♂ 12—14 mm.

Hab. Generally distributed, and abundant in some localities.

The ♀ much resembles that sex of *lapidarius*, but the short abdomen and red hairs of the posterior tibiæ distinguish it at once.

13. *Bombus soroensis*, Fab. (Pl. XII., fig. 14).

Fab., Gen. Ins., p. 246; Smith, Cat. Brit. Hym., 2nd ed., p. 215 = *Cullumanus*, Kirby.

This species is probably the most variable of all in colour, and has led to great confusion on account of this peculiarity, as in some varieties the whole insect is

black, with the exception of the apex of the abdomen, which is whitish; in others the thorax has a wide yellow band in front, the 2nd segment of the abdomen, and sometimes also the 1st, is yellow, the 3rd black; the 4th and following segments white, or white with a narrow red line between the black and white, or red; in the ♂ the apex of the abdomen is often clothed with almost pink hairs, which gives a most characteristic appearance. I will give here the structural and other characters by which this species can be known from its allies.

♂. This sex may be known from any other species by the shape of the genital armature, the sagittæ of which are curved outwards at the apex and thickened, with their apical margin truncate; they are also bluntly toothed beneath near the middle; the squama is long, sinuate on its inner margin; the lacinia bidentate at the apex, the inner tooth longer and more curved (see Pl. XII., fig. 14). Besides these characters the white-tailed ♂ may be known from *terrestris* by having the 2nd joint of the flagellum shorter, it only being of the same length as the 3rd, whereas in *terrestris* it is nearly once and a half as long, by the longer cheeks and face, and by the longer more erect pubescence, and by the narrower more convex posterior tibiæ, which are destitute of any longitudinal impression; from *pratorum* and *Derhamellus* the red-tailed ♂ may be known by the form of the genital armature, the larger size and more erect pubescence, and the shape of the posterior metatarsi, which are much more narrowed at the base, and the more arcuate joint of the antennæ.

♂ and ♀. May be known from *terrestris* by the longer face and cheeks, the latter being nearly as long as their apical width, by the less defined yellow abdominal band, which is of a less bright colour than in *terrestris* var. *lucorum*, and generally extends on to the basal segment, and also by the less compressed apical ventral segment; the red-tailed varieties differ from *pratorum*, which they so much resemble, in the broader rather more squarely-shaped face, the shorter tongue and palpi, these latter hardly so long as the head, and the narrower black abdominal band, which occupies the 3rd segment only. Length, ♂ and ♀ 12–17 mm., ♀ 10–12 mm.

Hab. Rare. Croydon; Southend; Brighton Downs; Bristol; Carlisle; Yorkshire; Scotland.

14. *Bombus pomorum*, Panz. (Pl. XII., fig. 9).

Panz., Faun. Germ., 86, 18; Smith, Cat. Brit. Hym., 2nd ed., p. 206.

♂ greyish, with a darker band across the thorax; the abdomen reddish posteriorly; ♀ and ♂ black, with the abdomen black at the base, gradually shading into red at the apex, sometimes with the thorax pale in front and on the metathorax; the ♂ in continental specimens often fades to a greyish colour.

♂. Head clothed with black hairs; cheeks long, shining, impunctate, longer than the width of their apex. Antennæ with the 2nd joint of the flagellum longer than the 3rd, the 3rd a little more than half the length of the 4th. Thorax clothed with grey hairs, with a rather wide indefinite black band between the wings; wings slightly dusky. Abdomen clothed with grey hairs on the basal segment, with reddish hairs on the others, the hairs on the apex of each segment paler; segments beneath sparingly clothed with reddish hairs; genital armature with the sagittæ curved at the apex, much thickened and obliquely truncate, with a strong inferior tooth near the base; squama short, triangular, projecting at its internal angle; lacinia narrow, and somewhat twisted and apiculate (see Pl. XII., fig. 9). Legs clothed with black hairs, intermixed with finer reddish ones; sides of the metatarsi subparallel to their base.

♀ and ♂. Clothed with black hairs; head long, as in the ♂; the thorax in front and a band on the metathorax often more or less pale. Abdomen clothed with black hairs at the extreme base, gradually shading to red at the apex, the transition from one to the other being almost imperceptible; in the ♂ the base of the abdomen is sometimes reddish, sometimes grey; but this form has not yet been recorded from this country. Length, ♂ and ♀ 15—18 mm., ♂ 12—14 mm.

Hab. Very rare; the ♂ and ♀ only have occurred in this country, and we have only one locality recorded, viz., near Deal, where Mr. F. Smith captured three males in 1863 and his son a ♀ in 1864. I have a ♂ in my collection without note of locality.

15. *Bombus lapidarius*, Linn. (Pl. XII., figs. 8—8 a).

Linn., Syst. Nat., ed. x., i., p. 579; Smith, Cat. Brit. Hym., 2nd ed., p. 211.

Clothed with deep black hairs; the 4th and following segments bright red; ♂ with the face, a band across the thorax in front, the sides of the thorax beneath the wings, and a few hairs round the

posterior margin of the metathorax, yellow; the posterior tibiæ in this sex with red hairs, in the ♀ and ♂ with black; the ♀ and ♂ have rarely a pale anterior band on the thorax.

♂. Head clothed on the vertex with black hairs, and with yellow on the face; cheeks about as long as their apical width. Antennæ with the 2nd joint of the flagellum slightly longer than the 4th; the 3rd about two-thirds as long as the 2nd. Thorax clothed with black hairs, with a wide band of yellow hairs in front, which is continued under the wings and covers nearly the whole of the under side; there are also a few pale hairs generally on the metathorax. Abdomen clothed with black hairs; the sides of the segments sometimes more or less greyish; 4th and following segments clothed with bright red hairs; beneath coloured as above; genital armature with the sagittæ simple beneath, their apices each with a sharp hama on the inner side; squama rounded in front, projecting slightly on its inner margin at the base; lacinia flat, sinuate at the apex (see Pl. XII., fig. 8); posterior tibiæ clothed with red hairs.

♀ and ♂. Entirely clothed with deep black hairs, with the exception of the three bright red segments at the apex of the abdomen, and in some varieties of a pale anterior thoracic band. Length, ♂ and ♀ 14—20 mm., ♀ 12—15 mm.

Hab. Very common and widely distributed.

The only British species with which this can be confounded is *Derhamellus*, but the ♀ and ♂ of that species have the hairs of the posterior tibiæ red, and the abdomen shorter and more globose.

16. *Bombus terrestris*, Linn. (Pl. XII., fig. 13).

Linn., *Syst. Nat.*, ed. x., p. 578 = *lucorum*, Smith, *Cat. Brit. Hym.*, pt. i., p. 225 = *virginialis*, Kirby, Smith, &c.

Head clothed with black hairs, or with the face yellow in var. *lucorum* of the ♂; thorax with black hairs, a band in front yellow, and often in the ♂ also with a band behind; in some extreme vars. of the ♂ the yellow is so extended as to leave only a narrow black band between the wings; abdomen with the basal segment black, 2nd yellow, 3rd and 4th black, the latter at the apex and the two apical segments white or tawny. In the ♂ the yellow hairs often cover the 1st and 2nd segments in var. *lucorum*, and there is sometimes a line of yellow hairs dividing the central black belt of the abdomen into two.

♂. Face short, the cheeks shorter than their apical width. Antennæ shorter than in most of the species, scarcely reaching

beyond the tegulæ; 2nd and 4th joints of the flagellum subequal; 3rd a little more than half as long as the 4th. Thorax with the pubescence coloured as above, the yellow varying from pale lemon-yellow, var. *lucorum*, to brownish yellow, var. *virginalis*. Wings only very slightly dusky. Abdomen variable in colour (see general description above), the yellow varying in depth and tint like that of the thorax; genital armature of the ♂ unlike that of any other species; the sagittæ slightly divergent, very deep and much flattened laterally; squama produced inwardly at right angles to the stipes; lacinia short, scarcely projecting beyond the squama (see Pl. XII., fig. 13). Legs clothed with pale hairs; posterior metatarsi narrowed towards the base.

♀ and ♂. With the pubescence coloured as stated in the general description, the tint of the yellow varying as in the ♂; cheeks short, shorter than their apical length; tongue reaching to about the base of the abdomen. Length, ♂ and ♀ 16—22 mm., ♀ 12—14 mm.

Hab. Very common and generally distributed.

There can be little doubt that the two forms which used to be considered distinct, viz., *lucorum* and *virginalis*, are only colour varieties of one species; there is no structural difference, and the genital armatures of the males agree exactly.

APIS, Linn.

Linn., Syst. Nat., ed. x., i., p. 574, 218.

Labial palpi 4-jointed; maxillary palpi 1-jointed; ♂ with the eyes approximate on the vertex; anterior wings with three submarginal cells; abdomen truncate at the base; ♂ with the anal opening inferior, and with the armature not polished and shining as in the other genera of the Aculeates, but of the same consistency as the other abdominal segments, the sagittæ lying apparently detached, and only obtainable by dissection.

Communities of males, female, and workers.

1. *Apis mellifica*, Linn. (Pl. XII., figs. 15—15 b).

Linn., Syst. Nat., ed. x., i., p. 576; Smith, Cat. Brit. Hym., 2nd ed., p. 226.

Brown, clothed with pale brown hairs; margins of the abdominal segments paler.

♂. Eyes meeting on the vertex; the pubescence of the thorax very dense. Abdomen broad and blunt at the apex (for genitalia see Pl. XII., figs. 15—15 b); tibiæ and metatarsi convex externally.

♀. Eyes remote on the vertex. Abdomen elongate, conical, pointed at the apex, longer than the wings; tibiæ and metatarsi subconvex externally, the former foveated just above the apex.

♂. Eyes remote on the vertex. Abdomen shorter than the wings, less conical than in the ♀; posterior tibiæ and metatarsi dilated and excavated externally, and clothed with long hairs at the edges, the metatarsi sharply dentate at the base. Length, 13—17 mm.

Hab. Common; the hive bee.

EXPLANATION OF PLATES.

PLATE V.

FIG. 1. *Panurgus ursinus*, ♂ armature.

1 a. " " 7th ventral segment.

1 b. " " 8th " "

2. " *calcaratus*, ♂ armature.

2 a. " " 8th ventral segment.

3. *Rophites 5-spinosus*, ♂ armature.

3 a. " " 7th ventral segment.

3 b. " " " " lateral view.

3 c. " " 8th ventral segment.

3 d. " " " " lateral view.

4. *Dufourea vulgaris*, ♂ armature.

4 a. " " 7th ventral segment,

4 b. " " 8th " "

PLATE VI.

1. *Nomada Roberjeotiana*, ♂ armature.

1 a, 1 b. " " 8th ventral segment, ventral and lateral views.

2. " *solidaginis*, ♂ armature.

2 a, 2 b. " " 8th ventral segment, ventral and lateral views.

3. " *varia*, ♂ armature.

3 a, 3 b. " " 8th ventral segment, ventral and lateral views.

4. " *6-fasciata*, ♂ armature.

4 a, 4 b. " " 8th ventral segment, ventral and lateral views.

5. " *lincola*, ♂ armature.

5 a, 5 b. " " 8th ventral segment, ventral and lateral views.

FIG. 6. *Nomada alternata*, ♂ armature.

- 6 a, 6 b. " " 8th ventral segment, ventral and lateral views.
7. " *alboguttata*, ♂ armature.
- 7 a, 7 b. " " 8th ventral segment, ventral and lateral views.
8. " *jacobææ*, ♂ armature.
- 8 a, 8 b. " " 8th ventral segment, ventral and lateral views.
9. " *succincta*, ♂ armature.
- 9 a, 9 b. " " 8th ventral segment, ventral and lateral views.
10. " *lateralis*, ♂ armature.
- 10 a, 10 b. " " 8th ventral segment, ventral and lateral views.
11. " *ochrostoma*, ♂ armature.
- 11 a, 11 b. " " 8th ventral segment, ventral and lateral views.

PLATE VII.

1. *Nomada Fabriciana*, ♂ armature.
- 1 a, 1 b. " " 8th ventral segment, ventral and lateral views.
2. " *ruficornis*, ♂ armature.
- 2 a, 2 b. " " 8th ventral segment, ventral and lateral views.
3. " *furva*, ♂ armature.
- 3 a, 3 b. " " 8th ventral segment, ventral and lateral views.
4. " *flavoguttata*, ♂ armature.
- 4 a, 4 b. " " 8th ventral segment, ventral and lateral views.
5. " *Lathburiana*, ♂ armature.
- 5 a, 5 b. " " 8th ventral segment, ventral and lateral views.
6. " *ferruginata*, ♂ armature.
- 6 a, 6 b. " " 8th ventral segment, ventral and lateral views.
7. " *bifida*, ♂ armature.
- 7 a, 7 b. " " 8th ventral segment, ventral and lateral views.
8. " *obtusifrons*, ♂ armature.
9. *Epeolus rufipes*, ♂ armature.
- 9 a, 9 b. " " 7th dorsal and 8th ventral segment.
- 1 " " *productus*, ♂ armature.
- 10 a. " " 7th ventral segment.

PLATE VIII.

- FIG. 1. *Melecta armata*, ♂ armature.
 1 a. " " 7th ventral segment.
 1 b. " " 8th " "
 2. " *luctuosa*, ♂ armature.
 2 a. " " 7th ventral segment.
 2 b. " " 8th " "
 3. *Cælixys rufescens*, ♂ armature.
 4. " *4-dentata* "
 5. " *acuminata* "
 6. " *elongata* "
 7. " *vectis* "
 8. *Osmia xanthomelana* "
 9. " *rufa* "
 10. " *aurulenta* "
 11. " *parietina* "
 12. " *spinulosa*, ♂ armature, showing 8th ventral segment beneath.
 13. " *carulescens*, ♂ armature.
 14. " *bicolor* "
 15. " *fulviventris* "
 16. " *leucomelana* "

PLATE IX.

1. *Megachile Willughbiella*, ♂ armature.
 1 a. " " 6th ventral segment, and much enlarged spines of do.
 2. " *maritima*, ♂ armature.
 2 a. " " 6th ventral segment, and much enlarged spines of do.
 2 b. " " 8th ventral segment.
 3. " *ligniseca*, ♂ armature.
 3 a. " " 6th ventral segment, and much enlarged spines of do.
 4. " *circumcincta*, ♂ armature.
 4 a. " " 6th ventral segment, and much enlarged spines of do.
 5. " *centuncularis*, ♂ armature.
 5 a. " " 6th ventral segment, and much enlarged spines of do.
 6. " sp. ?,* ♂ armature.
 6 a. " " 6th ventral segment, and much enlarged spines of do.

* I figured this from a continental specimen ticketed *pyrina* in F. Smith's collection, but I have now reason to think that it does not represent true *ericetorum*.

FIG. 7. *Megachile argentata*, ♂ armature.

7a. " " 6th ventral segment, and much enlarged spines of do.

PLATE X.

1. *Heriades truncorum*, ♂ armature.
- 1a. " " 5th ventral segment.
2. *Stelis aterrima*, ♂ armature.
3. *Anthidium manicatum*, ♂ armature.
- 3a. " " 8th ventral segment.
4. *Chelostoma florissomne*, ♂ armature.
- 4a. " " 5th ventral segment.
5. " *campanularum*, ♂ armature.
- 5a. " " 7th ventral segment.
- 5b. " " 8th "
6. *Eucera longicornis*, ♂ armature.
- 6a. " " 7th ventral segment.
- 6b. " " 8th "
7. *Anthophora retusa*, ♂ armature.
- 7a. " " 7th ventral segment.
- 7b. " " 8th "
8. " *pilipes*, ♂ armature.
- 8a. " " 7th ventral segment.
- 8b. " " 8th "

PLATE XI.

1. *Saropoda bimaculata*, ♂ armature.
- 1a. " " 7th ventral segment.
- 1b. " " 8th "
2. *Anthophora furcata*, ♂ armature.
- 2a. " " 7th ventral segment.
- 2b. " " 8th "
3. " *quadrinaculata*, ♂ armature.
- 3a. " " 7th ventral segment.
- 3b. " " 8th "
4. *Osmia pilicornis*, ♂ armature.
5. *Ceratina cyanea*, "
- 5a. " " 6th ventral segment.
6. *Psithyrus Barbutellus*, ♂ armature.
- 6a. " " 7th ventral segment.
- 6b. " " 8th "
7. " *vestalis*, ♂ armature.
8. " *rupcstris*, ♂ armature, 8th ventral segment showing beneath.

PLATE XII.

- FIG. 1. *Psithyrus campestris*, ♂ armature.
 1 a. " " 7th ventral segment.
 1 b. " " 8th " "
 2. " *quadricolor*, ♂ armature.
 3. *Bombus Smithianus* " "
 4. " *cognatus* " "
 4 a. " " 8th ventral segment.
 5. " *pratorum*, ♂ armature.
 5 a. " " apex of sagittæ.
 5 b. " " 7th and 8th ventral segments.
 6. " *hortorum*, ♂ armature.
 7. " *muscorum* " "
 8. " *lapidarius* " "
 8 a. " " apex of sagittæ.
 9. " *pomorum*, ♂ armature.
 10. " *Derhamellus* " "
 11. " *sylvarum* " "
 12. " *Latreillellus* " "
 12 a. " " 7th ventral segment.
 12 b. " " 8th " "
 13. " *terrestris*, ♂ armature.
 14. " *soroensis* " "
 15. *Apis mellifica*, ♂ armature.
 15 a. " " sagittæ.
 15 b. " " " laterally.

XIII. *Further notes on the terminal segments of Aculeate Hymenoptera.* By EDWARD SAUNDERS, F.L.S.

[Read March 5th, 1884.]

PLATE XIII.

IN the volume of our 'Transactions' for 1882 I made some remarks on the terminal segments of the genus *Prosopis*, and pointed out that good specific characters were obtainable from an examination of the 8th ventral segments of the ♂, as well as of the genital armature. Since then I have extended my observations to the other genera of the Anthophila, as well as to those of the Fossores, Heterogyna, and Diploptera, and I find so many interesting features disclosed by these examinations that I thought a few remarks on them might be interesting to the members of the Society.

I may observe, in the first place, that the 8th ventral segment is always distinctly present in the Aculeata, and I have in several cases removed it entire, so as to show the connection between the valves. As a rule it varies more in form than the 7th, especially as regards its ventral valve. It is the ventral valve of the 8th segment which bears the three spines in *Scolia*, the up-turned spine in *Myzine* and *Methoca*, and the spoon-shaped apical process in *Andrena* and its allies; and yet the presence of this 8th segment seems to have been ignored by most hymenopterists, Klug and a few others being the exceptions, or to have been mistaken for that of the 7th, where this latter is hidden beneath the 6th, as is the case in many genera, such as *Pompilus*, *Andrena*, &c. In many others the 8th segment is entirely hidden, and can only be observed after dissection; but even then, as in *Prosopis*, it exhibits great variety of form; there is one character whereby the ventral valve of the 8th may in most cases be known, *viz.*, that it is produced basally in the centre, whereas the 7th is only produced basally at the sides. The dorsal valve of the 8th is generally more or less membranous or corneous,

and is rarely visible; as a rule it fits into and is of the same shape as the 7th, but there is an important modification of it in the Heterogyna, *Mutillidæ* and *Pompilidæ*, and the genus *Astata*, where it bears at its apex two little pilose processes of a somewhat palpiform nature (see Pl. XIII., figs. 1a, 2a, 3a, &c.): these are generally visible beyond the apex of the 7th segment, and will be found more fully described under the head Heterogyna, &c., further on, where the distinctive features exhibited by the terminal segments in each family and genus that I have been able to examine are noticed in natural order. It seems to me that these features, although unfortunately only existing in the ♂ sex, afford far better characters for classification than the neuriation of the wings, which have formed the basis of the arrangement of the Fossores, &c., which we now use. We know how subject neuriation is to vary, and how often specimens are found with one or more nervures of the wing imperfect or missing; also how in a series of specimens of one species a certain nervure will vary in its exact relative position to another; also how in *Tropoxylon* there are several cells merely indicated, as it were, by the very faintest nervures, besides those enclosed by nervures of the ordinary size, so that classing it by the ordinary nervures it takes its place amongst the genera having only one submarginal cell; whereas, if the entire system of neuriation be admitted, it would come amongst those with two.

There is, I think, also very grave doubts whether the insect we know as *Pompilus pectinipes* is more than a variety of the ♀ of *Evagethes bicolor*, with three submarginal cells instead of two, which is the characteristic of the latter genus. Certain it is that the two forms often frequent the same locality, and that the ♂ of *pectinipes*, the ♀ of which is far from rare, is unknown to us (the ♂ which F. Smith refers to it is that of *chalybeatus*); and specimens have occurred with three submarginal cells on one side and two on the other. All these variations in neuriation make it to my mind a very dubious character for classificational purposes, and, if the characters derivable from the terminal segments could be used instead, I think they would probably afford a more natural arrangement, and be far more constant. I say this after carefully observing that a certain type of segments will run through a whole genus,

modified only according to the species, but perfectly distinct from those of the allied genera; and also that, in like manner, a general similarity of form will run through a whole family. Certainly the adoption of these characters brings genera together in accordance with those derivable from general outline facies, &c.,—in fact gives what appears to be a natural arrangement.

Regarding an aculeate hymenopterous insect theoretically as a twenty or twenty-one segmented creature, six or seven of these segments, according to which view is adopted, are represented at one apex in the combination which we call the head, which bears various pairs of appendages denoting the existence of the segments. At the other apex of the creature two segments, I believe, are represented in what is called the genital armature of the ♂, the 9th abdominal segment beyond the basal constriction, *i. e.*, not reckoning the propodeum of Newman, being represented by the "cardo" of Thomson, and its appendages by the stipites, the 10th being represented dorsally by the spatha, and its appendages by the sagittæ; the 8th segment of the abdomen also in some genera bears appendages dorsally, as if it also were tending to join the combination. Now, as the shapes and appendages of the head-segments are regarded as amongst the best and most constant for generic classification, I think there is good reason why the shapes of the modified segments and appendages which compose and surround the armature should have equal value.

Of course no single character should be employed to the exclusion of others, and, without extending one's observations to the many exotic genera which I have been unable hitherto to examine, it is impossible to say how far these characters will prove constant. Still, from what I have been able to examine, I have little doubt that they afford a good basis for classification, and that the extension of one's observations would show that a classification on these sexual characters would produce a far more natural arrangement than the one we have at present in use.

The great difficulty to be contended with is that of obtaining subjects for dissection, and I should be most thankful to any one who can give me old specimens of exotic aculeates, however broken, for that purpose, *i. e.*, so long as the apex of the abdomen remains.

I now propose to give a list of the families and genera which I have examined, with remarks on the special characters of each, as exhibited in their apical segments and armature. Of these latter Dufour, in his 'Recherches Anatomiques,' &c., has already described a good many, and his paper is a most important one to anyone working on this subject. I may remark that his "hypotome" is the 8th ventral segment; his "forceps," the pair of stipites; his "baguettes du fourreau," the sagittæ; his "volselle," the lacinia of the stipes; his "piece basilaire," the cardo; he only mentions the spatha as the central piece of the "fourreau de la verge." In the following descriptions I have adopted the nomenclature of C. J. Thomson, viz.:—*Cardo*, the basal portion, in which the two *stipites* or outer forceps move; *Spatha*, the corresponding basal portion of the *sagittæ* or inner forceps, which, however, are often united into a single piece; *Lacinia*, the apical production of the stipes existing in many genera.

HETEROGYNA.—In this section the 8th segment is very distinctly represented in both valves, and is generally visible both dorsally and ventrally; the dorsal valve bears two lateral pilose appendages, which seem to have been noticed but misunderstood by some entomologists. Forel, in his 'Fourmis de la Suisse,' p. 13, regards them as part of the genital armature, calling them "penicilli." E. André* also takes this view, calling them "pinceaux," and figures them protruding from under the 7th segment,† and remarks that they project from a square plate situated under the epipygium. In this latter statement he is quite correct, but he does not seem to have realised that this plate is the 8th dorsal segment, and in no way connected with the armature (see Pl. XIII., figs. 1, 1 a); in fact he says, at p. 13, that the abdomen of the ♂ is composed of seven segments. He also remarks that they are often wanting in *Myrmicocystus*. I cannot help fancying that their apparent absence must be due to the retraction of the 8th segment under the preceding. The most interesting feature in these little tail-like appendages is that they are not simple outgrowths from the segments, but are almost palpiform in their nature; being received into a

* 'Species des Formicides d'Europe,' p. 14. † Pl. I., fig. 12 a.

distinct fovea in the substance of the segment, they naturally remind one of the *Cerci* in the Orthoptera; but the latter occur on the 10th abdominal segment, whereas these (reckoning the propodeum) occur on the 9th. The "*Cerci*" of the *Tenthredinidæ*, however, occur on the 9th segment, and to these the penicilli above mentioned are, I think, clearly analogous. This character appears to run through the entire section.

Fossoræ: Mutillidæ.—Here, again, the "penicilli" occur, at any rate in *Mutilla* and *Myrmosa*; and as they occur also in *Myzine* I think it very probable that this last genus should be removed from the *Scoliidæ*, and placed here. The 8th ventral segment in both *Methoca* and *Myzine* is very plainly visible, and bears a peculiar upturned process, very different from the apical armature of *Scolia* (see Pl. XIII., figs. 2, 2 a, 3, 3 a, 3 b), &c. *Myzine* also lacks the reniform shape of the eye observable in the *Scoliidæ*.

Scoliidæ.—In this family (see Pl. XIII., figs. 4, 4 a, 4 b) I can find no trace of appendages to the 8th segment dorsally; in most species it is produced and somewhat rounded in the middle, but the ventral valve of the 8th segment is conspicuously exposed, and armed generally with three strong elongate prongs. The *Scoliidæ* bear a most striking resemblance in this armature, and also in the genital armature, which has the stipites flattened and dilated, to the *Bembecidæ* and *Nyssonidæ* (see Pl. XIII., figs. 12, 12 a, 14, 14 a); and I cannot but think that the position of these latter in the arrangement should be transferred from where it now stands to an earlier place in the section.

Tiphidæ.—No apparent penicilli; 8th segment beneath with an upturned process (see Pl. XIII., figs. 5, 5 a). To my mind a very distinct family from the preceding, the ♂ having the genital armature laterally compressed, and the cardo apparently produced above, and enclosing the sagittæ.

Sapygidæ.—No apparent penicilli; 8th ventral segment simple; exposed ventrally.

Pompilidæ.—Penicilli distinct; it should therefore, to my mind, follow the *Mutillidæ* in arrangement; 7th segment beneath very short, and visible only as a shining spot at the base of the 8th; 8th exposed (sometimes mistaken for the 7th), very variable in form,

and affording excellent specific characters; armature with the cardo generally very long (see Pl. XIII., figs. 6, 6 a, 6 b). In *Ceropales* the penicilli are very wide and foliaceous, not constricted at the base, and not palpi-form, in fact are mere lateral productions of the apical margin.

Astatidæ (*Astata*).—This genus, alone of the section with short prothoraces, so far as my examinations have gone, has distinct penicilli (see Pl. XIII., fig. 8). This, I think, is very interesting, as in habits it certainly comes near *Pompilus*, and in general character will not agree with any other group. Thomson has created a family for the genus; and I certainly think its peculiarities warrant its adoption. Eighth dorsal valve exposed, truncate at its extremity.

Sphigidæ.—No penicilli; eight ventral segments exposed, 8th generally flattened and wide; armature very variable; cardo short; stipites often armed with strong spine-like bristles (see Pl. XIII., fig. 11).

Larridæ.—Eighth segment narrow ventrally, often emarginate at the apex; stipites of the armature sub-depressed and rather wide, except in *Palarus* (see Pl. XIII., fig. 19), which would, I think, be well placed in a separate family, the 8th segment ventrally being rounded, and the stipites exceedingly long and narrow, and bent downwards, fringed with long apical hairs.

Pemphredonidæ.—Eighth dorsal valve simple, ventral valve armed with an exposed, recurved, or at least straight process; genital armature often with the stipites very thin, and overlapping at the apex.

Mimesidæ.—Almost identical with the preceding family.

Bembecidæ.—As above stated, very like the *Scoliidæ*. Eighth dorsal segment simple or bidentate, ventral segment with a single short spine, 7th segment much narrowed to the apex; armature with the stipites much flattened, and somewhat elongate towards the apex, which is rounded (see Pl. XIII., figs. 12, 12 a).

Nyssonidæ.—Very like the *Bembecidæ* in the shape of the armature; 8th dorsal segment simple, 8th ventral with a single apical spine or process; or in *Stizus* (see Pl. XIII., figs. 14, 14 a), *Stizomorphus* and *Bembecinus* with three prongs, as in *Scolia*.

Mellinidæ (*Mellinus*).—Eighth dorsal segment simple, 8th ventral with a short apical process; genital arma-

ture short; the apices of the stipites on their inner margins each with a wide membranous lateral production, the left-hand membrane folding over the right. In this form of armature this genus seems to stand alone.

Cerceridæ.—Eighth dorsal segment simple, 8th ventral bidentate; armature very variable, but with the stipites not flattened and dilated towards the apex (see Pl. XIII., fig. 7); 8th segment simple.

Crabronidæ.—In the genus *Crabro* the stipites are produced into a long membranous wing at the apex, and often may be seen projecting beyond the apex of the abdomen; and the cardo in many species is very long (see Pl. XIII., fig. 9). In *Entomognathus* and *Lindenius* the stipites are shorter; and in *Oxybelus*, although the cardo is long, the stipites are not wing-shaped, but simple and elongate. This last genus, however, I scarcely think belongs naturally to the *Crabronidæ*.

Trypoxylonidæ.—Terminal segments simple; armature with the cardo short; the stipites not wing-shaped.

The characters above noticed would draw together the *Heterogyna*, *Mutillidæ*, *Pompilidæ*, and *Astatidæ*, on account of the appendages of the 8th dorsal segment; the *Scoliidæ*, *Tiphidæ*, *Bembecidæ*, and *Nyssonidæ*, on account of the form of the armature, and the processes of the 8th ventral segment; the *Pemphredonidæ* and *Mimesidæ* would come close to the *Nyssonidæ*, on account of the apical process of the 8th ventral segment; the *Crabronidæ*, on account of their dilated wing-like stipites, also show a distinct relation to these families. The *Sphigidæ* and *Larridæ* seem to come together naturally, both as regards habits and structure. Still I wish to avoid offering any new arrangement until I have had the opportunity of examining more of the exotic genera.

DIPLOPTERA.—In this section the 8th segment is simple, and the armature is very similar in nearly all the genera, being very convex and highly polished; the stipites each bearing a long spine, which may be often seen in life projecting beyond the apex of the abdomen (see Pl. XIII., fig. 20). In *Vespa*, however, this spine is obsolete, or nearly so; the sagittæ are generally united. This section, to my mind, bears strong proof of the

value of the characters derived from the armature, as no one can doubt that it is one of the best and most natural groups that we have among the Hymenoptera, and throughout it the armature has a distinct character of its own quite unlike that of any other section.

ANTHOPHILA.—In this section more attention has been paid to the genital armature than in the others of the Aculeata, for, besides Dufour's excellent remarks, Schenck, Thomson, and others have used it with good results, as exhibiting characters for discriminating the species of *Bombus*. Morawitz has figured, in the 'Reise Turkestan von A. Fedtschenko,' the armature of several species of *Anthophora*, and v. Hagens, in the 'Berliner Ent. Zeits.' for 1874, has noticed and described the armature in many of the genera, besides using it as a character for the species of the genus *Sphcodes*. He speaks of the "zangen" or stipites as being "eingliedrig" or "zweigliedrig," his 2nd joint being the lacinia of Thomson.

I have adopted Thomson's nomenclature for the parts of the armature, as it seems to express very well what is wanted. The lacinia is merely a prolongation or branch of the stipes, and is often absent, and in some species it is difficult to know whether one should designate it by a distinct name or merely treat it as a process; still in many genera, such as *Bombus*, *Psithyrus*, &c., it is such a distinct feature that for descriptive purposes a special name is useful. V. Hagens, in his remarks (*loc. cit.*), mentions the "bauchsegmentverlängerung," and describes it; but it should be remembered that in *Andrena*, &c., this represents the 8th segment, whereas in *Anthophora* it represents the 7th. In *Halictoides* and *Dufourea* he mentions that the "bauchsegmentverlängerung" is prolonged into three points. Here he has evidently been examining the 7th and 8th together, as the 7th bears two lateral processes and the 8th one apical; but, clinging tightly together as these two plates do, it is in no way to be wondered at that v. Hagens should have been misled.

The lacinia is present in nearly all the genera with the exception of *Andrena* and of those in the subdivision *Dasygastræ*, and, curiously enough, in the parasites or "cuckoos" of these latter; but this does not apply to the parasites of *Andrena*, viz., the species of *Nomada*, which have a distinct lacinia. Still it is worthy of note that there is often an extraordinary general similarity in

the apical segments and armatures of the parasites, and of the bees with whom they live: *Megachile* and *Cœlioxya*, *Chalicodoma* and *Dioxys*, *Anthophora* and *Melecta*, are rather striking cases of this similarity. Throughout the *Anthophila*, so far as I have been able to examine them, the hairs of the armature are branched or plumose, and the 8th dorsal segment is simple, fitting into the 7th, and of a horny submembranous texture.

Prosopis and *Colletes*.—In the *Obtusilingues* the 7th and 8th ventral segments have most interesting modifications. I have figured those of *Prosopis* in our 'Transactions' for 1882, Pl. VI., and those of *Colletes* are no less peculiar; the 7th is dilated at the apex into one or two wing-like appendages, very variable in form, according to the species; the 8th has a central apical process, hairy beneath at its apex; the armature in each genus is of a form peculiar to itself (*vide* volume of our 'Transactions' quoted above, Pl. VII.).

Sphecodes and *Halictus*.—In these two genera the 7th and 8th ventral segments are nearly simple; they lie hidden by the 6th at the base of the armature as two corneous plates, generally slightly produced and rounded in the centre; the armature has the stipites short and somewhat curved, with a distinct lacinia to each, the sagittæ bent downwards at the apex; in both genera the form of armature affords excellent specific characters (*vide* Trans. Ent. Soc. Lond., 1882, Pl. VIII., IX.).

Nomia.—In this most extraordinary genus the ventral segments of the abdomen are flattened and somewhat concave; the 8th is pale and corneous, truncate in the centre; the 7th is emarginate, with the sides of the emargination rounded and fringed with golden hairs; genital armature with a semicircular membranous apex to each stipes; the sagittæ raised and subtriangular (see Pl. XIII., fig. 18).

Nomioides.—In this little halictiform genus seven ventral segments are visible, and the 8th lies close under the armature, and is produced at the apex into an elongate process; the armature has the stipites elongate, narrow and somewhat curved, the sagittæ narrow and nearly straight.

Andrena.—In this genus the 7th ventral segment is

hidden beneath the 6th, and the 8th appears at the apex, being generally somewhat dilated apically and rounded or subtruncate; the 7th is sometimes emarginate in the centre of the apical margin. The armature is very little liable to variation in the genus, and except in a few species shows no important modifications. It has the stipites bent and arched over the sagittæ, and each flattened and more or less pilose at the apex (see Trans. Ent. Soc. Lond., 1882, Pl. X). *Andrena carinata*, Mor., is a notable exception.

Macropis.—This genus is most peculiar in its terminal segments (see Trans. Ent. Soc. Lond., 1882, Pl. X.), the 7th segment being subquadrate and fringed at the sides with a series of flattened spines; the 8th is produced at the apex into a subrotundate process, terminating in a sharp point; the genital armature has the stipites each terminating in two deflected furcate prolongations, very unlike that of the surrounding genera.

Dasyпода and *Cilissa*.—In both these genera the 8th ventral segment is exposed beneath as in *Andrena*, and dilated at the apex; the 7th is hidden and generally emarginate at the apex, with a lateral projection on each side (see Trans. Ent. Soc. Lond., 1882, Pl. XI).

Panurgus.—All eight ventral segments exposed in some species, the 6th being emarginate so as to show the 7th, the 8th projecting and dilated at the apex, as in *Andrena* and its allies; armature with the cardo very elongate (see Pl. V., figs. 1, 2).

Panurginus.—All eight ventral segments exposed; 7th slightly elevated, narrowed and bidentate at the apex; 8th with an elongated central process fitting into the emargination of the 7th segment, its apex slightly swollen and rounded; armature very like that of *Panurgus*, with the cardo very elongate.

Dufourea.—7th segment hidden, bilobate; 8th with a long straight central process, visible beyond the 6th; armature with the stipites pointed, the sagittæ distant at the base (see Pl. V., figs. 4—4 b).

Systropha.—7th ventral segment consisting of a basal band, from which emerge two elongate processes somewhat curved, thickest in the middle and pointed at the apex, with an elevated ridge on each on the side nearest the armature (see Pl. XIII., fig. 13 a); 8th with an elongate apical process, bent upwards, and hairy beneath

towards the extremity, which is rounded and dilated (see fig. 13); armature short and stout, stipites with the apices rounded, and a distinct blunt spine (lacinia), projecting from beneath, beyond them (fig. 13).

Halictoides.—7th ventral almost exactly as in *Systropha*; 8th with the central process very long and bent upwards, dilated and thickened at the apex; armature with the stipites densely pubescent externally.

Rhophitoides.—In the form of the 8th segment and genitalia almost identical with the preceding, but, having broken the 7th in the only specimen I have been able to dissect, I cannot record its form.

Rhophites.—7th ventral segment with two elongate flat testaceous lateral processes, slightly widened at the apex; at the base of each externally is a shorter, small, curved process; 8th with a very long central process, as in the foregoing genera, densely hairy at the apex; armature, with the stipites, with a flattened lacinia; sagittæ widely separated at the base, and converging to the apex (see Pl. V., figs. 3—3 d).

Biareolina.—7th ventral segment simple; 8th with an elongate central process, truncate at the apex, densely clothed with hairs at the sides and beneath; armature with the stipites produced at the apex into a semi-circularly dilated lacinia.

Nomada.—The terminal ventral segments of this genus are most characteristic; the 7th is simple, and with the 8th is hidden; the 8th is generally produced in the centre into a long process, which is more or less incurved at the apex and armed with reflexed spines, varying greatly in number and form according to the species (see Pl. VI., VII). In some few species the segment is subtriangular, but still is armed with spines at the apex. The armature is rather quadrate in form, and the stipites largely and deeply emarginate inwardly, densely clothed on their lacinia with long plumose hairs; the sagittæ are narrow and covered with the membranous spatha nearly to the apex. Excellent specific distinctions can be obtained from these characters.

Epeolus.—7th segment truncate at the apex; 8th with a short central process, not spinose; armature with the stipites wide, and with wide lacinia not tufted with hairs; sagittæ very wide, united and produced in the centre into a narrow truncate process (see Pl. VII., figs. 9, 10).

Biastes.—7th and 8th segments hidden, 7th slightly

produced at the apex, 8th produced into an elongate process; armature with the stipites stout; laciniaë long and very narrow; sagittæ produced beyond the apex of the laciniaë; spatha long, extending to about the apex of the laciniaë.

Of the several other curious genera that are placed here I have been unable to procure specimens for dissection.

Melecta.—7th segment consisting of two elongate convergent rather narrow plates, which are united near the apex by only a thin membrane, so that in dissecting they often become separated; 8th subtriangular, pointed at the apex; armature large and massive; laciniaë produced into a narrow pilose process (see Pl. VIII., figs. 1, 2).

Crocisa.—Almost as *Melecta*, but the laciniaë of the armature are broader and set with strong bristly hairs.

Cælioxys.—The terminal segments and armature in this genus resemble very closely those of *Megachile* and the other *Dasygastræ*, the 6th dorsal segment terminates the abdomen, and the anal opening is inferior, the 7th dorsal being only visible beneath; only five ventral segments are exposed; the 7th is a mere membranous band, slightly thickened at each side, and almost certain to get broken in dissecting; the 8th is short and tongue-like, lying close under the armature; the armature itself has the stipites without laciniaë, and their apices hairy, the sagittæ covered with a membrane to their apex (see Pl. VIII., figs. 3—7).

Dioxys.—Similar to *Cælioxys* in the 7th and 8th segments, but armature clear testaceous-brown, highly polished and glabrous; stipites simple and narrow, slightly curved; sagittæ widely separated, flat, and paler than the stipites, hamate externally at the apex; between the sagittæ is stretched a membrane, which is clear at the sides and thicker in the centre (see Pl. XIII., fig. 16).

Chalicodoma.—Only four ventral segments clearly exposed; 5th with a squarish central scale-like spot at the apex; 6th narrow and submembranous, bearing a dense tract of hairs across its middle, each terminating in several finer hairs in *C. pyrenaica*. In *muraria* this segment has most remarkable characters;

at the sides may be remarked the usual recurrent angles, which are strong and horny; the segment is concave, membranous posteriorly, and only thickened anteriorly in a ridge running between the lateral supports, if they may be so termed; in the centre of this thicker portion, on its anterior margin, are two long recurved spines dilated at the apex; at each side, but at some distance from these central spines, are a number of finer spines with sharply truncate dilated heads; from these a thickened line runs diagonally on to the disk of the segment, bearing a number of simple spine-like hairs, which appear to be much thickened at the base; beyond the anterior spines is a subtriangular apical membranous production (see Pl. XIII., fig. 21 a). In *C. sicula* the 6th segment has a strong semicircular ridge dividing the more membranous parts across the disk; in front of this at each side is a thick fascicle of somewhat twisted, flat, ribbon-like hairs, so densely matted together that it is difficult to see one separately; beneath these, on the ridge running from them on to the concave anterior portion of the segment, are a number of fine simple hairs, on thickened bases; 7th segment narrow and membranous; 8th tongue-shaped, with a basal angle at each side; armature clear testaceous-brown, glabrous, highly polished; stipites long and narrow, nearly straight, widened at the apex into a broad internal hama; sagittæ straight, widely apart at the base, converging to the apex, with a membrane covering the space between them (see Pl. XIII., fig. 21).

Megachile.—Very like *Chalicodoma* in character; the 6th segment membranous, and bearing hairs or spines of different forms across its centre, its apex sometimes terminating in a wing-like process; armature with the stipites more or less straight, generally divergent at the apices, which are nearly simple; no distinct lacinia, but the apex of each stipes in *maritima* is bifurcate; stipites very large at the base, and enclosed by a ring-like cardo; sagittæ simple, united by a membrane (see Pl. IX., figs. 1—7).

Diphysis serratulæ.—The armature of this insect is quite unlike that of *Osmia*, in or near which genus it has been usually placed: it has almost exactly the same form as that of some of the species of *Anthidium*, next to which genus I should propose to place it; the white clypeus of the ♂ also favours this view, which is held

also by Professor Perez, 'Contr. à la Faune des Apiaries de France,' p. 89.

Anthidium.—Apical segments very variable in form; 8th sometimes with a narrow apical process, sometimes tongue-like, as in *Megachile*; 7th sometimes rounded at the apex, with long recurrent basal angles, sometimes merely a transverse band with short recurrent angles. In *strigatum*, Pz. = *contractum*, Latr., the 6th segment is produced into a strong central spine, and in *flavilabre*, &c., has lateral comb-like processes (see Pl. XIII., fig. 15 a); armature with the stipites short and curved inwards at the apex in some species; in *laterale*, on the other hand, they are slightly divergent, and approach more to *Megachile* in form; in *strigatum* they are foliaceous; and in *flavilabre* widely triangular. These segments evidently exhibit strong specific characters in this genus, and would probably serve well to divide it into subgenera (see Pl. X., figs. 3—3 a; Pl. XIII., figs. 15—15 a).

Stelis.—7th and 8th ventral segments simple, the 8th being very slightly produced and rounded in the centre; armature with the stipites each suddenly thickened at the apex into an angular, four-sided, truncate club, bent inwards towards each other; sagittæ simple, slightly convergent (see Pl. X., fig. 2).

Chelostoma florissomne.—7th ventral segment bilobed; 8th triangularly elongate; armature with the stipites long and straight, enlarged at the apex of each into a pointed club, hairy on its sides; sagittæ straight, convergent at the apex, with a central membrane extending to their apex; 5th segment fringed with curved spirally twisted or knotted hairs (see Pl. X., figs. 4—4 a).

C. campanularum.—This species, in the terminal segments, shows very distinct characters; the 7th segment has a slight pilose production on each side, united by a thin membrane; the 8th is short and subtruncate; the armature has the stipites very narrow and curved, not thickened at the apex; the sagittæ wide at the base (see Pl. X., figs. 5—5 b).

Heriades.—Very like *C. campanularum* in the form of the armature, but the 8th ventral segment is narrow and pointed; the 7th I have not been able to extract satisfactorily; 5th segment with a row of six or seven teeth on each side set on a square projection (see Pl. X., figs. 1, 1 a).

Lithurgus.—The 7th ventral segment in this peculiar genus is simply rounded at the apex; the 8th is widely truncate; the armature is extraordinarily small for the size of the insect; the stipites are large and swollen at the base, and produced at the apex of each into a long straight process; sagittæ wide at the base, then narrowed to the apex, each with an apical dilatation (see Pl. XIII., fig. 17).

Osmia.—Very variable as regards the number of ventral segments exposed, and probably divisible into many good subgenera; 6th segment simply hairy; 7th membranous or nearly so; 8th tongue-like, sometimes narrowly emarginate at the apex; armature with the stipites without lacinia, generally very straight and elongate, curved or angularly bent inwards at the apex, the apical portion more or less clothed with hairs, and occasionally slightly dilated at the angle; sagittæ straight or converging beyond the middle, sometimes united by a membrane at the base (see Pl. VIII., figs. 8—16).

Anthocopa.—Same as *Osmia*, but 7th segment distinct.

Meliturga.—7th ventral segment with two apical bidentate processes, united by only a very thin connection, recurrent plates wide and straight; 8th terminating in a narrow process, widened into a spoon-like dilatation at the apex; armature with the stipites wide at the base; lacinia long, narrow, and pointed; obliquely truncate, viewed sideways; sagittæ short, blade-like, divergent at the apex (see Pl. XIII., fig. 10).

Eucera and *Tetralonia*.—In these two genera the style of the apical segments and armature is almost similar; the 7th ventral segment is emarginate in the centre, and is produced and raised at each anterior angle into two or three tubercular processes; the 8th is rather wide, and more or less truncate at the apex; armature stout, with the stipites terminating in a long narrow lacinia, often dilated at the apex; sagittæ widely triangular beyond the middle, and externally hamate (see Pl. X., figs. 6—6 b).

Habropoda, *Anthophora*, and *Saropoda*.—7th ventral segment with a more or less square apical plate, or produced at the apex into a variously-shaped process, rarely simply truncate; 8th short and usually five-sided; the apical margin often with two slight projections bearing

a few apical hairs. In *Habropoda ezonata* the apex of the 7th has a distinct thickened transverse ridge, beyond which is a thinner, somewhat quadrate, appendage fringed with hairs; in *H. zonatula*, beyond the middle of the 7th, are two strong lateral spines, and the apex beyond is attenuated and finely truncate; armature in all three genera stout and squarish in form; stipites with very variable laciniaë; sagittæ thick, widely separated in the middle and converging at the apex, often dentate on their inner margins (see Pl. X., figs. 7, 8; Pl. XI., figs. 1—3).

Xylocopa.—7th ventral segment a simple narrow band; 8th of a somewhat quadrate form; armature in *X. violacea* nearly square; the stipites without distinct laciniaë, curved inwards at the apex; sagittæ subparallel, their apices dilated and flattened, bent downwards, and convergent.

Ceratina.—I have had great difficulty in finding the 7th and 8th segments in this genus, but I have a specimen of *chalcites* which shows a distinct submembranous band, uniting the two sides of the 7th dorsal, and crossing the armature beneath, which I take to be the 7th; the 8th is a very fine thin membranous plate, lying beneath the armature, and emarginate at the apex; the armature is short and stout; the stipites with somewhat narrow laciniaë, pilose at the sides and apex; sagittæ widely separated at the base, and converging to the apex (see Pl. XI., fig. 5).

Psithyrus and *Bombus*.—There is very little difference between these two genera in their armature, &c.; the 7th ventral segment is corneous and bears a few hairs at the apex; the 8th similar in texture to the 7th, but narrower and somewhat pointed; armature with distinct and very variously-formed laciniaë to the stipites, which are stout; the sagittæ are elongate and vary much in form, so that the armature affords excellent specific characters in both genera (see Pl. XI. and XII.).

APIS.—Quite unlike any other genus in the armature, which has the stipites wide and triangular (see Pl. XII., fig. 15), and the sagittæ hidden and separated from them, only to be discovered by dissection (see Pl. XII., figs. 15 a, 15 b); and the whole armature is of much the same consistency as the other segments of the body, instead of being hard and shining as in the allied genera.

EXPLANATION OF PLATE XIII.

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- FIG. 1. *Formica rufa*, ♂ armature.
 1 a. " " 8th dorsal segment, showing penicilli.
 2. *Mutilla europæa*, ♂ armature.
 2 a. " " 8th dorsal segment, showing penicilli.
 3. *Myzine 6-fasciata*, ♂ armature.
 3 a. " " 8th dorsal segment, showing penicilli.
 3 b. " " 8th ventral segment.
 4. *Scolia bicincta*, ♂ armature.
 4 a. " " 8th dorsal segment.
 4 b. " " 8th ventral segment.
 5. *Tiphia morio*, ♂ armature.
 5 a. " " 8th ventral segment.
 6. *Pompilus viaticus*, ♂ armature.
 6 a. " " 7th and 8th ventral segments.
 6 b. " " 8th dorsal segment, showing penicilli.
 7. *Philanthus coronatus*, ♂ armature.
 8. *Astata boops*, 8th dorsal segment, showing penicilli.
 9. *Crabro cribrarius*, ♂ armature.
 10. *Melliturga clavicornis*, ♂ armature.
 11. *Psammophila viatica*, "
 12. *Bembex rostrata*, "
 12 a. " " 8th ventral segment.
 13. *Systropha curvicornis*, ♂ armature.
 13 a. " " 7th ventral segment.
 13 b. " " 8th "
 14. *Stizus ruficornis*, ♂ armature.
 14 a. " " 8th ventral segment.
 15. *Anthidium flavilabre*, ♂ armature.
 15 a. " " 5th ventral segment.
 16. *Dioxys cincta*, ♂ armature.
 17. *Lithurgus cornutus*, ♂ armature.
 18. *Nomia difformis*, "
 19. *Palarus* sp., "
 20. *Odynerus parietum*, "
 21. *Chalicodoma muraria*, "
 21 a. " " 6th ventral segment.



XIV. *Notes on the Diptera of New Zealand, supplementary to Prof. Hutton's last Catalogue of 1881.* By W. F. KIRBY, Assistant in the Zoological Department of the British Museum.

[Read October 3rd, 1883.]

IN the present paper I have not attempted to do much more than supplement Prof. Hutton's work with additional references, which he had overlooked; and to clear up those species named, but not described, by Adam White, which, though quoted by Walker as about to appear in the 'Voyage of the Erebus and Terror,' were never published in that work. The specimens of *Limnobia* are, however, so much damaged that I have not ventured to attempt to throw any further light upon them.

The total number of species enumerated by Professor Hutton is 119 (White's MS. species not being taken into account). Four species, including three of White's, are described in the present paper, and several others, passed over by Prof. Hutton, are noticed; but, on the other hand, various names have been sunk as synonyms, so that the total number of species admitted now stands at 123.

(The MS. of this paper was submitted to Baron Osten-Sacken, of Heidelberg, before publication; and he has favoured us with critical remarks on various points, which I have much pleasure in incorporating, with due acknowledgment.)

MYCETOPHILIDÆ.

Rhyphus neozelandicus, Schin.

? *Rhyphus phaleratus*, White MS.

The types of *R. phaleratus* agree fairly with Schiner's description, but in a series of specimens the legs are almost wholly yellow, with the tips of the tarsi blackish.

[I have a series of specimens. The *brown coxæ* are characteristic. At the same time a complete agreement is not to be expected, as the colouring of the body is variable.—O.-S.]

TIPULIDÆ.

Cloniophora Wakefieldii, Westw.

Gymnoplastia Wakefieldii, Westw., Trans. Ent. Soc. Lond., 1881, p. 372, Pl. XVIII., fig. 5.

Tipula senex, White & Butl.

Tipula senex, White & Butl., Voy. Erebus and Terror, Ins., p. 27, pl. vii., fig. 15 (1875).

Tipula Novaræ, Schin.

[Baron Osten-Sacken regards this identification as probable, but notes that Schiner's statement that the second spot is placed "close to the discoidal cell" is apparently an error for "close to the first discoidal cell." He likewise remarks on some apparent discrepancies in Schiner's description, such as his not mentioning the brownish longitudinal stripe on the abdomen; his calling the white lateral spots triangular, &c. I may add that we have nine specimens in the Museum, and that it appears to be a variable species, some of the specimens, which I cannot regard as specifically distinct, agreeing very fairly with Schiner's description.]

Tipula Dux.

Tipula Dux, White MS.

Long. corp. 6 lin.; exp. al. 17 lin.

Orange; head orange; basal joint of antennæ (the rest broken off), palpi, and most of the upper surface of the muzzle (which is moderately broad, obtuse, and set with short stiff bristles), blackish; base of palpi brown, a long black streak running forwards to a double point from the middle of the vertex. Thorax orange; front of prothorax and first pleural suture black; a wide black stripe on the back of the mesothorax, ceasing before the lateral suture, and with a brown extension on each side in front; and two wide black stripes on each side, starting at about one-fourth of the length of the mesothorax, and curving towards each other, but not meeting, in front of the scutellum, which is wholly orange. Abdomen

orange, with a broad black stripe on the back widened at the extremity of each segment, a black stripe on each side, and a central one (paler towards the base of the abdomen) beneath; legs black; front femora yellowish beneath. Wings hyaline, naked, iridescent, with short longitudinal folds along the outer half of the upper edge of the front basal cell, along the lower edge of the hind basal cell, and along the lower edge of the axillary cell; nervures brown; costal cells and stigma yellowish brown; the subcostal cell, as far as the stigma and the cubital cell, clear; a triangular dusky spot extending to the transverse nervure; halteres yellow, with the clubs black.

Tipula Clara.

Tipula Clara, White MS.

Head and thorax orange-yellow; antennæ, except the long basal joint, palpi, tip of muzzle, and a spot between the eyes, dusky; palpi set with short bristles. Abdomen black, with a stripe on each side, the incisions and anus yellow; coxæ yellow; legs brown; under surface shading into yellowish. Wings nearly as in *T. Dux*, but without longitudinal folds; the apex is clouded, and the triangular spot on the transverse nervure is smaller and more sharply defined; halteres yellow, with black tips.

Tipula obscuripennis.

Tipula obscuripennis, White MS.

Exp. al. 1 in.; long. corp. 6 lin.

Reddish brown above, with a greyish bloom beneath. Head reddish brown, with a white ring round the black eyes. Thorax greyish, with two contiguous reddish brown stripes occupying the middle above; they are divided by a narrow pale line, and are slightly narrower behind than before; on each side is a darker oval spot, which is continued on the metathorax. This and the scutellum are pale and shining, the latter edged with dusky behind. Abdomen reddish brown above, with an obsolete dark spot in the middle of each segment; 2nd segment almost entirely dusky. Legs tawny, with the knees and tarsi blackish. Wings hyaline, with the costal cell and the rather large oblong stigma pale yellow; halteres blackish, a transparent space in the costal cell, and the lower part of the hinder cell with small perpendicular folds.

Tipula viridis, Walk.

Tipula viridis, Walk., Ins. Saund., Dipt., p. 445 (1856).
 ? *Tipula holochlora*, Now.

I am indebted to Baron Osten-Sacken for this suggestion. Judging from the diagnosis (which is all that Hutton quotes, though Nowicki's description is lengthy) I had at first regarded *T. holochlora* as probably identical with *T. obscuripennis*.

Limnobia vicarians, Schin.

Limnobia chorica, White MS.

Limnobia fumipennis, White & Butl.

Limnobia fumipennis, White & Butl., Cist. Ent., i., p. 355 (1875).

Tanyderus forcipatus, Ost.-Sack.

Tanyderus forcipatus, Ost.-Sack., Verh. zool.-bot. Ges. Wien. xxix., p. 520, figs. (1879).

Dilophus nigrostigma.

Bibio nigrostigma, Walk., List Dipt. B. M., i., p. 121 (1848).

I am indebted to Baron Osten-Sacken for suggesting that this species is a *Dilophus*, as, on examination, I have found to be the case. But I cannot agree with his proposed identification of *D. nigrostigma* with *D. spectabilis*, Now., as the former species has a shining black pronotum in the male, and a uniformly red pronotum in the female.

Dilophus Zealandicus, Walk.

Bibio Zealandicus, Walk., Trans. Ent. Soc. Lond., (2), iv., p. 235 (1858).

Dilophus spectabilis, Now.

This identification is certain, but Baron Osten-Sacken was led to question it, because Walker's description is incomplete, the thorax being varied with black and dull red.

SIMULIIDÆ.

Simulium Australense, Schin.

Simulium Australensis, Schin., Reise Nov., Dipt., p. 15
(1868).

S. cæcutiens, White MS.

TABANIDÆ.

Pangonia Lerda, Walk.

Pangonia Lerda, White & Butl., Cist. Ent., i., p. 354
(1875).

P. larda, Hutt.

Pangonia Adrel, Walk.

Pangonia Adrel, White & Butl., Cist. Ent., i., p. 356
(1875).

Tabanus Sarpa, Walk.

Tabanus Sarpa (White MS.) Walk., Zool., viii., Suppl.,
p. lxx. (1850).

Tabanus truncatus, Walk.

Tabanus truncatus, Walk., Zool., viii., Suppl., p. lxxii.
(1850).

Tabanus oplus, Walk.

Tabanus oplus (White MS.), Walk., Zool., viii., Suppl.,
p. lxx. (1850); Butl., Cist. Ent., i., p. 356 (1875).

Tabanus impar.

Tabanus impar, Walk., Zool., viii., Suppl., p. lxxi.
(1850).

ACROCERIDÆ.

Apsona muscaria, Westw.

Apsona muscaria, Westw., Trans. Ent. Soc. Lond.,
1876, p. 510, pl. v., fig. 2.

ASILIDÆ.

Promachus floccosus, n. s.

Exp. al. 17 lin. ; long. corp. 10½ lin.

Black, with* dense tawny hair on the face, checks, and sides of the prothorax, more thinly clothed with hair of the same colour at

the base of the abdomen above, and on the whole body beneath, including the under surface of the femora and tibiæ; at the base of the four anterior femora beneath the hair is more dense, and shades into whitish; halteres and pulvilli orange-tawny, 2nd and 3rd segments of the abdomen with snow-white, diverging tufts on each side. Wings smoky hyaline; costa yellowish.

Opabo, New Zealand.

Described from a single male specimen received from Mr. H. W. Marsden, of Gloucester. Allied to *T. strenua*, Walk., from Celebes; but in that species the hairs on the under surface of the abdomen are decidedly whitish instead of tawny.

THEREVIDÆ

Thereva (?) *bilineata*, Fabr.

Bibio bilineata, Fabr., Syst. Ent., p. 757, n. 3 (1775).

The type, in very poor condition, exactly resembles *Apiocera mærens*, Westw., in shape, but the neuration is quite different.

Thereva innotata.

Thereva innotata, Walk., Ins. Saund., Dipt., p. 455 (1856).

STRATIOMYIDÆ.

Odontomyia dorsalis, Walk.

Odontomyia dorsalis, White & Butl., Voy. Erebus and Terror, Ins., pl. vii., fig. 16 (1868).

Odontomyia atrovirens, Bigot.

Odontomyia atrovirens, Bigot, Ann. Soc. Ent. France, (5), ix., p. 520 (1879).

SYRPHIDÆ.

Syrphus novæ-zelandiæ, Macq.

Baron Osten-Sacken thinks it probable that *S. ortas*, Walk., and *S. rectus*, Now., are synonymous with this species.

MUSCIDÆ.

Tachina lupina, Swed.

Musca lupina, Swed., Nya Handl., viii., p. 289 (1787).

Tachina zelica, Walk.

Nemoræa nyctemeriana, Huds.

Nemoræa nyctemerianus (sic), Hudson, Tr. N. Z. Inst.,
xv. p. 218 (1883).

Appears to be closely allied to, if not identical with,
N. orasus, Walk.

Musca vicaria, Walk.

Musca vicaria, Walk., Ins. Saund., Dipt., p. 348
(1850).

Calliphora quadrimaculata, Swed.

Musca violacea, Walk., Ins. Saund., Dipt., p. 335.

Calliphora hortona, Walk.

Musca hortona, Walk. (1849).

Calliphora auronotata, Macq. (1855).

This species is easily distinguished from the last,
being only half the size.



XV. *On the classification of the Australian Pyralidina.*
By E. MEYRICK, B.A.

[Read April 2nd, 1884.]

THE present instalment includes the *Musotimidæ*, *Botydidæ*, and *Scopariadæ*, with some additional species of the two families previously treated. There remain the *Hydrocampidæ* and *Pterophoridæ*, which will form the subject of a third paper; and the *Crambidæ*, *Phycididæ*, and *Galleriadæ*, which have been already described elsewhere. I think that this family subdivision will allow of the development of the group being properly understood. Its essential principle is, as I have explained before, that one family is not bound to be absolutely separated from another simply by the presence or absence of a single character, but by a majority of several distinguishing points; which is the most that can be expected from a system really arranged on natural lines.

It seems to me useless to attempt to judge of the value of characters for classification, without strict reference to the principles of evolution. I think it might be laid down as an axiom, that when an organ has wholly disappeared in a genus other genera which originate as offshoots from this genus cannot regain the organ, although they might develop a substitute for it. Thus in the *Geometrina* we have a number of genera in which the larvæ have wholly lost three pairs of abdominal legs, the character being proved to be very persistent; it must be held that no genera derived from any of these could recover the lost pairs of legs, and therefore the Geometrid genera with 12-legged larvæ must be ancestral types, and not derivative; and for the same reason the *Geometrina* must be regarded as a terminal development, a group which ends in itself and has given rise to no other groups. The character of the absence of ocelli may be applied in the same way. So, in the present group, the *Botydidæ* are specially characterised by the absence of the uncus in the male

genitalia ; so far, that is, as I have been able to examine. It is therefore certainly probable—since the other families all, as a rule, have the uncus developed—that the *Botydidæ* are also a terminal development. But we need not be surprised if we find in the other families of the group genera where the uncus is also obsolete ; because the obsolescence of a character normally present may occur at any time. It is for this reason that single characters are not usually reliable for family separation. Similarly, in neuration, when a vein disappears (which in the higher groups—that is, all except the *Tineina*—never occurs except by coincidence with another vein) it can never reappear in the descendants of the genus ; the two coincident veins cannot be separated (although veins which are only partially coincident—*i. e.*, stalked—may be). The *Musotimidæ* are therefore also a terminal group. I do not, however, propose to explain my views of the process of development of the *Pyralidina* until I have finished the remaining families, when they can be stated more completely ; I have only indicated as much as is necessary to explain the family limits adopted. I think the principles expressed above may be briefly defined by saying that for systematic purposes negative characters are of more importance than positive.

As mentioned above, I have examined and employed the structure of the genitalia in the male as giving characters of family value in this group. In the absence of information from other sources I do not feel very secure of my results ; and I have not attempted here to investigate specific differences, assuming that such exist. Adopting the terminology of Mr. P. H. Gosse in his memoir on the *Papilionidæ*, I recognise the uncus existing in a very similar form ; the scaphium I have found occasionally distinct, but usually it appears to be absent ; the harpes do not appear to be represented at all. The clasping organs appear to consist of a pair of strong horny valves, which may be either retractile and usually withdrawn within the abdomen, or apparently permanently exerted, only concealed by the anal tuft ; and sometimes also of a pair of elongate clasps, which appear to be prolongations of the integument of the abdomen, and are more feeble than the valves ; these clasps are not usually well-developed and often entirely absent, but when present the valves are apparently modified and

reduced; I have not been able always to satisfy myself of this structure, in the absence of fresh specimens, through my inexperience of these organs.

I have thought it necessary in these families to give the characters of all the genera in full, as I have attempted a more minute classification than that of Lederer: I conceive that it is absolutely necessary, for the understanding of the group, to subdivide the genus *Botys* as adopted by him, and, although I make no claim of finality, I think the differences in the structure of the legs and maxillary palpi which I have utilised will be found to indicate natural groups, and such as are capable of scientific definition.

The geographical distribution of many species of *Botydidæ* is amazingly wide; very many of the Australian species range through the Malay Archipelago, Southern Asia, and Africa down to the Cape of Good Hope. The cause of this wide distribution, which is not found in other groups, is at present not intelligible to me, and more accurate and general information must be awaited. I will only indicate here the very limited nature of the indigenous Australian Botydid fauna, consisting principally of genera allied to *Eurycreon*, Ld., which thus appears to be an older type than the true *Botys*. All the more highly developed genera, especially the group with long antennæ, are only represented by species of Malayan or wider range. The New Zealand indigenous fauna of *Botydidæ* is extremely small, some half-dozen species, apparently of South American affinity; and it possesses also a few species of wide range, which have made their way thither from Australia or the Pacific Islands. On the other hand, the New Zealand *Scopariadæ* are greatly developed, and the genus *Scoparia* is the largest lepidopterous genus in New Zealand, where I have no doubt that there are over 100 endemic species; it is also well represented, but much less conspicuous in Australia. That these facts are of geographical rather than of climatic importance I have no doubt.

The identifications of Walker's and Butler's species have been made from the types; in the case of other authors, when the identification has been verified by other means in addition to their works, I have mentioned it.

EPIPASCHIADÆ.

I have only examined the genitalia of *Catamola*, which seem not to differ from the normal type of the *Pyralididæ*. I have seen species of this family from China and Japan.

CATAMOLA, *Meyr.*

Valves of male exerted, densely scaled; uncus well developed. In the following additional species the antennal process is erect instead of recurved, but all other characters agree.

Catamola classota, n. s.

♂, 14 mm. Head, palpi, and thorax pale greyish ochreous, coarsely mixed with dark fuscous, Antennæ grey, basal process moderate, erect. Abdomen pale ochreous. Legs dark fuscous, posterior tibiæ whitish above, apex of all tarsal joints white. Fore wings moderate, triangular, costa slightly arched, apex rounded, hind margin rather obliquely rounded; pale greyish ochreous, mixed with grey, and irrorated with blackish; a tolerably straight thick black line from one-third of costa to two-fifths of inner margin, irregularly interrupted in disc; a similar line from slightly beyond middle of costa to two-thirds of inner margin, forming a right angle in middle, its inner edge emitting an ill-defined linear tooth inwards at one-third from inner margin; a small black discal spot; a row of ill-defined subquadrate black spots on hind margin; cilia ochreous-whitish with two grey lines, basal third spotted with grey. Hind wings grey, hind margin rather darker; cilia grey-whitish, with two indistinct grey lines.

Distinguished from all the rest of the genus by its small size, the exact position of the antennal process, and the different costal origin of the second line. Nearest to *C. thyridalis*.

Quorn, South Australia, in October; one specimen.

PYRALIDIDÆ.

To the definition of this family should be added: vein 10 of fore wings separate from 9. Valves of male exerted, clothed with scales, sometimes modified; claspers sometimes developed; uncus generally well developed,

Six additional species are given.

BALANOTIS, *Meyr.*

Valves of male strong; uncus moderately long.

Balanotis hercophora, n. s.

♀, 25 mm. Head and palpi ochreous-yellow. Antennæ grey. Thorax ochreous-yellow; a ring before anterior margin, a large central spot, a small lateral spot, and another at extremity of patagia, dark fuscous. Abdomen whitish ochreous, partially suffused with yellow, with a large irregular dark fuscous spot on side of each segment. Anterior legs dark fuscous (others broken). Fore wings moderate, triangular, costa slightly arched, apex rounded, hind margin rather obliquely rounded; yellowish white, veins and margins of dark markings yellow, markings dark fuscous; a spot on base of costa; four transverse fasciæ; first straight, moderately broad, near base; second straight, from one-third of costa to two-fifths of inner margin, outer edge with a short projection above middle; third from two-thirds of costa to two-thirds of inner margin, irregular-edged, rather strongly curved outwards in middle, rather sinuate beneath, united with second by a rather broad streak along costa, and another along inner margin; fourth hind marginal, inner edge irregular; a transverse-elongate black discal spot, almost touching costal border; cilia dark fuscous (imperfect). Hind wings yellow-whitish, suffused with yellow towards costa and inner margin; a small cloudy fuscous spot in disc before and below middle; a dark fuscous fascia at two-thirds, and another along hind margin, both as in fore wings, but former not reaching inner margin; cilia as in fore wings.

A conspicuously distinct species, allied to *B. didymalis*, with which it entirely agrees in structure (unless the male presents differences) except that vein 6 of the fore wings also rises out of 9 near base, whilst in *B. didymalis* 6 and 9 rise from a point; not improbably this difference may not persist in the male.

Port Darwin, North Australia; one specimen.

Balanotis didymalis, Walk.

I have been enabled to examine the male; the fore wings have no glandular swelling beneath the costa; the antennæ are evenly ciliated ($\frac{1}{2}$). I do not think these differences need involve generic separation. The genus cannot be confused with any other structurally except

Stemmatophora, from which it is separated by the quite different palpi.

STEMMATOPHORA, Gn.

Valves of male strong; uncus stout, strongly curved.

Stemmatophora vibicalis, Ld.

I have little doubt that *Paredra eogenalis*, Snell., Midd. Sum., 60, Tijds. v. Ent., 1883, pl. vi., 1, is a synonym of this; Snellen separated his species generically from *Stemmatophora* on the ground of certain differences in the palpi and antennæ, which (if the identification is correct) I am disposed to think in this instance insufficient. Snellen received his specimens from Celebes.

AGLOSSA, Latr.

Valves of male strong; uncus stout, gently curved. In *A. cuprealis* the uncus is furnished with a short process beneath its apex, bearing a sharp horny upwards-bent terminal hook.

ASOPIA, Tr.

Asopia gerontialis, Walk.

Pyralis gerontesalis, Walk., 896; *P. despectalis*, ib., Suppl., 1243; *P. miseralis*, ib., Suppl., 1244; *P. achatina*, Butl., E. M. M., xiv., 49.

Very similar in appearance to *A. farinalis*, but readily separated by its grey colouring.

I have not myself received this species, but specimens from Eastern Australia are in the British Museum; also from Ceylon, Java, Celebes, the Hawaiian Islands, and West Africa.

Asopia caustica, n. s.

♂, 15 mm. Head, palpi, and antennæ ochreous, face paler Thorax ochreous, mixed with fuscous. Abdomen whitish ochreous, mixed with fuscous. Legs whitish ochreous, anterior pair suffused with dark fuscous. Fore wings moderate, triangular, costa faintly sinuate, apex obtuse, hind margin rounded, rather strongly oblique; whitish ochreous, mixed with brownish ochreous; a pale line from one-fourth of costa to two-fifths of inner margin, thrice sinuate outwards, most strongly in middle, posteriorly margined by a dark fuscous streak; basal area suffused with reddish fuscous, becoming dark fuscous on margins; a second pale line, dilated on costa,

from two-thirds of costa to four-fifths of inner margin, gently outwards-curved, obscurely toothed at one-fourth and three-fourths, indistinctly margined with fuscous, which forms small cloudy spots on inner edge opposite teeth; costa between first and second lines dark fuscous, marked with three pale dots; a conspicuous subquadrate blackish discal spot; a cloudy dark fuscous spot on costa immediately after second line, shading posteriorly into reddish fuscous; cilia pale whitish ochreous, slightly mixed with reddish fuscous. Hind wings pale greyish ochreous; an obscure irregular dentate grey line beyond middle; cilia as in fore wings.

Appears allied to *A. torridalis*, Ld., and *A. fusci-costalis*, Snell. (which are apparently very similar to each other, though I have not seen either), but the first line is quite different, being very much more divergent on the costa from the second than in either of these as figured.

Duaringa, Queensland; one specimen received from Mr. G. Barnard. I think it improbable that this species is confined to Australia, but cannot identify it with any other description.

ENDOTRICHA, Z.

Claspers apparently developed. In *E. pyrosalis* the claspers appear to be large and tufted, the valves reduced to a long spinous process lying beneath the clasper, the uncus well developed; on apex of abdomen above origin of uncus is a raised rounded protuberance.

PERSICOPTERA, n. g.

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ moderate, in male apparently very strongly ciliated. Labial palpi moderate, arched, ascending, 2nd joint with dense rough projecting scales beneath, terminal joint short, exposed, filiform. Maxillary palpi very short, filiform. Fore wings with vein 3 remote from 4, 4 and 5 very near together from angle, 6 from a point with 9, 7 and 8 stalked out of 9, 10 separate, 11 from near 10, anastomosing shortly with 12. Hind wings as broad as fore wings; 3 remote from 4, 4 and 5 tolerably approximated from angle, 7 out of 6 rather near origin, anastomosing with 8 moderately.

Differs from all other described Pyralid genera, except *Semnia*, Hb., and *Eurypta*, Ld., by the anastomosing for a short space of veins 11 and 12 of the fore wings.

Lederer forms a separate family (*Semniidæ*) for their reception solely on this ground, as well as one (*Homalochroidæ*) for the genus *Homalochroa*, Ld., in which these veins anastomose, but do not separate again, merely an extreme case of the same structure. He describes one vein as cutting through the other, which is essentially erroneous. The second of these families is certainly untenable; and I see no reason at present for separating any of these genera from the *Pyrilididæ* as defined. *Persicoptera* differs from *Semnia* and *Eurypta* in that veins 8 and 9 rise separately out of 7, not on a common stalk, in the presence of distinct maxillary palpi, in the basal joint of the antennæ not being elongate, and other characters.

Persicoptera pulchrinalis, Gn.

Endotricha pulchrinalis, Gn., 220, pl. iii., 7; *Scopula gavisalis*, Walk., Suppl., 1475.

A striking species, somewhat variable in the breadth of the first white fascia.

Sydney, New South Wales; Mount Lofty range, South Australia; and from Tasmania: in September. I have seen, but have not been enabled to examine, the male; it does not appear to present any singular characters.

DIPLOPSEUSTIS, n. g.

Forehead flat, vertical. Ocelli present, concealed. Tongue well developed. Antennæ moderate, in male tolerably filiform, evenly ciliated ($\frac{1}{2}$), rough-scaled above. Labial palpi moderate or rather long, 2nd joint straight, porrected, with dense tolerably short projecting scales, somewhat thickest in middle, forming a short apical tuft beneath; terminal joint moderate, slender, filiform or loosely scaled in middle, obliquely ascending. Maxillary palpi moderate, strongly dilated with dense scales towards apex, obliquely truncate. Abdomen rather long, in male with moderate anal tuft; valves apparently strong, exerted. Fore wings with veins 4 and 5 stalked, 8 and 9 stalked out of 7. Hind wings broader by one-fourth than fore wings; 4 and 5 stalked, 7 out of 6 near origin, anastomosing moderately with 8.

Differs from all the other genera of the family known to me in the form of the maxillary palpi, which recall those of *Crambus* and *Scoparia*. In superficial appearance the species (especially the second) strongly resemble

Pseudochoreutes, Snell., but structurally they differ considerably from it. The two species described are readily separated by the difference in the length of the labial palpi, as well as in marking.

Diplopseustis minima, Butl.

Cymoriza minima, Butl., Proc. Zool. Soc., 1880, 684.

♂, ♀, 13—16 mm. Head white, crown ochreous-tinged. Labial palpi two and a half times as long as head, dark fuscous, internally white, terminal joint black, tip white. Maxillary palpi white, basal half dark fuscous. Antennæ whitish, spotted with grey on back. Thorax pale greyish ochreous, more whitish posteriorly. Abdomen whitish, segments with a posterior fuscous suffusion, two penultimate segments wholly fuscous. Anterior legs dark fuscous; middle and posterior legs white, spurs banded with dark fuscous. Fore wings elongate-triangular, narrow, costa gently arched, apex rounded, hind margin oblique, irregular, with a rather deep sinuous indentation above middle and an obtuse bidentate median projection; ochreous-white, mixed with pale ochreous and thinly irrorated with dark fuscous; veins ochreous-brown; costa ochreous-brown, marked with several irregularly placed small ochreous-white blackish-margined spots; an almost obsolete irregularly dentate pale transverse line at one-third, lower half suffusedly margined posteriorly with dark fuscous; a small black discal dot; a pale line from three-fourths of costa to four-fifths of inner margin, suffusedly margined anteriorly with dark fuscous, especially towards inner margin, sinuate-curved outwards above middle; hind marginal area somewhat suffused with ochreous-brown; a small double black spot on hind margin in indentation, and two or three others smaller towards anal angle; cilia with basal half ochreous-white, apical half white, divided by a sharply marked dark fuscous line; costal cilia ochreous-white with three subquadrate blackish spots. Hind wings irregularly indented below apex and sinuate below middle; grey-whitish, towards apex greyer; a very indistinct pale sinuate line towards hind margin; a cloudy triangular blackish spot on hind margin below middle, its apex cut by the pale line; cilia as in fore wings.

Var. α , 16—20 mm. More or less wholly suffused with fuscous, but markings distinct.

Christchurch and Wanganui, New Zealand; Melbourne, Victoria; Sydney, New South Wales; in February and March, not uncommon, frequenting rushes in damp places, and also taken at light. The form

described here as typical is the New Zealand one; the larger and darker var. α is that found in Australia; but there can be no question of their specific identity. The aspect of the species is singular and recalls that of some *Crambidae*. Butler's type is a small, dark, sharply marked specimen, from Formosa.

Diploseustis hemiophthalma, n. s.

♂, 12 mm. Head and palpi whitish ochreous; labial palpi one and a half times as long as head, externally suffused with dark fuscous, except at apex of terminal joint. Antennæ whitish ochreous, above spotted with dark fuscous. Thorax whitish ochreous, with a few dark fuscous scales. Abdomen whitish, irrorated with dark fuscous. Anterior legs dark grey; middle and posterior legs whitish, tarsi banded with grey. Fore wings elongate-triangular, rather narrow, costa gently arched, apex rounded, hind margin sinuate above and below middle, oblique; ochreous-white, mixed with pale ochreous, and irregularly irrorated with fuscous and grey; costa suffused with dark fuscous; a pale line from one-third of costa to one-third of inner margin, suffusedly margined posteriorly with dark fuscous, curved outwards in middle, and again less strongly beneath costa; a round blackish discal spot; costa marked at one-half, five-eighths, and three-fourths with three semicircular dark-centred pale spots; a pale line from four-fifths of costa to four-fifths of inner margin, suffusedly margined with dark fuscous, more strongly anteriorly, slightly angulated above middle; a row of small obscure blackish spots along hind margin, tending to be confluent in upper sinuation; cilia with basal third ochreous-white, bounded by a dark fuscous line, remainder white, with a faint greyish line; costal cilia imperfect. Hind wings indented above middle; white, irrorated with grey; a round black discal spot, surrounded by a white patch; a white line parallel to hind margin at two-thirds, partially margined with dark fuscous; a row of small obscure dark fuscous spots along hind margin, a larger one in indentation; cilia as in fore wings.

Although superficially like *Pseudochoreutes*, the lines are quite differently placed to those in the described species.

Sydney, New South Wales; one specimen in March.

MUSOTIMIDÆ.

Fore wings with vein 10 absent, 8 and 9 stalked, sometimes also 7 out of 8. Hind wings with vein 6 from upper angle of cell, 7

from upper margin of cell before angle, anastomosing with 8. Abdomen in male with uncus strongly developed, complex.

Distinguished from all neighbouring families by the peculiar origin of vein 7 of the hind wings. The absence of vein 10 of the fore wings is also a remarkable point, but I hardly expect this to be essential. The development of the genitalia of the male in these two genera is more complex than in any others yet examined. The two genera are immediately separated by the structure of the palpi and the difference in neurulation.

TRICHOPHYSETIS, n. g.

Forehead with a short conical scaly projection. Ocelli absent. Tongue well developed. Antennæ moderate, in male stout, filiform, clothed with moderate pubescence, with whorls of stiff scales at joints, except towards base. Labial palpi moderate, tolerably straight, porrected, clothed with very long fine dense hairs capable of depression and expansion, terminal joint concealed. Maxillary palpi long, terminating in a long expansible pencil of loose very fine hairs. Posterior tibiæ short, spurs all long and equal. Abdomen moderate, in male with moderate anal tuft; uncus broad and thick at base, forming a long slender downwards-bent hook, the apex of which touches that of a straight slenderer process from beneath thick basal part, so as to form a large triangular loop; claspers moderately long, very slender; valves exerted, reduced each to a pair of very fine acute processes projecting above and below claspers, somewhat incurved. Fore wings with veins 7 and 8 stalked out of 9, 10 absent. Hind wings with veins 3 and 4 from point of angle, 5 tolerably approximated at base, 6 from upper angle, 7 from a bend in upper margin of cell shortly before angle, anastomosing with 8 immediately from origin to middle. Lower median of hind wings not pectinated.

Perhaps the expansible tufts of the palpi may not occur in the female, which is not known to me. A very curious and interesting genus.

Trichophysetis neophyla, n. s.

♂, 14—15 mm. Head, thorax, and maxillary palpi white. Labial palpi externally ochreous-yellow, base and apex dark fuscous, internally white. Antennæ pale whitish ochreous. Abdomen white, somewhat mixed with pale ochreous, irrorated with dark fuscous opposite lines of hind wings. Legs white, anterior tibiæ dark fuscous. Fore wings moderate, triangular, costa gently

arched, apex rounded-rectangular, hind margin not oblique, sinuate below apex, rounded beneath; snow-white, sometimes wholly suffused with light ochreous; median space generally ochreous-brown, except on costa; a faint ochreous-brown line near base; a double slightly-curved fuscous line from one-third of costa to one-third of inner margin; a double fuscous line from two-thirds of costa to three-fourths of inner margin, strongly curved outwards, somewhat sinuate inwards towards inner margin; a transversely elongate white discal spot; beneath this in one specimen a large oval black spot; sometimes a fuscous suffusion towards costa before apex, and anal angle; a blackish inwardly sinuate line near hind margin, extending from costa to middle, leaving a narrow yellow-ochreous hind marginal streak; cilia white, with a dark fuscous line. Hind wings white, partly mixed and sometimes almost wholly suffused with ochreous; a double slightly curved dark fuscous line at one-third, and another at two-thirds, becoming obsolete towards costa; a very slender brownish ochreous hind marginal streak, anteriorly obscurely edged with dark fuscous; cilia as in fore wings.

Certainly very variable, perhaps exceeding the limits of this description. The neuration of the fore wings is that of the *Pyralididæ*; the character of the hind marginal streak clearly indicates affinity with the *Hydrocampid* genera.

Rosewood, Queensland, in September; Sydney, New South Wales, in November; three specimens in thick bush.

MUSOTIMA, n. g.

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ moderate, in male stout, dentate, evenly ciliated ($\frac{1}{2}$), back rough-scaled. Labial palpi moderately long, porrected or ascending, 2nd joint with evenly projecting scales beneath, terminal joint moderately exposed, ascending, slender, with rough scales beneath towards apex. Maxillary palpi moderate, dilated with rough scales, truncate. Posterior tibiæ with spurs almost equal. Thorax in male beneath with a curved pencil of hairs on each side behind anterior legs, projecting laterally. Abdomen moderate, in male with moderate anal tuft; uncus forming a long slender downwards-bent hook, which meets at apex a similar less curved process from beneath its base; from between these at base rises a rather thicker straight blunt process, variable in length (short in *aduncalis*, in *nitidalis* nearly reaching apex of others); scaphium distinct, sometimes with a horny double spine; valves broad, exerted. Fore

wings with 8 and 9 stalked, 10 absent, 11 short. Hind wings somewhat broader than fore wings; 3, 4, 5 remote; 6 from angle, 7 from considerably before angle, anastomosing with 8 from very near origin to one-third; transverse vein very faint. Lower median of hind wings not pectinated.

The species are neatly and elegantly marked. Besides the four given below I am only acquainted with one other, *Isopteryx acclaralis*, Walk., 403; it is represented by a single type in the British Museum, of which I cannot investigate the structure, but evidently referable here, and closely allied to *M. nitidalis*, from which it may be easiest distinguished by the first line forming a conspicuous round white spot on fold, and by the white discal lunule being notably nearer base; the locality is given as Ceylon. The larvæ probably all feed on ferns.

- A. Fore wings with upper half of second line curved outwards *aduncalis*.
- B. Fore wings with upper half of second line curved inwards or straight.
1. White discal spot divided into two small round dots *nitidalis*.
2. White discal spot single, transverse.
- a.* Second line of fore wings forming an acute angle below middle *ochropteralis*.
- b.* Second line of fore wings obtusely bent in middle *acrias*.

Musotima aduncalis, Feld.

Diathrausta aduncalis, Feld., Reis. Nov., cxxxv., 11.

Variable in colour from white to ochreous-yellow.

Auckland, New Zealand; three specimens in January.

Musotima acrias, n. s.

♂, ♀, 17—18 mm. Head and thorax whitish ochreous, suffused with reddish ochreous. Palpi pale whitish ochreous, base and apex of 2nd joint reddish ochreous. Antennæ whitish ochreous. Abdomen whitish, mixed with ochreous. Legs ochreous-whitish, tibiæ irrorated with ochreous-fuscous. Fore wings moderate, triangular, in female more elongate, costa slightly arched, apex tolerably rectangular, hind margin somewhat oblique, waved, sinuate below costa so as to project obtusely in middle, rounded beneath; whitish ochreous, mixed and suffused with reddish ochreous, with some scattered fuscous scales; a very small blackish spot on inner margin near base, and another in disc obliquely beyond it, both

followed by small obscure white spots; a row of four similar spots, preceded by small white spots, crossing wing from two-fifths of costa to two-fifths of inner margin, third spot from costa largest but not conspicuous; a conspicuous white 8-shaped discal spot, margined with blackish; a small obscure white spot on middle of inner margin, and another between this and discal spot, both preceded by dark fuscous scales; a small dark fuscous mark on costa above discal spot; an indistinct interrupted dark fuscous line from two-thirds of costa to disc at three-fourths, margined posteriorly by several small white spots, only distinct on costa, becoming obsolete below middle; a cloudy dark fuscous line from apex near and parallel to hind margin throughout, slightly margined with white posteriorly; cilia white, with a dark grey basal line broadly interrupted below middle, and dark grey spots at apex, middle, and anal angle. Hind wings sinuate below apex; white, partly mixed with ochreous in disc; a straight dark fuscous line at one-third from middle to inner margin; an irregular dark fuscous discal spot, connected with inner margin by a thick curved dark fuscous line, from apex of which proceeds a strongly outwards curved line of obscure fuscous lunules to costa; a broad pale ochreous hind marginal band, cut near hind margin by an irregular dark fuscous line preceded by lunulate white spots; cilia white, with an interrupted grey line near base.

Nearly allied to *M. nitidalis*, but white markings much less developed; discal white spot not separated into two dots.

Blackheath (3500 feet), New South Wales, in March; Deloraine, Tasmania, in November; two specimens.

Musotima nitidalis, Walk.

Isopteryx nitidalis, Walk., Suppl., 1417; *Diathrausta timaralis*, Feld., cxxxv., 23.

Varies principally in depth of colouring, New Zealand specimens being usually darker and more sharply marked than Australian, and slightly smaller.

Larva feeds on *Adiantum* (perhaps also on other ferns), sometimes doing much damage in greenhouse plants.

Sydney, New South Wales; Fernshaw, Victoria; Cambridge, Taranaki, Otira River, Invercargill, New Zealand; common from October to May.

Musotima ochropteralis, Gn.*Isopteryx ochropteralis*, Gn., 230.

Varies very little.

Sydney, New South Wales; Fernshaw, Victoria; Launceston, Tasmania; Mount Lofty range, South Australia; in October, November, January, and March, tolerably common.

Fam. ?.

The following genus cannot, I think, be included in any of the families here given, on account of the essentially different neuration of the hind wings; but I am not prepared to say whether it may not be classed with the *Pterophoridae*; the point will be discussed hereafter.

TINEODES, Gn.

Forehead flat, vertical. Ocelli present. Tongue very long and slender. Antennæ as long as fore wings (according to Guenée not ciliated). Labial palpi very long, roughly scaled above and beneath, gradually attenuated, straight, porrected, terminal joint short, concealed. Maxillary palpi moderately long, considerably dilated with loose scales. Legs very long and slender; posterior tibiæ (in female) with outer spurs two-thirds of inner. Abdomen elongate, slender, more than twice the breadth of the hind wings, ovipositor rather long, filiform. Fore wings with 8 and 9 stalked, 11 from middle of cell, long. Hind wings as broad as fore wings; 3 and 4 remote; 5 and 6 from transverse vein, rather nearer together than to 4 or 7; 7 from angle of cell, only touching 8 at about one-fifth.

I have not seen a male. The neuration of the hind wings is of a primitive type, as compared with ordinary Pyralids.

Tineodes adactylalis, Gn.

Tineodes adactylalis, Gn., 237, pl. ix., 7; *Carcantia pterophoralis*, Walk., 425.

Sydney, New South Wales; one specimen. Walker's specimen is also Australian; Guenée suggests Africa as the locality of his type, but only conjecturally, and there is at present no reason to suppose that the species occurs outside Australia.

BOTYDIDÆ.

Fore wings with veins 8 and 9 stalked, 7 separate, 10 separate, or rarely stalked with 9 or 11. Hind wings with vein 6 from upper angle of cell, 7 stalked or from same point with 6, anastomosing with 8 or rarely free; lower median naked, or rarely with tolerably defined pectination towards base. Abdomen in male with valves exerted or retracted; no claspers; uncus obsolete.

The following is a tabulation of the genera given:—

- | | | |
|-------|---|----------------------|
| 1 a. | Antennæ at least as long as fore wings. | |
| 2 a. | Anterior tibiæ of male with long dense hairs beneath. | |
| 3 a. | Antennæ in male simple | <i>Phalangiodes.</i> |
| 3 b. | „ „ strongly ciliated | <i>Rhimphalea.</i> |
| 2 b. | „ „ not hairy | <i>Euclasta.</i> |
| 1 b. | Antennæ shorter than fore wings. | |
| 2 a. | Terminal joint of palpi triangularly scaled. | |
| 3 a. | Patagia in male terminating in a long tuft | <i>Pelecynthis.</i> |
| 3 b. | „ normal. | |
| 4 a. | Antennæ in male ciliated with tufts (2) | <i>Tetracona.</i> |
| 4 b. | „ „ evenly ciliated ($\frac{1}{2}$) | <i>Hellula.</i> |
| 2 b. | „ „ not triangularly dilated. | |
| 3 a. | Antennæ in male bent above middle, with tuft of scales. | |
| 4 a. | Antennæ in male with a tuft of scales on back of bend | <i>Semioceros.</i> |
| 4 b. | Antennæ in male with a streak of scales in bend beneath | <i>Protermia.</i> |
| 3 b. | Antennæ in male not bent or tufted. | |
| 4 a. | Antennæ in male excavated above base, with an erect projection of scales. | |
| 5 a. | Palpi porrected, triangularly scaled | <i>Pachyarches.</i> |
| 5 b. | Palpi curved, ascending, terminal joint slender, erect | <i>Zinckenia.</i> |
| 4 b. | Palpi curved, not excavated or with basal projection. | |
| 5 a. | Forehead with distinct horny projection. | |
| 6 a. | Tongue obsolete | <i>Sedenia.</i> |
| 6 b. | „ well developed. | |
| 7 a. | Spurs of posterior tibiæ unusually short | <i>Sceliodes.</i> |
| 7 b. | „ „ „ normal. | |
| 8 a. | Hind wings broader by one-half than fore wings | <i>Tritæa.</i> |
| 8 b. | „ „ about as broad as fore wings. | |
| 9 a. | Anal valves exerted. | |
| 10 a. | Antennæ in male strongly ciliated ($1\frac{1}{2}$) | <i>Proteræca.</i> |
| 10 b. | „ „ moderately ciliated ($\frac{1}{2}$ — $\frac{3}{4}$) | <i>Eurycreon.</i> |
| 9 b. | „ „ retracted. | |

- 10 a. Veins 3 and 4 of hind wings remote *Criophthona*.
 10 b. Veins 3 and 4 of hind wings tolerably approxi-
 mated *Metallarcha*.
 5 b. Veins flat or rounded.
 6 a. Ocelli absent *Cirrhochrista*.
 6 b. ,, present.
 7 a. Maxillary palpi with fine terminal pencil .. *Glyphodes*.
 7 b. ,, ,, not penicillate.
 8 a. Abdomen in male with expansible spherical anal
 tuft *Phacellura*.
 8 b. Abdomen in male without expansible tuft.
 9 a. Posterior tibiæ in male with outer middle-spur
 obsolete.
 10 a. Posterior tibiæ in male with outer end-spur rudi-
 mentary *Atelocentra*.
 10 b. Posterior tibiæ in male with outer end-spur well
 developed *Scopula*.
 9 b. Posterior tibiæ in male with outer end-spur well
 developed.
 10 a. Antennæ more than three-fourths of fore wings.
 11 a. Maxillary palpi filiform *Siriocauta*.
 11 b. ,, ,, terminally dilated, truncate .. *Margarodes*.
 10 b. ,, not more than three-fourths of fore wings.
 11 a. Veins 7 and 8 of hind wings anastomosing almost
 to extremity.
 12 a. Veins 10 and 11 of fore wings stalked *Cnaphalocrocis*.
 12 b. ,, ,, ,, separate *Dolichosticha*.
 11 b. ,, ,, ,, hardly beyond middle.
 12 a. Antennæ of male with median sinuation.
 13 a. Posterior tibiæ in male with end-spurs absent .. *Sameodes*.
 13 b. ,, ,, ,, present .. *Pessocosma*.
 12 b. ,, ,, without sinuation.
 13 a. Lower median vein of hind wings with loose basal
 pectination *Mnesictena*.
 13 b. Lower median vein of hind wings naked.
 14 a. Labial palpi arched, ascending.
 15 a. Maxillary palpi broadly dilated towards apex .. *Molybdantha*.
 15 b. ,, ,, filiform.
 16 a. Patagia in male broadly elongated *Pachyzancla*.
 16 b. ,, ,, normal.
 17 a. Terminal joint of labial palpi cylindrical, truncate.
 18 a. Forehead flatly rounded. *Notarcha*.
 18 b. ,, obtusely but not distinctly projecting.. *Deuterarcha*.
 17 b. ,, ,, ,, pointed.
 18 a. Terminal joint of palpi slender, needle-shaped .. *Conchylodes*.
 18 b. ,, ,, ,, conical *Conogethes*.
 14 b. ,, ,, straight, porrected.
 15 a. Middle tibiæ in male dilated, grooved, often con-
 taining a tuft *Mecyna*.
 15 b. Middle tibiæ in male not grooved.

- 16 a. Antennæ in male naked *Aphytoceros*.
 16 b. " " ciliated.
 17 a. Veins 4 and 5 of hind wings stalked *Godara*.
 17 b. " " " separate.
 18 a. Terminal joint of palpi exposed *Nesarcha*.
 18 b. " " " tolerably concealed.
 19 a. Hind wings twice as broad as fore wings .. *Nomophila*.
 19 b. " not more than one-fourth broader
 than fore wings.
 20 a. Forehead flat, very oblique *Bæotarcha*.
 20 b. " more or less rounded or vertical.
 21 a. Maxillary palpi filiform *Botys*.
 21 b. " " dilated terminally with loose scales.
 22 a. Posterior tibiæ of male with middle-spurs almost
 equal *Diasemia*.
 22 b. Posterior tibiæ of male with outer middle-spur
 one-fourth of inner *Myriostephes*.

PHALANGIODES, *Gn.*

Forehead rounded, somewhat projecting. Ocelli present. Tongue well developed. Antennæ as long as fore wings, in male slender, filiform, simple. Labial palpi rather short, somewhat ascending, with long dense projecting scales beneath, terminal joint concealed. Maxillary palpi very short, rather thick, filiform. Legs very long; anterior tibiæ and three basal joints of tarsi in male clothed with long fine dense hairs, especially on inner side; middle tibiæ in male somewhat expanded in middle, containing a tuft of long fine hairs enclosed in a groove; posterior tibiæ with outer middle-spur one-half, outer end-spur three-fourths of inner. (Abdomen broken). Fore wings with veins 2 and 3 short-stalked from angle, 4 and 5 from transverse vein, which is angulated at origin of 4; 7 from a point with 8; 10 closely approximated to 8, 11 remote, very oblique. Hind wings broader than fore wings; 2, 3, 4, 5 all tolerably closely approximated at base; 2 straight, 3 strongly sinuate towards base, so as to enclose with 4 an elongate-oval posteriorly acute transparent space; 4 from angle, 4 and 5 somewhat sinuate towards base; 7 out of 6 near origin, anastomosing with 8 to two-fifths, 6 bent beyond origin of 7.

I have not been able to examine a female, which is without many of the above abnormal peculiarities; nor the genitalia of the male. Lederer's statement of the neuriation is erroneous, as already indicated by Snellen.

Phalangiodes neptis, Cr.

Phalæna neptis, Cr., 264, F.; *Phalangiodes neptisalis*, Gn., 279.

Brisbane, Queensland; one specimen received from Mr. W. H. Miskin; the British Museum has also Australian specimens. Occurs also in Ceylon, India, and South America.

LEPYRODES, Gn.

Not having my specimens at hand I cannot give the full characters at present. The antennæ are as long as the fore wings; the maxillary palpi are stated by Guenée to be absent, but this is probably erroneous, as in many other cases.

Nearly allied to *Phalangiodes*, but without its abnormal structures.

Lepyrodes geometralis, Gn.

Lepyrodes geometralis, Gn., 278, pl. viii., 6.

Duaringa, Queensland; received from Mr. G. Barnard. Occurs also in Java, China, Ceylon, and Mauritius.

EUCLASTA, Ld.

I have not obtained the Australian species, and can add nothing to the characters given by Lederer. The antennæ are here markedly longer than the fore wings.

Euclasta maceratalis, Ld.

Euclasta maceratalis, Ld., 481, pl. xv., 11.

Eastern Australia. Besides Lederer's described types there are specimens (unnamed) in the British Museum. The species is certainly very close to *E. splendidalis*, H.-S.

PACHYARCHES, Ld.

Forehead flat, oblique. Ocelli present. Tongue well developed. Antennæ more than three-fourths of fore wings, in male stout towards base, filiform, evenly ciliated ($\frac{1}{4}$ — $\frac{1}{5}$), sharply excavated above basal joint, basal joint stout, with a strong erect projection of scales in front of excavation. Labial palpi rather long, straight, porrected, triangularly scaled, terminal joint lying in scales of second. Maxillary palpi rather short, dilated with dense scales

towards apex, truncate. Posterior tibiæ with outer spurs in male one-third of inner. Abdomen elongate, in male with dense anal tuft of long hair-scales; valves retracted. Fore wings with vein 11 very long and oblique. Hind wings somewhat broader than fore wings; 3, 4, 5 tolerably approximated at base, 7 out of 6 near origin, anastomosing with 8 to one-third. Costa of fore wings beneath with a fold of scales towards middle, concealing a pencil of long hairs.

Pachyarches psittacalis, Hb.

Parotis psittacalis, Hb., Zut., 523, 524; *Margarodes psittacalis*, Gn., 308.

Port Darwin, North Australia; one male. Also occurs in Celebes, China, India, and Ceylon.

MARGARODES, Gn.

Forehead somewhat ridged, oblique. Ocelli present. Tongue well developed. Antennæ more than three-fourths of fore wings, in male filiform, evenly ciliated ($\frac{1}{2}$). Labial palpi moderate, porrected, broadly dilated beneath with dense projecting scales, anteriorly truncate, terminal joint concealed. Maxillary palpi rather short, dilated towards apex with dense scales, truncate. Posterior tibiæ in male with outer middle-spur one-fourth of very long inner, outer end-spur one-third of inner. Abdomen elongate, in male with dense anal tuft of hairs; valves retracted. Fore wings with vein 11 very long and oblique. Hind wings slightly broader than fore wings; 3, 4, 5 tolerably approximated at base, 7 out of 6 rather near origin, anastomosing with 8 to one-third. Hind wings beneath with a dense clothing of hairs along vein 1*b*, stronger and almost forming a tuft posteriorly, but ceasing before extremity.

Margarodes vertumnalis, Gn.

Margarodes vertumnalis, Gn., 309; *Margaronia atlitatis*, Walk., 533.

Duarina, Queensland; Sydney, New South Wales, in March; two males. Also occurs in the Philippines, Celebes, Borneo, and India.

CIRRHOCRISTA, Ld.

I have not been able to obtain specimens for examination, and can add nothing to Lederer's characters.

Cirrhochrista brizonalis, Walk.

Margaronia brizonalis (*brizoalis*), Walk., 976 ; *Cirrhochrista ætherialis*, Ld., pl. xviii., 9.

Eastern Australia ; also from Amboina and China.

PHACELLURA, *Lnsd. Gld.*

Forehead flat, oblique. Ocelli present. Tongue well developed. Antennæ more than five-sixths of fore wings, in male slender, filiform, evenly ciliated ($\frac{1}{3}$). Labial palpi moderate, somewhat ascending, 2nd joint strongly dilated beneath with projecting scales, rounded in front, terminal joint concealed. Maxillary palpi moderate, anteriorly dilated with dense scales. Posterior tibiæ in male with outer spurs less than half inner. Abdomen elongate, in male with large spherically expansible double anal tuft of long flattened scales ; valves retracted. Fore wings with vein 11 long, oblique. Hind wings rather broader than fore wings ; 3, 4, 5 very closely approximated at base ; 7 out of 6 near origin, anastomosing with 8 to one-third.

Lederer correctly writes *Phacellura* for *Phakellura*, the latter form being classically inadmissible.

Phacellura indica, Saund.

Eudiotis indica, Saund., Zool., ix., 3070 ; Trans. Ent. Soc. Lond., n. s., i., Pl. XII., 5—7 ; *Phakellura gazorialis*, Gn., 297 ; *Eudiotis capensis*, Z., Caff., 52.

The larva feeds on melons in gardens and is sometimes very destructive.

Port Darwin, North Australia ; Duaringa, Queensland ; common. Also occurs in Samoa, Celebes, Java, Formosa, China, India, Ceylon, and South Africa.

GLYPHODES, *Gn.*

Forehead flat, very oblique. Ocelli present. Tongue well developed. Antennæ four-fifths of fore wings, in male filiform, evenly ciliated ($\frac{1}{3}$). Labial palpi moderate, ascending, 2nd joint with long dense projecting scales beneath, truncate in front, terminal joint concealed. Maxillary palpi moderate, terminating in a fine pencil of hairs. Posterior tibiæ in male (*excelsalis*) with outer middle-spur one-sixth of inner, outer end-spur one-third ; in female (*perspicillalis*) with outer middle-spur two-thirds of inner,

end-spurs equal. Abdomen rather elongate, in male with short truncate anal tuft; valves retracted. Fore wings with vein 11 long, oblique. Hind wings broader than fore wings; 3, 4, 5 closely approximated at base; 7 out of 6 near origin, anastomosing with 8 to beyond one-third.

a. Hind wings with dark fuscous posterior band.

1. Hind margin of both wings narrowly white .. *excelsalis*.

2. " " " not white.

i. White discal blotch of fore wings starting from costa *piepersialis*.

ii. White discal blotch of fore wings not touching costa *perspicillalis*.

b. Hind wings without dark band *tolumnialis*.

Glyphodes tolumnialis, Walk.

Leucochroma tolumnialis, Walk., 492; *Oligostigma sexpunctalis*, Moore, Proc. Zool. Soc., 1877, 616, pl. lx., 12; *Glyphodes lomaspilalis*, Snell., Tijd. v. Ent., 1880, 223; *G. sexpunctalis*, ib., Tijd. v. Ent., 1883, pl. viii., 12; *Cataclysta nympha*, Butl., Proc. Zool. Soc., 1880, 684.

I have not been able to examine the structure of this species.

Eastern Australia; also from Celebes and Formosa.

Glyphodes excelsalis, Walk.

Glyphodes excelsalis, Walk., Suppl., 1360.

Apparently differs from *G. piepersialis* only by the white streak along hind margin of fore wings, and also along that of hind wings to below middle; and by the broad blackish margin of the white dorsal streak of fore wings.

Port Darwin, North Australia; one male. Walker's type is stated to be from West Australia. I hardly anticipate that the species is confined to Australia.

Glyphodes piepersialis, Snell.

Glyphodes piepersialis, Snell., Midd. Sum., 68, Tijd. v. Ent., 1883, pl. viii., 11; *G. malayana*, Butl., Proc. Zool. Soc., 1880, 684.

Duarina, Queensland; one imperfect specimen received from Mr. G. Barnard. Also from Celebes, Borneo, and Formosa.

Glyphodes perspicillalis, Z.

Eudioptis perspicillalis, Z., Caff., 53; *Glyphodes diurnalis*, Gn., 294, pl. v., 5; *G. parvalis*, Walk., Suppl., 1355.

Port Darwin, North Australia; one specimen. Also from Celebes, Java, Ceylon, India, and South Africa.

SIRIOCAUTA, Ld.

Fore wings somewhat ridged, oblique. Ocelli present. Tongue well developed. Antennæ five-sixths of fore wings, slender, filiform, serrate towards apex, in male (?). Labial palpi moderately long, straight, porrected, triangularly scaled, terminal joint concealed. Maxillary palpi rather short, filiform. Legs long; posterior tibiæ (in female) with outer middle-spur one-fourth, outer end-spur one-third of inner. Abdomen elongate, in male (?). Fore wings with veins 4 and 5 closely approximated towards base, almost from a point with 3; 11 long, oblique. Hind wings broader than fore wings; 4 and 5 closely approximated towards base, 3 very near; 7 out of 6 near origin, anastomosing with 8 to middle.

Siriocauta testulalis, Hb.

Crochiphora testulalis, Hb., Zut., 629, 630; Gn., 247; Ld., 424 (non Z., Caff., 46); *Hydrocampa aquatilis*, Boisd., Guér. Ic., pl. xc., 9 (teste Walk.); *Maruca aquatilis*, Walk., 540.

Lederer's reference to Zeller (Caff., 46) is quite erroneous, the species there described being wholly different. I have not been able to examine the male.

Duaringa, Queensland; Sydney, New South Wales; two specimens. Also occurs in Amboina, Borneo, Japan, Ceylon, India, South and West Africa, Honduras, and Brazil.

RHIMPHALEA, Ld.

Forehead tolerably flat, oblique. Ocelli present. Tongue well developed. Antennæ as long as fore wings, in male filiform, towards apex somewhat serrate, ciliated with tufts of cilia (almost 1). Labial palpi moderate, somewhat ascending, 2nd joint with dense projecting scales beneath, terminal joint short, almost concealed. Maxillary palpi very short, filiform. Anterior tibiæ in male densely rough-haired beneath, posterior tibiæ with outer spurs about half inner, posterior tarsi long, basal joint somewhat

bent. (Abdomen broken). Fore wings with vein 11 long, oblique. Hind wings as broad as fore wings; 3 moderately, 4 and 5 closely approximated at base, 7 out of 6 very near origin, anastomosing with 8 to one-third.

Lederer erroneously states the maxillary palpi to be absent.

Rhimphalea sceletalis, Ld.

Rhimphalea sceletalis, Ld., 411, pl. xv., 3.

Duaringa, Queensland; one imperfect specimen received from Mr. G. Barnard. I have seen a second, also from Queensland. Lederer's type was from Amboina.

SAMEODES, *Snell*.

Forehead somewhat ridged, rather oblique. Ocelli present. Tongue well developed. Antennæ three-fourths of fore wings, in male (Snellen) filiform, sinuate in middle, shortly ciliated. Labial palpi moderate, 2nd joint with rough projecting scales, terminal joint exposed, smooth. Maxillary palpi short, filiform. Posterior tibiæ in male (Snellen) with a thickening above middle, outer middle-spur one-fourth of inner, end-spurs absent; in female outer spurs nearly half inner. Abdomen in male (?). Fore wings with vein 11 moderately long and oblique. Hind wings as broad as fore wings; 3, 4, 5 approximated at base, 7 out of 6 near origin, anastomosing with 8 to one-third. Fore wings in male (Snellen) with a fold on middle of costa beneath.

Sameodes pipleidalis, Walk.

Stenia pipleidalis (*pipleisalis*), Walk., 420; *Lepyrodes lepidalis*, ib., 465; *Samea sidealis*, ib., 937; *Hymenia meridionalis*, ib., Suppl., 1314; *Sameodes trithyralis*, Snell., Tijd. v. Ent., 1880, 218; ib., 1883, pl. viii., 4; *Samea vespertinalis*, Saalm., Ber. Senck. Ges., 1880, 301.

I have not been able to examine the male.

Duaringa, Queensland; two specimens received from Mr. G. Barnard. Also occurs in Celebes, Java, Ceylon, India, and West and Central Africa.

PESOCOSMA, n. g.

Forehead tolerably flat, oblique. Ocelli present. Tongue well developed. Antennæ three-fourths of fore wings, in male slender, filiform, markedly sinuate in middle, ciliated with tufts of cilia

(1½). Labial palpi moderately long, straight, porrected, triangularly scaled, terminal joint moderately long, in male exposed, in female concealed. Maxillary palpi moderate, filiform. Posterior tibiæ with outer spurs half inner. Abdomen moderate, in male with short slender apical tuft; valves retracted. Fore wings with vein 11 moderately long and oblique. Hind wings as broad as fore wings; 4 and 5 approximated towards base, 3 tolerably approximated at base, 7 out of 6 near origin, anastomosing with 8 to beyond one-third.

Closely allied to *Sameodes*, of which it possesses the peculiar antennal sinuation of the male, but not the costal fold of the fore wings, nor are the terminal spurs of the posterior tibiæ absent.

Pessocosma iolealis, Walk.

Lepyrodes iolealis, Walk., 466.

♂, ♀, 16—18 mm. Head, palpi, and thorax ochreous-fuscous, mixed with ochreous-whitish. Antennæ light grey. Abdomen ochreous-fuscous, segmental margins white. Legs ochreous-fuscous, irrorated with white. Fore wings rather elongate-triangular, narrow at base, costa slightly sinuate, gently arched towards apex, apex tolerably rounded, hind margin waved, oblique, somewhat sinuate above, bowed in middle; ochreous-brown, mixed with whitish ochreous, and irregularly suffused with dark fuscous; markings white, semitransparent, laterally suffusedly edged with dark fuscous, consisting of several small subquadrate spots; two transversely placed at one-fourth, lower on inner margin, upper touching lower of two others transversely placed in disc immediately beyond them; two larger spots above and below middle of disc; an irregular obscure dark fuscous line from four-fifths of costa to two-thirds of inner margin, forming an angulated curve outwards on middle third, and followed on upper and lower portions by several small white lunate marks, on central portion by three small spots; two or three moderate spots transversely placed before upper part of this line; cilia white, with a fuscous line at one-third, terminal two-thirds sharply barred with fuscous. Hind wings markedly sinuate below apex; ground colour and markings much as in fore wings, but central spots attenuated and fascia-like, antemedian spots reduced to a suffused subbasal band; cilia as in fore wings.

Superficially much resembling *Samea* and *Sameodes*; smaller and darker than *S. pipleidalis*, with the markings differently placed.

Duaringa, Queensland; Sydney, New South Wales; three specimens in March. Herr Snellen returned me the species as unknown to him.

DIASEMIA, Gn.

Forehead somewhat rounded, rather oblique. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male filiform, ciliated with tufts of cilia ($1\frac{1}{3}$). Labial palpi rather long, porrected, second joint with long obliquely projecting scales beneath, terminal joint rather drooping, loosely scaled. Maxillary palpi moderate, towards apex loosely dilated with scales. Posterior tibiæ with spurs almost equal. Abdomen elongate, in male with slender anal tuft; valves retracted. Fore wings with vein 11 moderate, tolerably oblique. Hind wings one-fourth broader than fore wings; 3, 4, 5 tolerably remote; 7 out of 6 rather near origin, anastomosing with 8 to one-fourth, shortly.

I have not examined *D. ramburialis*, of which my specimens are not to hand. *D. grammalis* is quite identical in structure with the European *D. litterata*.

Diasemia ramburialis, Dup.

Diasemia ramburialis, Dup.; Gn., 334; Z., Caff., 30; *Isopteryx melaleucalis*, Walk., 402; *Diasemia reconditalis*, ib., Suppl., 1325; *D. leucophæalis*, ib., Suppl., 1326.

I have compared two named European types in Zeller's collection with those of Walker and my own.

Duaringa, Queensland; also from Southern Europe and Ceylon.

Diasemia grammalis, Dbld.

Diasemia grammalis, Dbld., Dieff. N. Z., ii., 287; *D. spilonotalis*, Snell., Midd. Sum., 73.

Herr Snellen kindly sent me a type of his species, which appears identical with that of Doubleday; only the white line of the hind wings forms almost a right angle inwards above middle, whilst in New Zealand it is never more than very obtusely bent. Doubleday's descriptions of New Zealand species are clear and good.

Hamilton, Masterton, and Castle Hill, New Zealand; in January and March, common amongst rough herbage in dry places, but rather local. Also occurs in Java,

Sumatra, and Celebes. I should like to see a series from various localities.

SCELIODES, *Gn.*

Forehead with a moderate obtuse conical projection. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male serrate, ciliated with tufts of cilia (1). Labial palpi rather long, straight, porrected, somewhat ascending, basal joint with a projecting tuft beneath, 2nd joint with evenly projecting scales, somewhat produced at apex beneath, terminal joint rather slender, moderate, exposed, with appressed scales. Maxillary palpi extremely short, filiform. Posterior tibiæ with spurs extremely short, outer spurs somewhat shorter than inner. Abdomen elongate, in male with a moderate anal tuft; valves large, exerted. Fore wings with vein 11 moderately long and oblique. Hind wings as broad as fore wings; 3, 4, 5 tolerably remote; 7 out of 6 near origin, anastomosing with 8 to one-third.

Not nearly allied to any genus known to me; characterised specially by the peculiarly short spurs. Snellen's genus *Eretria* was founded on this species, and must lapse.

Sceliodes cordalis, Dbl.

Margaritia cordalis, Dbl., Dieff. N. Z., ii., 288; *S. mucidalis*, Gn., 400; *Daraba extensalis*, Walk., Suppl., 1311; *Eretria obsistalis*, Snell., Tijd. v. Ent., 1880, 206; *ib.*, 1883, pl. vi., 12.

Guenée's description is sufficiently good; Snellen's figure is poor, but he informs me that his species is identical with a type of this insect which I sent him.

Duaringa, Queensland; Sydney, New South Wales; Mount Lofty range, South Australia; Taranaki and Wanganui, New Zealand. Tolerably common in February and March, coming freely to lamps, but not often seen otherwise. Also from Celebes.

CNAPHALOCROCIS, *Ld.*

Forehead flat, oblique, somewhat ridged in front. Ocelli present. Tongue well developed. Antennæ three-fourths of fore wings, in male filiform, joints angularly projecting towards apex, evenly ciliated ($\frac{1}{2}$). Labial palpi moderately long, straight, porrected, triangularly scaled. Maxillary palpi moderate, dilated with loose scales towards apex, truncate. Posterior tibiæ with outer spurs

about half inner; anterior tibiæ in male very short, strongly dilated with hairs. Abdomen elongate, in male with very slender pointed anal tuft; valves retracted. Fore wings with veins 10 and 11 short-stalked in male, long-stalked in female. Hind wings as broad as fore wings; 3, 4, 5 closely approximated at base; 7 out of 6 near origin, anastomosing with 8 almost to apex. Fore wings in male with an indentation beneath costa before middle, covered above by a rough double coalescing tuft of hairs, and a tuft of hairs from middle of costa curved back over disc.

Lederer did not make out the peculiar venation of the fore wings, which destroys the distinction of his family *Homophysidæ*; nor am I aware that it has been noticed since. This and the following genus belong to a group specially characterised by the structure of veins 7 and 8 of the hind wings, which anastomose throughout almost the whole of their length. The tufts or excrescences on the fore wings of the male in this and some other species are probably not to be depended on as generic characters, which are here well marked in the neuration.

Cnaphalocrocis rutilalis, Walk.

Botys rutilalis, Walk., 665; *B. iolealis*, ib., 666; *B. nurscialis*, ib., 724; *Cnaphalocrocis iolinalis*, Ld., pl. xii., 7.

Duaringa, Queensland; sent commonly by Mr. G. Barnard. Also occurs in Celebes, Borneo, China, Ceylon, India, and Texas (the last locality on the authority of Snellen).

DOLICHOSTICHA, n. g.

Forehead flat, somewhat oblique. Ocelli present. Tongue well developed. Antennæ four-fifths of fore wings, slender, pubescent, joints somewhat expanded in middle, with terminal whorls of scales in male (?). Labial palpi moderate, somewhat ascending, 2nd joint with long dense scales produced beneath in a broad subquadrate tuft, terminal joint small, concealed. Maxillary palpi rather short, dilated with scales towards apex. Posterior tibiæ with outer middle-spurs about half, outer end-spurs three-fourths of inner. Abdomen moderate, in male (?). Fore wings with vein 11 long, oblique. Hind wings somewhat broader than fore wings; 3, 4, 5 tolerably approximated at base, 7 out of 6 near origin, anastomosing with 8 almost throughout.

Near *Cnaphalocrocis*, but 10 and 11 of fore wings separate.

Dolichosticha venilialis, Walk.

Asopia venilialis, Walk., 373; *Botys marisalis*, ib., 717.

♀, 17 mm. Head pale ochreous, with a fine white line on each side of face. Palpi ochreous, beneath white. Antennæ whitish ochreous. Thorax light ochreous, paler posteriorly. Abdomen pale ochreous, apex darker, base whitish. Legs whitish. Fore wings moderate, triangular, costa straight, moderately arched towards apex, apex obtuse, hind margin obliquely rounded; whitish ochreous, thinly scaled; costa between first and second lines with about eight small dark fuscous spots; a rather broad indistinct fuscous suffusion beneath costa from base to second line; lines fine, fuscous; first from one-fourth of costa to one-third of inner margin, slightly curved; second from three-fourths of costa to middle of inner margin, shortly sinuate beneath costa, abruptly right-angled at two-thirds to below discal spot; discal spot rather small, linear, dark fuscous; a moderately broad fuscous hind marginal band, darker anteriorly, rather dilated on costa, and again more abruptly at anal angle to touch angulation of second line; a darker hind marginal line; cilia ochreous-whitish, with a dark grey line at one-third. Hind wings ochreous-whitish, semi-transparent; a tolerably straight fine fuscous line from opposite one-third of costa to two-thirds of inner margin; a short straight similar line slightly beyond middle from near costa to between veins 2 and 3; hind marginal band and cilia as in fore wings.

The male is unknown to me, and may perhaps have peculiar characters. A pale inconspicuous species.

Rosewood, Queensland, in September; Sydney, New South Wales, in May; three specimens. Also occurs in Borneo. Snellen returned it as unknown to him.

BÆOTARCHA, n. g.

Forehead flat, very oblique. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male apparently stout, ciliated (?). Labial palpi moderately long, straight, porrected, with dense tolerably appressed scales, terminal joint moderate. Maxillary palpi moderate, dilated with dense scales towards apex, obliquely truncate. Posterior tibiæ in female with outer spurs one-third of inner. Abdomen long, in male proportionately very stout, pointed; in female (?). Fore wings with vein 11 moderately long and oblique. Hind wings broader by one-fourth than fore wings; 3, 4, 5 closely approximated at base, 7 out of 6 near origin, anastomosing with 8 very shortly to one-fifth.

I have not been able to examine the male, and Snellen gives no characters for it. The genus is peculiar, and at present of uncertain affinity; the very oblique forehead recalls the first group of the family, but the shorter antennæ are a discordant character.

Bœotarcha crassicornis, Walk.

Botys crassicornis, Walk., Suppl., 1455; *B. tænalis*, Snell., Tijds. v. Ent., 1880, 209; ib., 1883, pl. vii., 3.

A singularly marked species.

Port Darwin, North Australia; one female. Also from Celebes.

NOMOPHILA, Hb.

Forehead flat, oblique. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male filiform, ciliated with tufts of cilia ($1\frac{1}{2}$). Labial palpi moderately long, straight, porrected, triangularly scaled, terminal joint concealed. Maxillary palpi very short, filiform. Posterior tibiæ with both outer spurs less than half inner. Abdomen moderately elongate, margins angularly dilated, in male with short anal tuft; valves retracted. Fore wings with vein 11 moderate, oblique. Hind wings twice as broad as fore wings; 3, 4, 5 almost from a point, 4 and 5 closely approximated towards base, 7 out of 6 near origin, anastomosing with 8 to before middle.

Also an abnormal and isolated genus, of questionable affinity; the unusually broad hind wings and narrow fore wings show a resemblance to some of the *Scopariadæ*, but the reduced and very different maxillary palpi are probably a sufficient proof that there is really no close affinity.

Nomophila noctuella, Schiff.

Stenopteryx hybridalis, Hb.; *Scoparia itysalis*, Walk., 828.

Duaringa, Queensland; Newcastle and Sydney, New South Wales; Melbourne, Victoria; Mount Lofty range, Wirrabara, and Port Lincoln, South Australia; common in September, October, and from January to March. Also throughout Europe, Asia, Africa, and America. In face of this wide range it should be observed that it appears to be absent from New Zealand and Tasmania.

TETRACONA, n. g.

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ three-fourths of fore wings, in male filiform, ciliated with tufts of long cilia (2). Labial palpi moderate, arched, ascending, basal joint with dense scales forming a terminal projection beneath; 2nd joint scaled so as to form two similar projections, in middle and at apex; terminal joint with a fourth similar projection whence scales diminish to apex, so as to appear obliquely truncate. Maxillary palpi very short, filiform. Posterior tibiæ with outer middle-spur one-fourth, outer end-spur two-fifths of inner. Abdomen elongate, slender, in male with a very small bifid anal tuft; valves retracted, clothed with fine loose hairs, which rise from the base and are withdrawn or exposed with the valves. Fore wings with vein 11 moderately long and oblique. Hind wings slightly broader than fore wings; 3, 4, 5 approximated at base; 7 out of 6 near origin, anastomosing with 8 to one-third.

Probably allied to *Agrotera*; characterised by the peculiar four-tufted palpi, of which the terminal joint resembles that of *Agrotera*, but is also found in other genera not nearly related.

Tetracona amathealis, Walk.

Ædiodes amathealis, Walk., 348; *Pyralis ornatalis*, ib., Suppl., 1246.

♂, ♀, 17—21 mm. Head, palpi, and thorax reddish orange, mixed with pale yellow. Antennæ whitish ochreous, spotted with dark fuscous above. Abdomen ochreous, three basal segments mixed with yellow and orange on back, three terminal segments suffused with whitish above. Legs white, anterior tibiæ ochreous, tarsi with two ochreous rings and a subapical black band, middle tibiæ fuscous above. Fore wings moderately broad, triangular, narrow at base, costa at first straight, posterior half moderately arched, apex obtuse, hind margin somewhat bowed, rather strongly oblique, scales on inner margin dilated before middle; rather light purplish grey; a slightly irregular straight dark fuscous line from two-fifths of costa to before middle of inner margin; basal area up to this line wholly pale yellow, mixed with reddish orange, with a short oblique fuscous mark on costa near base; a suffused whitish central fascia parallel to first line, sometimes indistinct; a small black discal dot; a narrow orange irregularly dentate fascia from three-fourths of costa to three-fourths of inner margin, mixed with pale yellow, and suffusedly margined with blackish; a row of fine black linear marks along hind margin; cilia pale whitish grey,

broadly interrupted with white below apex, with a grey line spotted with dark fuscous. Hind wings whitish; a rather broad suffused light purplish grey hind-marginal band, closely preceded by a somewhat irregular purplish grey line, rather sharply dentate inwards below middle; a triangular reddish ochreous spot, mixed with pale yellow, on middle of inner margin, posteriorly black-margined; a row of black linear marks along hind margin; cilia white, with an interrupted dark fuscous line.

A very elegant insect, coloured somewhat as in *Agrotera*.

Duaringa and Brisbane, Queensland; taken in September, and received from Mr. G. Barnard; seven specimens.

ZINCKENIA, Z.

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male serrate, evenly ciliated ($\frac{3}{4}$), thickened towards base, notched above basal joint, basal joint stout, with a broad erect projection of dense scales on inner side. Labial palpi moderate, curved, ascending, 2nd joint with dense projecting scales beneath, terminal joint moderately long, slender, pointed. Maxillary palpi moderate, filiform. Posterior tibiæ with outer spurs almost as long as inner. Abdomen moderate, in male with small slender apical tuft; valves retracted. Fore wings with vein 11 moderately long and oblique. Hind wings one-third broader than fore wings; 4 and 5 closely approximated towards base, 7 out of 6 near origin, anastomosing with 8 to one-third.

Coptobasis, Ld. closely approaches this genus, although widely removed from it by Lederer himself. The two species are both well known.

Zinckenia recurvalis, F.

Phalæna recurvalis, F., E. S., 407; Z., Caff., 55; Gn., 225; *P. angustalis*, F., Mant., 309; *P. fascialis*, Stoll., pl. xxxvi., 13; Cr. 398; O.; *Hydrocampa albifacialis*, Boisd., Mad., 119, pl. xvi., 1.

Sydney, New South Wales; Auckland, New Zealand; not common. Also occurs in Java, Japan, China, Ceylon, India, Mauritius, Madagascar, South Africa, West Indies, and South America.

Zinckenia perspectalis, Hb.

Pyralis perspectalis, Hb., Exot., 101; Gn., 226;
Zinckenia primordialis, Z., Caff., 56; *Spoladea*
exportalis, Gn., 227.

Duaringa and Rosewood, Queensland; in September, not common. Also occurs in India, West Indies, North and South America, and South Africa.

MOLYBDANTHA, n. g.

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male filiform, evenly ciliated ($\frac{1}{2}$), somewhat serrate towards apex. Labial palpi moderate, somewhat arched, ascending, 2nd joint with dense projecting scales beneath, terminal joint rather short, thick, filiform, exposed, porrected. Maxillary palpi rather large, broadly dilated with scales towards apex, obliquely truncate. Posterior tibiæ with outer spurs about half inner. Abdomen moderate, in male with slender somewhat trifid anal tuft; valves retracted. Fore wings with vein 11 moderate, oblique. Hind wings one-fourth broader than fore wings; 3, 4, 5 approximated at base, 7 out of 6 near origin, anastomosing with 8 to one-third.

Apparently allied to *Notarcha*, but immediately separated by the triangularly dilated maxillary palpi.

Molybdantha bracteolalis, Z.

Botys bracteolalis, Z., Caff., 30; *Isopteryx plumbalis*, Gn., 231; *I. abnegatalis*, Walk., 404; *Botys abnegatalis*, Ld., pl. xi., 17.

Duaringa, Queensland; several specimens received from Mr. G. Barnard. Also occurs in Sumatra, Java, Ceylon, West and South Africa.

Eurrhyparodes accessalis, Walk. (*stibialis*, Snell.) has considerable superficial resemblance to this species, and is perhaps nearly related.

CONCHYLODES, Gn.

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male filiform, evenly ciliated ($\frac{1}{2}$), rough-scaled above. Labial palpi moderate, arched or almost recurved, ascending, 2nd joint with appressed scales, terminal joint slender, filiform, almost acute. Maxillary palpi very short,

filiform. Posterior tibiæ with outer spurs less than half inner. Abdomen moderate, in male with slender anal tuft; valves retracted. Fore wings with vein 11 very long, oblique. Hind wings as broad as fore wings; 3, 4, 5 approximated at base, 7 out of 6 near origin, anastomosing with 8 to one-half. Hind wings in male with median fold dilated and enlarged in cell into an elongate-oval depression.

Nearly allied to *Notarcha*, of which it appears to be a development.

Conchylodes meritalis, Walk.

Zebronia meritalis, Walk., 479; *Z. plexippusalis*, ib., 485; *Conchylodes baptalis*, Snell., Tijd. v. Ent., 1880, 42.

I sent a type to Snellen, who identified it as his species.

Duaringa, Queensland; several specimens received from Mr. G. Barnard. Also occurs in Celebes, Java, and Ceylon.

NOTARCHA, n. g.

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ three-fourths of fore wings, in male filiform, ciliated with tufts of cilia ($1\frac{1}{2}$) or evenly ($\frac{1}{4}$), scaled or pubescent above. Labial palpi moderate, arched, ascending, 2nd joint with dense projecting scales beneath, terminal joint short, thick, cylindrical. Maxillary palpi moderate, filiform. Posterior tibiæ with outer spurs somewhat less than half inner. Abdomen elongate, in male with slender anal tuft; valves retracted. Fore wings with vein 11 long, oblique. Hind wings slightly broader than fore wings; 3, 4, 5 approximated at base, 7 out of 6 near origin, anastomosing with 8 to one-third.

The genus forms two sections, distinguished by the character of the antennal ciliations; it is not likely that this point would prove sufficiently definite for generic separation. The only European species of the genus is *N. ruralis*, Sc., which belongs to the second section, agreeing closely with *N. multilinealis*. The genus is, however, well represented in the Indo-Malayan region.

Lines dark fuscous.

- | | | | | | | |
|------------------------|----|----|----|----|----|------------------------|
| 1. Wings yellow | .. | .. | .. | .. | .. | <i>clytalis</i> . |
| 2. ,, ochreous-whitish | .. | .. | .. | .. | .. | <i>multilinealis</i> . |

b. Lines ochreous-yellow.

1. Discal spot of fore wings sharply triangular, blackish *cassalis*.
2. Discal spot of fore wings yellow, or with a few dark fuscous scales *chrysoplasta*.

A. Antennæ of male ciliated with tufts of cilia ($1\frac{1}{2}$).*Notarcha chrysoplasta*, n. s.

♂, ♀, 22—23 mm. Head, palpi, antennæ, thorax, abdomen, and legs ochreous-yellow; palpi with a spot on basal joint, and terminal joint except apex blackish; anterior tibiæ with apical half blackish, tarsi with apex of 1st joint broadly, of others very narrowly blackish. Fore wings moderate, triangular, costa very slightly sinuate, gently arched posteriorly, apex obtuse, hind margin obliquely rounded; light ochreous-yellow, with darker ochreous-yellow markings; two irregular lines near base; an irregular somewhat curved line from one-fourth of costa to one-third of inner margin; a small discal spot; an irregular line from costa at two-thirds to middle of inner margin, rectangularly arched outwards in middle and returning to beneath discal spot; a suffused subterminal band, contracted or interrupted a little above inner margin; sometimes three minute blackish subcostal dots near base, at one-fourth, and two-thirds, and also one on discal spot, but these are often wholly absent; cilia with basal half ochreous-yellow, apical half whitish yellow. Hind wings with ground colour and markings as in fore wings, but two basal lines absent, no black dots, subterminal band tinged with fuscous-grey; cilia as in fore wings.

Belongs to the same group of closely allied species as *N. cassalis*, Walk., and *N. trigalis*, Ld.; distinguished from the rest by the usual obsolescence of the blackish dots. Compared with *N. cassalis* it is larger, the ground colour yellower and markings less defined, and the subterminal band of hind wings is distinctly tinged with grey.

Duaringa, Queensland; four specimens received from Mr. G. Barnard.

Notarcha cassalis, Walk.

Zebronia cassalis (*cassusalis*), Walk., 477; *Z. auro-linealis*, ib., 478; *Astura obrinusalis*, ib., 549 (nec Ld.); *Botys faustalis*, Ld., pl. x., 15.

Lederer's species, figured as *obrinialis* (*obrinusalis*), Walk., is certainly not this insect, but probably identical

with *plutalis* (*plutusalis*), Walk. *N. cassalis* is the smallest species of the group, very similar to *N. plutalis*, but with the black spots smaller, and the angle of the second line of the fore wings less rectilinear.

Duaringa and Brisbane, Queensland; common in September and October. Also occurs in Celebes, Java, Sumatra, Ceylon, India, and South Africa.

Notarcha clytalis, Walk.

Astura clytalis (*clytusalis*), Walk., 550; *Botys clytialis*, Ld., pl. x., 16.

Duaringa, Queensland; Sydney, New South Wales; common on its food-plant. The larva feeds on *Sterculia*, and is gregarious, living socially in a large nest of silk and leaves.

B. Antennæ of male evenly ciliated ($\frac{1}{4}$).

Notarcha multilinealis, Gn.

Botys multilinealis, Gn., 337, pl. viii., 11; *Zebronia salomealis*, Walk., 476, Suppl., 1348; *Botys oty-salis*, ib., 723; *B. annuligeralis*, ib., Suppl., 1424; *B. basipunctalis*, Brem.

Duaringa and Rosewood, Queensland; three specimens in September. Also occurs in New Guinea, Celebes, Java, Japan, India, and South Africa.

DEUTERARCHA, n. g.

Forehead rounded, rather projecting. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male filiform, evenly ciliated ($\frac{1}{4}$), rough-scaled above. Labial palpi moderate, arched, ascending, 2nd joint with dense projecting scales beneath, terminal joint short, thick, cylindrical, truncate. Maxillary palpi moderate, filiform. Posterior tibiae with outer spurs somewhat less than half inner. Abdomen elongate, in male with slender anal tuft; valves retracted. Fore wings with vein 11 moderately long, oblique. Hind wings somewhat broader than fore wings; 3, 4, 5 approximated at base, 7 out of 6 near origin, anastomosing with 8 to one-fourth.

Distinguished from *Notarcha* by the rounded rather projecting forehead, which yet hardly forms a distinct protuberance. Both species are somewhat peculiar in appearance, and have little resemblance to each other.

Deuterarcha xanthomela, n. s.

♂, ♀, 14—15 mm. Head and palpi light ochreous-yellow. Antennæ fuscous. Thorax dark fuscous, two small spots on anterior margin and terminal half of patagia ochreous-yellow. Abdomen fuscous, segmental margins yellow. Legs yellowish, somewhat suffused with fuscous above. Fore wings moderate, triangular, costa faintly sinuate, gently arched towards apex, apex rounded, hind margin rounded, rather strongly oblique; rather dark fuscous, darker on costa, slightly purplish tinged, with well-defined ochreous-yellow markings; a rounded spot on inner margin almost at base, almost reaching costa; a large trapezoidal blotch extending on inner margin from one-fourth to two-thirds, its upper edge parallel and very near to costa; a moderately large suboblong spot on costa at two-thirds, not reaching middle; a small spot on inner margin before anal angle; sometimes a very obscure yellowish fascia from costa before apex to below middle of hind margin; cilia dark fuscous. Hind wings rather dark fuscous, costa suffused with yellow; cilia dark fuscous.

A handsome and conspicuous species.

Duarina, Queensland; several specimens received from Mr. G. Barnard.

Deuterarcha mesochlora, n. s.

♂, ♀, 14—16 mm. Head whitish ochreous, crown mixed with dark fuscous. Palpi whitish ochreous, externally banded with dark fuscous beneath apex of joints. Antennæ whitish ochreous, annulated with dark fuscous. Thorax dark fuscous, mixed with whitish ochreous. Abdomen whitish ochreous, with a suffused dark fuscous band before middle. Legs whitish ochreous, banded with dark fuscous. Fore wings somewhat elongate, triangular, costa faintly sinuate, gently arched towards apex, apex rounded, hind margin obliquely rounded; pale dull whitish ochreous; first line straight, thick, blackish, from one-third of costa to two-fifths of inner margin, basal area up to this line rather dark fuscous; second line thick, blackish, from three-fourths of costa to beyond middle of inner margin, obtusely indented outwards in middle, hind marginal area beyond this line rather dark fuscous; a cloudy fuscous discal spot; three small semicircular blackish fuscous-centred marks on costa between first and second lines; cilia whitish ochreous, somewhat suffused with fuscous, with a broad darker line. Hind wings pale ochreous-yellow, with a broad rather dark fuscous hind-marginal band, attenuated to anal angle,

irregularly indented in middle; cilia ochreous-whitish, with a suffused dark fuscous line.

Readily recognised by the contrast between the pale central and dark basal and hind marginal areas.

Duaringa, Queensland; several specimens received from Mr. G. Barnard.

CONOGETHES, n. g.

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ three-fourths of fore wings, in male (?). Labial palpi moderate, arched, ascending, 2nd joint densely rough-scaled beneath, terminal joint conically scaled, base as thick as apex of 2nd joint, apex pointed. Maxillary palpi rather short, filiform. Posterior tibiæ with outer spurs one-third of inner. Abdomen moderate, in male (?). Fore wings with vein 11 moderately long, oblique. Hind wings as broad as fore wings; 3, 4, 5 approximated at base, 7 out of 6 near origin or from a point with 6 (*punctiferalis*), anastomosing with 8 to beyond one-third.

I have not been able to examine the characters of the male, but they are probably not different from those of *Notarcha*, from which the genus is distinguished by the quite different form of the terminal joint of the labial palpi.

- | | | |
|---|----|-------------------------|
| a. Wings with dark fuscous dots and lines | .. | <i>punctiferalis</i> . |
| b. ,, without ,, ,, | .. | <i>infundibulalis</i> . |

Conogethes punctiferalis, Gn.

Astura punctiferalis, Gn., 320; *A. ersealis*, Walk., 980; *Botys evaxalis*, ib., 995; *B. nicippealis*, ib., 999; *Astura guttatalis*, ib., Suppl., 1381; *A. semifascialis*, ib., Suppl., 1381.

Astura semifascialis, Walk., seems to be a variety with a dark fuscous central suffusion, the markings not otherwise different.

Brisbane, Queensland; one specimen in September. Also from Ceram, China, and India.

Conogethes infundibulalis, Snell.

Botys infundibulalis, Snell., Midd. Sum., 64.

I sent a type to Snellen, who returned it as above.

Duaringa and Toowoomba, Queensland, in September; two specimens. Also occurs in Sumatra.

PACHYZANCLA, n. g.

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ three-fourths of fore wings, in male (?). Labial palpi moderate, somewhat arched, ascending, 2nd joint densely rough-scaled beneath, terminal joint thick, conical, base as thick as apex of 2nd joint. Maxillary palpi rather short, filiform. Posterior tibiæ with outer spurs one-third of inner. Abdomen moderate, in male (?). Thorax in male with patagia broadly elongate, nearly twice as long as thorax. Fore wings with vein 11 moderately long, oblique. Hind wings as broad as fore wings; 3, 4, 5 approximated at base, 7 out of 6 near origin, anastomosing with 8 to beyond one-third.

I have not examined the male, but have seen one. The genus is distinguished from *Conogethes* by the elongate patagia (which are not, however, produced into an elongate pencil as in *Omiodes*); the palpi are essentially similar, but considerably stouter.

Pachyzancla mutualis, Z.

Botys mutualis, Z., Caff., 40; *B. stultalis*, Walk., 669; *B. retractalis*, ib., Suppl., 1447; *B. ægrotalis*, Snell. (nec Z.), Tijds. v. Ent., 1872, 90, pl. vii., 8; Midd. Sum., 63.

I sent a type to Snellen, who assures me that it is identical with a specimen of *mutualis*, Z., communicated to him by Zeller himself. The specimens in the British Museum, added by Butler to *Botys bianoralis*, Walk., are this species (Walker's is an *Omiodes*, probably identical with one of Guenée's); the specimens added by Butler to *stultalis*, Walk., are *Botys phæopteralis*, Gn.

Duaringa, Queensland; two specimens sent by Mr. G. Barnard. Also occurs in Celebes, Java, Borneo, Japan, Ceylon, and South Africa.

PELECYNTIS, n. g.

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ three-fourths of fore wings, in male filiform, evenly ciliated ($\frac{1}{2}$), rough-scaled above. Labial palpi moderate, arched, ascending, basal joint with a tuft of projecting scales, 2nd joint with long projecting scales beneath, somewhat separated in middle to form two angular tufts, terminal joint very short, broadly dilated with scales towards apex so as to become triangular.

Maxillary palpi moderate, filiform, loosely scaled towards apex. Posterior tibiæ with outer middle-spur less than one-third of inner, outer end-spur less than one-half. Thorax in male with a tuft of very long scales from extremity of patagia. Abdomen elongate, in male with dense rather long anal tuft; valves retracted. Fore wings with vein 11 long, oblique. Hind wings somewhat broader than fore wings; 3, 4, 5 closely approximated at base, 7 out of 6 near origin, anastomosing with 8 to one-third.

Allied to *Pachyzancla*, but differing from it and *Omiodes* by the triangularly dilated terminal joint of the labial palpi; it has the elongate tuft of the patagia much as in *Omiodes*.

Pelecyntis abstitalis, Walk.

Pyrausta abstitalis (*absistalis*), Walk., 311; *Asopia lydialis*, ib., 374; *Botys ustalis*, Ld., pl. x., 14.

Duringa and Brisbane, Queensland, in September; three specimens. Also from Amboina, Ceylon, and India.

HELLULA, Gn.

Forehead flat, oblique. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male stout, evenly ciliated ($\frac{1}{4}$). Labial palpi moderate, obliquely ascending, 2nd and terminal joints triangularly dilated towards apex of each with projecting scales. Maxillary palpi moderately long, very slender, filiform. Posterior tibiæ with outer spurs nearly as long as inner. Abdomen moderate, in male with short truncate anal tuft; valves retracted. Fore wings with vein 11 moderate, tolerably oblique. Hind wings one-fourth broader than fore wings; 4 and 5 from a point, 7 from a point with 6, anastomosing with 8 to one-third. Lower median vein of hind wings with long loose pectination towards base.

Lederer makes the surprising error of stating that the maxillary palpi are absent, directly contradicting Herrich-Schäffer, who had seen them; they are as well developed as in any genus, but unusually slender. Moreover, he does not notice the pectination of the lower median. The genus is of uncertain affinity.

Hellula undalis, F.

Phalæna undalis, F., E. S., 362; Gn., 416; *Hellula hydralis*, Gn., 416; *Scopula criasusalis*, Walk., 1016; *Scoparia optatusalis*, ib., 1018; *Pyralis subtrigonalis*, ib., Suppl., 1244.

H. hydralis, Gn., is certainly only a common variety of the female.

Duaringa and Toowoomba, Queensland; Sydney, New South Wales; Melbourne, Victoria; Mount Lofty range, Port Lincoln, and Quorn, South Australia; very common generally; in September, October, November, and May. Also occurs in South Europe, India, and South Africa.

PROTERNIA, n. g.

Forehead with a blunt rounded projection. Ocelli present. Tongue well developed. Antennæ three-fourths of fore wings, in male stout, evenly ciliated (†), rough-scaled above, sinuate and bent at two-thirds, with a row of projecting scales in bend beneath, beyond it rapidly attenuated. Labial palpi moderately long, straight, porrected or somewhat ascending, 2nd joint with dense projecting scales beneath, terminal joint almost concealed. Maxillary palpi moderate, slender, filiform. Posterior tibiæ with outer spurs half inner. Abdomen moderate (in male broken). Fore wings with vein 11 long, oblique. Hind wings as broad as fore wings; 3, 4, 5 tolerably approximated at base, 7 out of 6 near origin, anastomosing with 8 to near middle.

Allied to *Semioceros*, from which it differs by the frontal projection, and by the antennal bend not being tufted above but containing a row of scales beneath.

Proternia philocapna, n. s.

♂, ♀, 21—26 mm. Head, palpi, antennæ, thorax, and abdomen rather dark fuscous, mixed with whitish ochreous. Legs dark fuscous, apex of joints and posterior pair whitish ochreous. Fore wings moderate, triangular, costa at first almost straight, on posterior half moderately arched, apex rectangular, hind margin slightly waved, obliquely rounded; rather dark fuscous, somewhat mixed with paler; markings obscurely darker fuscous; first line irregular, from one-third of costa to before middle of inner margin; a small round pale-centred spot in disc before middle, and an 8-shaped pale-centred discal spot; second line from three-fourths of costa to two-thirds of inner margin, rather sharply dentate, irregularly curved outwards below middle, followed by an obscure whitish ochreous line, tolerably distinct towards costa; an interrupted dark fuscous hind-marginal line; cilia whitish ochreous, mixed with fuscous, suffusedly spotted with dark fuscous towards base. Hind wings fuscous, darker on hind margin, obscurely mixed with whitish ochreous towards base; a cloudy dark fuscous

discal spot; a faint irregular dentate pale posterior line; cilia ochreous-whitish, with an interrupted dark fuscous line.

A very dull-looking species.

Hamilton, New Zealand; five specimens (one male, four females) taken in a house, presumably attracted by light, in January.

SEMIOCEROS, n. g.

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ three-fourths of fore wings, in male stout, subdentate or serrate, evenly ciliated ($\frac{4}{3}$) (*murcalis*) or with tufts of cilia ($1\frac{1}{2}$), rough-scaled above, bent before middle (not in *amphicedalis*), sharply bent beyond middle, with a tuft of scales on back above bend. Labial palpi moderate, porrected or ascending, 2nd joint with short dense projecting scales beneath, terminal joint short, stout, obtuse, exposed. Maxillary palpi short, slender, filiform. Posterior tibiæ with outer middle-spurs one-third, outer end-spurs one-half of inner. Abdomen moderate, in male with very short truncate tuft; valves retracted. Fore wings with vein 11 moderately long and oblique. Hind wings as broad as fore wings; 3, 4, 5 approximated at base, 7 out of 6 near origin, anastomosing with 8 to near middle.

Easily recognised by the antennal characters. To this genus belongs also (as I am assured by Snellen) *Botys gratalis*, Ld.

- a. Fore wings light yellow *chrysorycta*.
 b. ,, suffused with fuscous.
 1. Discal space before second line suffused with whitish *amphicedalis*.
 2. Discal space before second line fuscous .. *murcalis*.

Semioceros amphicedalis, Walk.

Salbia amphicedalis, Walk., 363.

♂, 22 mm. Head, palpi, and thorax rather dark fuscous, thorax mixed with whitish posteriorly, palpi with lower half white. Antennæ whitish, annulated with fuscous. Abdomen fuscous, mixed with white, with a suffused white basal band. Legs whitish, anterior tibiæ and tarsi, and middle tarsi dark fuscous, apex of joints whitish. Fore wings moderate, triangular, costa slightly sinuate, gently arched towards apex, apex tolerably rectangular, hind margin obliquely rounded; grey-whitish, with purple reflections, towards inner margin ochreous-tinged; costa with about six small dark fuscous spots; a rather dark fuscous suffusion

along costa from base to three-fifths; a suffused fuscous basal patch; a small round dark fuscous pale-centred spot in disc at one-third, a similar spot below it, and a curved-oblong similar discal spot; second line dark fuscous, from four-fifths of costa to two-thirds of inner margin, waved, middle third abruptly curved outwards; a broad fuscous hind marginal band, extending almost to second line; cilia grey, basal third whitish barred with dark fuscous, with a rather large white spot at anal angle. Hind wings with ground colour, second line, and hind-marginal band as in fore wings; a dark fuscous discal spot; cilia white, basal third barred with dark grey.

I have not seen the type of this species; it is the only one of Walker's which I have identified from the description alone, but I believe it is correct.

Duaringa, Queensland; one specimen received from Mr. G. Barnard.

Semioceros murcalis, Walk.

Nacoleia murcalis (*murcusalis*), Walk., 935; *Isopteryx sordidalis*, ib., Suppl., 1317; *Botys hypsidesalis*, ib., 1006.

♂, ♀, 16—21 mm. Head, palpi, antennæ, thorax, and abdomen brownish ochreous mixed with dark fuscous; palpi snow-white on lower half. Legs whitish ochreous, anterior tibiæ dark fuscous towards apex. Fore wings moderate, triangular, costa slightly sinuate, moderately arched towards apex, apex round-pointed, hind margin sinuate, rather strongly oblique; brownish ochreous, irrorated with dark fuscous; lines rather thick, conspicuous, dark fuscous; first line irregular, from one-fifth of costa to one-third of inner margin; second from three-fourths of costa to three-fifths of inner margin, irregularly dentate, sharply angulated inwards at two-thirds to beneath discal spot, followed by an ochreous-whitish line, angulation filled with a dark fuscous suffusion; a subquadrate discal spot, not darker than ground colour, but laterally dark-margined, and a smaller similar spot in disc before middle, the space between these forming a conspicuous white spot; a more suffused white spot beyond discal spot, and a whitish mark before first spot; a row of crescentic dark fuscous spots on hind margin; cilia whitish ochreous, with a dark fuscous line at one-third, terminal portion grey, a subquadrate white spot at anal angle. Hind wings with ground colour and markings as in fore wings, but apex suffused with dark fuscous, first line and first discal spot obsolete, costa suffused with whitish; cilia white, with a dark grey line at one-third.

Duaringa and Toowoomba, Queensland; Sydney, New South Wales; Launceston and Deloraine, Tasmania; common, in September, November, and March; almost certainly attached to *Acacia decurrens*.

Semioceros chrysorycta, n. s.

♂, ♀, 14—16 mm. Head, palpi, antennæ, thorax, abdomen, and legs pale ochreous-yellow; a small dark fuscous spot on shoulder; two dark fuscous rings on abdomen before middle, and a band near apex; anterior tibiæ dark fuscous towards apex. Fore wings moderate, triangular, costa sinuate, moderately arched towards apex, apex almost rectangular, hind margin obliquely rounded; light ochreous-yellow, markings dark fuscous; an interrupted line almost at base, and a spot on costa near base; an 8-shaped yellow-centred mark in disc at one-third, connected with inner margin at one-third by a straight line; a suboval yellow-centred discal spot; a line from three-fourths of costa to two-thirds of inner margin, sinuate inwards towards costa, sharply angulated inwards to below discal spot; a narrow streak along hind margin, forming a triangular spot above middle, and another at anal angle touching angulation of second line; cilia white, with a dark grey line at one-third. Hind wings with ground colour and hind-marginal markings as in fore wings; two dark fuscous lines at one-third and two-thirds, first straight, second irregular; cilia as in fore wings.

Lederer's *gratalis* is very similar to this species, but has a broader dark hind-marginal border, not forming distinct spots above middle and at anal angle.

Duaringa, Queensland; sent commonly by Mr. G. Barnard.

APHYTOCEROS, n. g.

Forehead flat, vertical. Ocelli present, but concealed with scales. Tongue well developed. Antennæ three-fourths of fore wings, in male stout, filiform, quite simple, naked. Labial palpi moderate, straight, porrected, triangularly scaled, terminal joint concealed. Maxillary palpi short, dilated with loose scales towards apex. Thorax densely hairy beneath between 1st and 3rd pair of legs. Anterior tibiæ with joints dilated with rough scales at apex; posterior tibiæ with outer spurs less than half inner. Abdomen moderately elongate, very stout, in male with scanty anal tuft; valves exerted. Fore wings with veins 6 and 7 from a point, 11 moderately long and oblique. Hind wings as broad as fore wings;

lower angle of cell produced; 3 tolerably near 4, 4 and 5 from a point, 7 out of 6 near origin, anastomosing with 8 to one-third.

Rather a peculiar type, and perhaps of South American affinity.

Aphytoceros lucalis, Walk.

Botys lucalis (*lucusalis*), Walk., 722; *B. histrionalis*, Ld., pl. ix., 13.

Sydney, New South Wales; two specimens taken on lamps in December and January.

GODARA, *Walk., Ld.*

I have not the specimens of this genus to hand, and cannot at present add anything to the characters given by Lederer.

Godara comalis, Gn.

Pionea comalis, Gn., 368.

Duaringa, Queensland; several specimens received from Mr. G. Barnard. Also occurs in India.

BOTYS, *Tr.*

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ three-fourths of fore wings, in male filiform, ciliated with tufts of cilia ($1\frac{1}{2}$) or evenly ($\frac{3}{4}$ — $\frac{1}{2}$), sometimes pubescent or rough-scaled above. Labial palpi moderate, straight, porrected, triangularly scaled, terminal joint tolerably concealed. Maxillary palpi moderate or short, filiform. Posterior tibiæ with outer middle-spur one-fourth to one-half, outer end-spur one-half of inner, or all long and equal. Abdomen moderate, in male with slender anal tuft; valves tolerably retracted (in *salentialis* exerted?). Fore wings with vein 11 moderately long and oblique. Hind wings somewhat broader than fore wings; 3, 4, 5 approximated at base, 7 out of 6 near origin, anastomosing with 8 to near middle.

The genus as thus restricted is probably quite wide enough; it may bear further subdivision on the basis of the differences in the spurs of the posterior tibiæ, as in the two main sections given below.

- | | | | | | | | |
|----|--------------------------------------|----|----|----|----|----|-----------------------|
| a. | Wings greyish fuscous | .. | .. | .. | .. | .. | <i>phaopteralis</i> . |
| b. | „ ochreous-whitish | .. | .. | .. | .. | .. | <i>incoloralis</i> . |
| c. | „ yellowish. | | | | | | |
| | 1. Hind wings without distinct lines | | | .. | .. | .. | <i>salentialis</i> . |

2. Hind wings with distinct lines.

- i. Second line of fore wings from three-fifths of costa *æqualis*.
- ii. Second line of fore wings from near three-fourths of costa *abruptalis*.

A. Posterior tibiæ with outer spurs not more than half inner.

- a. Antennæ of male evenly ciliated ($\frac{1}{3}$ — $\frac{1}{2}$).

Botys salentialis, Snell.

Botys salentialis, Snell., Tijd. v. Ent., 1880, 207; ib., 1863, pl. vii., 1.

As noticed by Snellen, the description of Guenée's *Botys furnacalis* comes very near this, but he distinctly states the middle tibiæ of the male to contain a long pencil of hairs, which is not the case in this species; I have not been able to identify Guenée's species, which he gives as Australian.

Sydney, New South Wales; three specimens on lamps in February. Also from Celebes and Java.

Botys incoloralis, Gn.

Botys incoloralis, Gn., 332; *B. melonalis*, Walk., 702; *Spilodes nitetisalis*, ib., 773; *S. dasconalis*, ib., 773 (nec Ld.); *Botys albidalis*, ib., Suppl., 1411; *B. ruficostalis*, Ld., Verh. z. b. G. Wien, 1855, 217, pl. iii., 4.

I have seen a specimen of Lederer's *ruficostalis*, probably authentic, in Zeller's collection; it is certainly this species. Lederer's identification of Walker's *dasconalis* is quite erroneous, according to his figure; I am not aware that this species occurs in North America.

Duaringa, Queensland; two specimens received from Mr. G. Barnard. Also occurs in Celebes, Java, India, and West Africa.

- b. Antennæ of male ciliated with tufts of cilia ($1\frac{1}{2}$).

Botys phæopteralis, Gn.

Botys phæopteralis, Gn., 340; *B. otreusalis*, Walk., 637; *B. triarialis*, ib., 639; *B. neloalis*, ib., 643; *B. abstrusalis*, ib., 663; *B. pharaxalis*, ib., 725; *B. immundalis*, ib., Suppl., 1448.

Specimens of this species in Zeller's collection are labelled *phæopteralis*, Gn., and are probably authentic.

Duaringa, Queensland; Sydney, New South Wales, in January; several specimens. Also occurs in Java, Formosa, China, Ceylon, Mauritius, West Africa, and South America.

Botys abruptalis, Walk.

Asopia abruptalis, Walk., 371; *A. dotatalis*, ib., Suppl., 1305; *A. suffectalis*, ib., Suppl., 1307; *Botys jucundalis*, Ld., 463, pl. viii., 17.

Duaringa, Queensland; one specimen sent by Mr. G. Barnard. Also occurs in Ceylon, India, and West Africa.

B. Posterior tibiæ with spurs all nearly equal.

Botys æqualis, Ld.

Botys æqualis, Ld., 468, pl. x., 3.

Duaringa, Queensland; three specimens received from Mr. G. Barnard. Also occurs in India.

ATELOCENTRA, n. g.

Forehead flat, somewhat oblique. Ocelli present. Tongue well developed. Antennæ three-fourths of fore wings, in male thick, filiform, evenly ciliated ($\frac{1}{2}$), with whorls of scales at joints. Labial palpi long, straight, porrected, elongate-triangularly scaled, terminal joint moderate, lying in scales of second. Maxillary palpi moderate, dilated with loose scales towards apex. Posterior tibiæ with both outer spurs in male rudimentary, almost obsolete. Abdomen moderate, in male with short anal tuft; valves retracted. Fore wings with vein 11 long, very oblique. Hind wings somewhat narrower than fore wings; 3, 4, 5 tolerably approximated at base; 7 out of 6 near origin, anastomosing with 8 to beyond middle.

Distinguished by the obsolescence of both outer spurs in male.

Atelocentra chloraspis, n. s.

♂, 18 mm. Head and antennæ fuscous. Palpi rather dark ochreous-fuscous, white towards base beneath. Thorax ochreous-brown. Abdomen reddish ochreous. Legs snow-white, anterior tibiæ dark grey towards apex. Fore wings short, rather broad, triangular, costa at first straight, towards apex moderately arched, apex rectangular, hind margin slightly oblique, straight, rounded

beneath; ochreous-brown, irrorated, especially towards base, with dark reddish fuscous scales, which are metallic-blue in some lights; first line indicated on inner margin at two-fifths; a very large light brassy yellow costal blotch, dark-margined, extending on costa from one-fourth to three-fifths, reaching towards anal angle more than half across wing, margins irregularly rounded, with a small indentation in middle of lower margin, beneath which is a pale yellow dot; within this blotch are two very small round ochreous dark-margined spots towards costa, two small dark fuscous dots towards lower margin, and a few dark scales in middle; an outwards-curved dark fuscous line from costa at five-sixths to close before hind margin below middle, followed by a row of five small light brassy yellow spots, the three lowest mostly suffused with reddish ochreous; costa towards apex paler; hind margin dark reddish fuscous, except a pale interrupted marginal line; cilia grey, with a blackish basal line. Hind wings brownish ochreous, becoming very much paler towards costa and inner margin; a pale brassy yellow central dot, surrounded by dark fuscous scales; an obscure dentate dark fuscous line towards hind margin; cilia as in fore wings, becoming much paler towards anal angle.

A beautiful and conspicuous species, certainly with some perceptible affinity to the European *sambucalis*, S. V. (which, however, has the outer end-spur developed).

Fernshaw, Victoria; one fine specimen in November, taken in swampy forest.

SCOPULA, *Schrk.*

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male rather stout, filiform, evenly ciliated ($\frac{1}{4}$ — $\frac{1}{3}$), rough-scaled above. Labial palpi rather long, straight, corrected, elongate-triangularly scaled, terminal joint concealed. Maxillary palpi moderate, dilated with loose scales towards apex. Posterior tibiæ with outer middle-spur in male obsolete, in female half inner, outer end-spur one-half to three-fourths of inner. Abdomen moderate, in male with moderate loose anal tuft; valves exerted. Fore wings with vein 11 moderately long, oblique. Hind wings as broad as fore wings; 3 rather remote, 4 and 5 closely approximated towards base, 7 out of 6 near origin, anastomosing with 8 to near middle.

This genus differs from all others of the family represented in Australia in having the outer middle-spur of

the male obsolete, whilst all the rest are as usual. In Europe there are very many species thus characterised, and they undoubtedly form a connected group, but are not necessarily to be included in a single genus; on this point I need express no opinion at present. Some at least, however (*prunalis*, Schiff., *olivalis*, S. V., *ferrugalis*, Hb., &c.), agree exactly with the characters given above, and I have therefore redefined the genus *Scopula* as adopted by Guenée to contain them.

Scopula dicealis, Walk.

Scopula dicealis, Walk., 792.

♂, ♀, 20—22 mm. Head, palpi, antennæ, and thorax pale greyish ochreous; palpi suffused with fuscous on sides, beneath white. Abdomen pale greyish ochreous irrorated with fuscous, segmental margins whitish. Legs ochreous-whitish, anterior tibiae fuscous. Fore wings broadly triangular, costa moderately arched on posterior half, apex rectangular, hind margin obliquely rounded, slightly sinuate beneath apex; pale greyish ochreous, irrorated with rather dark fuscous; lines distinct, dark fuscous; first from before one-fourth of costa to two-fifths of inner margin, obtusely bent in middle; second from three-fourths of costa to before two-thirds of inner margin, obscurely subdentate, moderately curved outwards from a little beneath costa to beneath discal spot, thence straight; discal spots pale, of the ground colour, margined with dark fuscous; first longitudinally oval; second 8-shaped; a row of dark fuscous hind marginal dots; cilia pale greyish ochreous, with two obscure dark fuscous lines. Hind wings pale greyish ochreous, irrorated with dark fuscous, becoming more whitish towards base; discal spot small, dark grey, and a fainter similar one before it; a cloudy dark grey rather irregular curved line at three-fourths; apex sometimes suffused with fuscous; a row of dark fuscous hind marginal dots; cilia ochreous-whitish, with two dark fuscous lines.

Closely allied and very similar to the European *S. prunalis*, Schiff., but paler and more ochreous-tinged.

Larva pale green, feeding on nettle (*Urtica*), in March.

Fish River Caves, New South Wales; common on the limestone hills amongst its food-plant in April.

MECYNÆ, *Gn.* (nec *Steph.*).

Forehead flat, somewhat oblique. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male filiform, tolerably evenly ciliated ($\frac{2}{3}$). Labial palpi long, straight, porrected, triangularly scaled, terminal joint moderately long, lying in scales of second. Maxillary palpi moderate, dilated with scales towards apex, obliquely truncate. Middle tibiæ in male broadly and flatly dilated, with a groove on inner side, generally containing a large exsertible tuft of woolly hairs; posterior tibiæ with outer spurs half inner. Abdomen moderate, in male with moderate anal tuft; valves exserted. Fore wings with vein 11 moderate, rather oblique. Hind wings somewhat broader than fore wings; 3, 4, 5 approximated at base, 7 out of 6 near origin, anastomosing with 8 to one-half.

Characterised by the triangularly dilated maxillary palpi, and the grooved middle tibiæ of male. I find it impossible at present to speak accurately about the species of this genus, which vary locally in colour, and require to be distinguished structurally. I cannot assert that there are others.

- a. Middle tibiæ of male containing a very large tuft of hairs *polygonalis*.
 b. Middle tibiæ of male without tuft *deprivalis*.

Mecynæ polygonalis, Hb.

Pyrallis polygonalis, Hb.; *Mecynæ ornithopteraleis*, Gn., 411.

The Australian form described by Guenée as *ornithopteraleis* only differs from the European in the somewhat broader and more extended dark border of the hind wings. Guenée's figure is exaggerated. I have not been able to examine properly the European form, but believe there is no structural difference. Probably some of the other species described by Guenée are merely local modifications of this also.

Larva in Australia on various *Leguminosæ* (*Templetonia*, &c.), in October and November. The following is a description of the Australian larva, which may be compared with that of other forms:—Elongate, cylindrical, somewhat tapering towards both ends, with very long scattered whitish hairs; yellowish green; a broad fuscous lateral stripe, containing three large irregular

nearly confluent black raised spots on each segment, each spot marked with a white dot on upper and lower margins; beneath these an irregular oval ochreous-reddish spot on each segment from 5th to 12th; subspiracular line slender, white, towards segmental divisions yellow, marked with an oblique black bar beneath each spiracle; spots beneath subspiracular large, black; head black, mouth yellowish; 2nd segment black, with slender dorsal and subdorsal white lines; 12th and anal segments black above, with irregular whitish dorsal spots.

Toowoomba and Duaringa, Queensland; Sydney and Blackheath (3500 feet), New South Wales; Fernshaw and Melbourne, Victoria; Hobart, Tasmania; Adelaide, Quorn, and Port Lincoln, South Australia; generally common, from September to December, and in March. Also from Southern Europe.

Mecyna deprivalis, Walk.

Mecyna deprivalis, Walk., 806; *Botys maoralis*, Feld., cxxxiv., 34.

Smaller, darker, and more suffused than the preceding. I have only been able to dissect one male, but could find no trace of the large tuft of hairs so conspicuous in the preceding species.

Auckland, Wanganui, and Christchurch, New Zealand; rather common, in January and March. Also occurs in Ceylon; I believe this form is also found in South Europe.

Larva in New Zealand on *Sophora tetraptera* (*Leguminosæ*); it differs from the preceding, but I have not a complete description.

MYRIOSTEPHES, n. g.

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ three-fourths of fore wings, in male filiform, with whorls of rough scales at joints, evenly ciliated ($\frac{1}{3}$). Labial palpi moderately long, straight, porrected, triangularly scaled, terminal joint somewhat pencil-form, partially concealed. Maxillary palpi moderate, dilated with rough scales towards apex. Posterior tibiæ with outer middle-spur in male one-fifth, in female one-half of inner, outer end-spur two-thirds of inner. Abdomen moderate, in male

with moderate anal tuft; valves exerted. Fore wings with vein 11 moderately long, oblique. Hind wings as broad as fore wings; 3 moderately remote, 4 and 5 approximated at base; 7 out of 6 near origin, anastomosing with 8 to middle.

Differs from *Botys* especially by the dilated maxillary palpi.

Myriostephes matura, n. s.

♂, ♀, 11—14 mm. Head, palpi, and thorax ochreous-yellow; palpi externally fuscous-tinged, beneath white. Antennæ ochreous, spotted with dark fuscous. Abdomen ochreous-yellow, paler posteriorly. Legs pale grey, anterior tibiæ darker. Fore wings moderate, triangular, costa faintly sinuate in middle, arched towards apex, apex tolerably acute, hind margin sinuate beneath apex, obliquely rounded; ochreous-yellow, often shading into brownish ochreous posteriorly; costal edge dark fuscous from base to beyond middle, thence yellowish white to four-fifths; lines ochreous-fuscous, faintly subdentate; first from one-fourth of costa to one-third of inner margin, slightly curved; second from a small blackish spot at two-thirds of costa to two-thirds of inner margin, gently curved to below middle, then shortly broken inwards; discal spot transversely linear, obscure, ochreous-fuscous; a blackish fuscous hind marginal line; cilia white, with a strong sharply marked blackish line at one-third. Hind wings yellow ochreous, posteriorly suffused with fuscous, in female broadly suffused with rather dark fuscous; a faint discal spot; second line, hind-marginal line, and cilia as in fore wings.

Sydney, New South Wales; common amongst dry scrub, in November, December, and March.

MNESICTENA, n. g.

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ three-fourths of fore wings, in male filiform, evenly ciliated ($\frac{3}{4}$ — $\frac{1}{2}$), or biciliated (1) (*notata*), rough-scaled above. Labial palpi moderate or long, straight, porrected, triangularly scaled, terminal joint somewhat pencil-form, partially concealed. Maxillary palpi moderate, dilated with rough scales towards apex. Posterior tibiæ with outer middle-spurs one-half, outer end-spurs two-thirds of inner. Abdomen moderate, in male with short anal tuft; valves exerted. Fore wings with vein 11 moderately long, oblique. Hind wings as broad as fore wings; 3 moderately remote, 4 and 5 approximated at base, 7 out of 6 near origin, anastomosing with 8 to two-fifths. Hind wings with lower median loosely and thinly pectinated towards base.

Distinguished from its nearest allies by the pectination of the lower median of hind wings; this character is, however, much less marked than in the *Crambidae*. Besides the three New Zealand species (all endemic), I have very little doubt that *Scopula amitina*, Butler (of which *S. cinerea*, Butler, is clearly a mere variety), from Chili, belongs to this genus; I have seen the types, but have not been able to examine their structure; they are, however, closely allied specifically to *Mnesictena marmorata* and *M. flavidalis*.

- a. Fore wings with a clear white spot in disc.
 1. Hind wings with a distinct line *marmorata*.
 2. " without " *notata*.
 b. Fore wings without white spots *flavidalis*.

Mnesictena marmorata, n. s.

♂, ♀, 20—28 mm. Head, palpi, antennæ, and thorax varying from ochreous to grey; palpi externally suffused with dark grey, beneath white. Abdomen varying from yellowish to grey. Legs ochreous-whitish, anterior pair suffused with grey. Fore wings broadly triangular, costa moderately arched on posterior half, apex obtuse, hind margin obliquely rounded; yellowish ochreous, irrorated with grey, sometimes wholly suffused with grey; lines slightly dentate, dark grey; first from one-fifth of costa to one-third of inner margin, obtusely bent in disc; second from four-fifths of costa to three-fourths of inner margin, externally margined with paler, between two-thirds and four-fifths strongly curved inwards to beneath discal spot; a tolerably round white spot in disc above middle, preceded and followed by subquadrate darker grey shades; apical half of costa pale, with four dark grey spots; a row of minute dark grey dots on hind margin; cilia grey, tips ochreous-whitish. Hind wings yellowish, irrorated with grey, sometimes mostly suffused with pale grey; two small round dark fuscous spots placed one obliquely above and before the other in disc; a dark grey line at three-fourths, sinuate inwards beneath costa, and sending a curve inwards beneath discal spot; a grey hind marginal band, obsolete towards anal angle, broader and darker at apex; hind marginal dots and cilia as in fore wings.

Near *M. flavidalis*, but larger and much greyer; always distinguished by the clear white spot in disc.

Palmerston, Christchurch, and Dunedin, New Zealand; several specimens in December, January, and March.

Mnesictena flavidalis, Dbld.

Margaritia flavidalis, Dbld., Dieff. N. Z., ii., 287 ;
M. quadralis, ib., 288 ; *Scopula dipsasalis*, Walk.,
 796 ; *Botys otagalus*, Feld., cxxxiv., 35.

Variable in brightness and depth of colouring.

Auckland, Taranaki, Napier, Wellington, Christchurch, and Dunedin, New Zealand ; probably generally abundant throughout the North and South Islands, from January to March.

Mnesictena notata, Butl.

Scopula notata, Butl., Cist. Ent., ii., 493.

Arthur's Pass (3000 feet) and Dunedin, New Zealand ; a local species ; several specimens in January.

NESARCHA, n. g.

Forehead flat, oblique. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male rather stout, filiform, evenly ciliated ($\frac{1}{2}$), rough-scaled above. Labial palpi very long, straight, porrected, 2nd joint with dense evenly projecting scales beneath, terminal joint rather long, exposed, with shorter projecting scales beneath. Maxillary palpi moderate, dilated with loose scales towards apex. Posterior tibiæ with outer middle-spur in male one-sixth, in female one-half, outer end-spur in male one-third, in female one-half of inner. Abdomen elongate, in male with moderate anal tuft ; valves exerted. Fore wings with vein 11 moderately long, oblique. Hind wings hardly broader than fore wings ; 3 remote, 4 and 5 somewhat approximated at base, 7 out of 6 rather near origin, anastomosing with 8 to one-half.

Of doubtful affinity, but I think there is a relationship with *Mnesictena* ; the form of wing is peculiar, but cannot be regarded as generic.

Nesarcha hybreadalis, Walk.

Scopula hybreadalis (*hybreasalis*), Walk., 797 ; *Scopula paronalis*, ib., 797 ; *Adena xanthialis*, ib., Cr., 198.

♂, ♀, 24—31 mm. Head and thorax varying from light ochreous to fuscous, white at base beneath. Antennæ ochreous, spotted with dark fuscous above. Abdomen whitish ochreous,

towards apex sometimes suffused with fuscous. Legs whitish ochreous, anterior tibiae fuscous. Fore wings moderately broad, triangular, costa at first slightly, on posterior half strongly arched, apex almost acute, hind margin with upper half excavated, lower half sinuate, so that there is formed a blunt rounded median projection; varying from light yellow ochreous or reddish ochreous to rather dark fuscous, often with these colours irregularly mixed and suffused, sometimes slightly purplish-tinged; lines tolerably distinct, dark fuscous; first from one-fourth of costa to one-third of inner margin, dilated beneath; second from three-fourths of costa to two-thirds of inner margin, tolerably parallel to hind margin, irregularly subdentate; sometimes a small pale ochreous-margined spot before first line beneath costa; a triangular white spot on middle of costa, its apex cut off by a pale ochreous streak, sometimes partially or wholly obsolete; a very small white spot on costa at two-thirds; second line preceded on costal third by three or four partially confluent variable small white spots, sometimes wholly obsolete; cilia greyish ochreous mixed with fuscous, with two dark fuscous lines. Hind wings sinuate below apex; pale yellow ochreous; a grey discal dot, and sometimes a second beyond it; generally a grey line about two-thirds, tolerably parallel to hind margin; sometimes hind margin more or less suffused with dark grey; cilia as in fore wings.

A very variable species, of peculiar appearance.

Auckland, Palmerston, Christchurch, and Dunedin, New Zealand; common in December, January, and March.

METALLARCHA, n. g.

Forehead with an obtuse truncate-conical or elongate flattened projection. Ocelli present. Tongue well developed. Antennae three-fourths of fore wings, in male filiform, slender, evenly ciliated ($\frac{1}{2}$ — $\frac{3}{4}$). Labial palpi moderate, straight, porrected, 2nd joint with long projecting scales beneath, terminal joint concealed. Maxillary palpi moderate, filiform. Posterior tibiae with outer middle-spurs one-third to one-half, outer end-spurs one-half of inner. Abdomen elongate, in male with short anal tuft; valves retracted. Fore wings with vein 11 moderate, rather oblique. Hind wings as broad as fore wings; 3, 4, 5 somewhat approximated at base, 7 out of 6 near origin, anastomosing with 8 to before middle.

A genus of beautiful species, distinguished from *Eurycreon* by the retracted valves and filiform maxillary palpi, but otherwise very closely allied.

- a. Hind wings with apex yellow *eurychrysa*.
 b. " " " dark fuscous.
 1. Fore wings with large triangular dark-margined
 orange patch from costa *calliaspis*.
 2. Fore wings with three orange or yellow blotches.
 a. Central blotch very broad *achoealis*.
 β. " " fascia-like.
 i. Central blotch straight *diplochrysa*.
 ii. " " bent over posteriorly at apex .. *epichrysa*.

A. Frontal projection long, flattened, terminal edge
 somewhat excavated.

Metallarcha calliaspis, n. s.

♂, ♀, 17—21 mm. Head, palpi, thorax, and abdomen reddish ochreous-yellow; palpi externally dark fuscous on upper half; shoulders and a central spot of thorax dark fuscous. Antennæ dark fuscous. Legs dark fuscous, tarsal joints yellowish at base, middle and posterior tibiæ yellowish. Fore wings moderate, triangular, costa faintly sinuate, arched towards apex, apex tolerably rounded, hind margin obliquely rounded; light greyish ochreous; a reddish ochreous-yellow spot at base of inner margin; a large blackish triangular blotch, irrorated with whitish grey, extending on costa from about one-third to five-sixths, its apex reaching nearly or quite to inner margin at two-thirds, sometimes truncate; this blotch connected with base by a tolerably broad streak along costa; within the blotch are three irregular orange or reddish spots, placed in a triangle, and occupying nearly the whole of the blotch; a blackish hind-marginal band, suffused anteriorly into ground colour; a few blackish scales along inner margin; cilia dark shining grey, with a basal ochreous-whitish line followed by a blackish line. Hind wings reddish ochreous-yellow; a blackish discal dot, sometimes obsolete; a well-defined broad dark fuscous hind marginal band, attenuated and disappearing before anal angle; cilia as in fore wings.

Variable to some extent, but very distinct.

Petersburg and Port Lincoln, South Australia; tolerably common in October and November, frequenting *Beyeria opaca* (*Euphorbiaceæ*).

B. Frontal projection truncate-conical.

Metallarcha diplochrysa, n. s.

♂, ♀, 16—19 mm. Head, palpi, thorax, and abdomen deep ochreous-yellow; sides of face, upper half of palpi externally, shoulders and a central spot of thorax, dark fuscous; abdomen

with 2nd, 3rd, and 7th segments, lateral and posterior margins of intermediate segments, and a spot on 8th, dark fuscous. Antennæ grey. Legs dark fuscous, tarsal joints towards base and posterior tibiæ ochreous-whitish. Fore wings moderate, triangular, costa faintly sinuate, arched posteriorly, apex tolerably rounded, hind margin obliquely rounded, very faintly sinuate below apex; dark fuscous, more or less mixed with greyish ochreous; markings deep ochreous-yellow, sometimes reddish-tinged; a rather large basal blotch, not reaching costa, sometimes suffused with ground colour towards inner margin; a moderately broad rather irregular fascia extending from beneath costa before middle to middle of inner margin, generally truncate above, edged with blackish; a similar fascia from costa at three-fourths, reaching towards anal angle three-fourths across wing, posterior edge sinuate inwards in disc; sometimes a yellow suffusion on costa before apex and on lower part of hind margin: a blackish hind-marginal line; cilia dark glossy grey, with a white basal line, followed by a black line. Hind wings deep ochreous-yellow, sometimes reddish-tinged; a small blackish discal spot; a broad blackish hind-marginal band, contracted in middle, and lower half much narrower; cilia as in fore wings.

Varies in depth and colouring.

Petersburg, Port Lincoln, and coast near Mount Gambier, South Australia; common in October and November, frequenting *Beyeria opaca*.

Metallarcha epichrysa, n. s.

♂, ♀, 14—22 mm. Head, palpi, and thorax bright yellow; upper half of palpi externally, and shoulders dark fuscous. Antennæ yellowish. Abdomen light ochreous-yellow. Legs deep ochreous-yellow, anterior pair suffused with blackish above. Fore wings moderate or rather elongate, triangular, costa faintly sinuate, moderately arched posteriorly, apex tolerably rounded, hind margin oblique, slightly rounded; very pale bluish grey, finely irrorated with black; markings bright yellow; a triangular blotch extending on inner margin from base to two-fifths, upper side near and tolerably parallel to costa; a rather broad direct fascia from middle of inner margin, its upper extremity bent over posteriorly and truncate, not reaching costa; a narrower fascia from three-fourths of costa to near inner margin before anal angle; cilia bright yellow, apical third rather dark shining grey. Hind wings light ochreous-yellow; sometimes a cloudy fuscous discal spot, generally absent; a fuscous hind-marginal band, its inner edge proceeding from two-thirds of costa almost to hind margin in

middle, thence rectangularly bent and running to middle of inner margin, lower half of band suffused with ground colour except on inner edge; cilia ochreous-yellow, tips paler.

A very elegant species, variable in size.

Quorn and Petersburg, South Australia; common in October, appearing to frequent *Dodonæa lobulata*.

Metallarcha eurychrysa, n. s.

♂, 22 mm. Head, palpi, antennæ, thorax, abdomen, and legs light ochreous-yellow; palpi somewhat mixed with dark fuscous above; antennæ spotted with dark fuscous; shoulders and a small central spot of thorax dark fuscous; anterior legs suffused with dark fuscous. Fore wings moderate, triangular, costa faintly sinuate, somewhat arched posteriorly, apex tolerably rounded, hind margin obliquely rounded; pale yellow; markings dark fuscous; a rather narrow streak along costa throughout, attenuated to a fine line posteriorly; a somewhat bent narrow fascia at one-third, dilated on costa; a broader fascia from two-thirds of costa to before anal angle, twice slightly sinuate; a rather narrow hind-marginal band, attenuated to a point at anal angle, anterior edge dentate, posterior marked with small triangular ochreous-yellow spots; cilia pale yellow, tips greenish. Hind wings pale ochreous-yellow; a fuscous-grey attenuated streak from costa at three-fourths to hind margin below middle, thence abruptly bent and continued very obscurely and almost obsoletely to middle of inner margin; cilia pale ochreous-yellow.

The hind-marginal band of the hind wings is only visible on its anterior edge.

Ardrossan, South Australia; February and April; a specimen received from the Adelaide Museum, which possesses a second.

Metallarcha achæalis, Walk.

Botys achæalis (achæusalis), Walk., 1007.

I have not obtained this species for description. The markings of the fore wings are much as in *M. eurychrysa*, but the pale yellow is replaced by deep orange; the hind wings are deep orange, with a dark fuscous hind-marginal band. Although I have not examined the structure, the species is probably referable here, and is conspicuously distinct.

Several specimens from Eastern Australia in the British Museum.

PROTERÆCA, n. g.

Forehead with a short rounded projection. Ocelli present. Tongue well developed. Antennæ three-fourths of fore wings, in male filiform, biciliated with tufts of cilia ($1\frac{1}{2}$). Labial palpi moderately long, tolerably straight, porrected, 2nd joint with rough projecting scales above and beneath, terminal joint somewhat pencil-form, partially concealed. Maxillary palpi moderate, slender, filiform, apex somewhat pencil-form. Posterior tibiæ with outer middle-spur somewhat more than half, outer end-spur nearly equal to inner. Abdomen elongate, in male with moderate anal tuft; valves exerted. Fore wings with vein 11 moderately long, rather oblique. Hind wings as broad as fore wings; 3, 4, 5 approximated at base, 7 out of 6 near origin, anastomosing with 8 to two-fifths.

Apparently related to *Eurycreon*, but the frontal projection is less developed, the antennæ much more strongly ciliated, the maxillary palpi not terminally expanded.

Proteræca comastis, n. s.

♂, ♀, 11—13 mm. Head, palpi, antennæ, thorax, and abdomen brownish ochreous, more or less irrorated coarsely with blackish; palpi white beneath. Legs ochreous-whitish, anterior and middle tibiæ irrorated with blackish above. Fore wings elongate-triangular, costa sinuate, slightly arched posteriorly, apex round-pointed, hind margin very obliquely rounded; ochreous-whitish, suffused with reddish ochreous except in disc; generally a dense blackish irroration (especially in male) forming a basal patch and broad fasciæ following first and second lines, the last fascia separated from second line on costa by a pale spot; lines blackish, rather thick; first at one-third, slightly curved; second from three-fourths of costa to three-fifths of inner margin, sinuate inwards below middle; an irregular dark fuscous discal spot; cilia ochreous-whitish, base more ochreous, with two dark grey lines, first interrupted. Hind wings ochreous-orange, with some scattered black scales anteriorly; a blackish line beyond middle, sinuate inwards below costa, angulated below middle; a blackish hind-marginal band, very narrow on lower half, gradually dilated on upper half; cilia grey-whitish, basal half blackish.

EURYCREON, *Ld.*

Forehead with an obtuse rounded or conical projection. Ocelli present. Tongue well developed. Antennæ three-fourths of fore wings, in male filiform, evenly ciliated ($\frac{1}{2}$ — $\frac{3}{4}$). Labial palpi

moderate, straight, porrected, 2nd joint with long projecting scales beneath, terminal joint concealed. Maxillary palpi moderate or rather long, expanded with loose scales towards apex. Posterior tibiæ with outer spurs one-half to three-fourths of inner. Abdomen elongate, slender, in male with moderately long anal tuft; valves exerted. Fore wings with vein 11 moderately long, oblique. Hind wings as broad as fore wings; 3, 4, 5 somewhat approximated at base, 7 out of 6 near origin, anastomosing with 8 to one-third to two-fifths.

The genus as here restricted is probably well represented in Australia by indigenous species.

a. Hind wings yellow.

1. Hind wings with a dark fuscous hind-marginal band *beatialis*.
2. " " without " " " " *ptoalis*.

b. Hind wings not yellow.

1. Second line of fore wings nearly straight *massalis*.
2. " " " " not nearly straight.
- α. First line of fore wings obsolete *familiaris*.
- β. " " " " tolerably distinct.
 - i. Cilia barred with light and dark *capnochroa*.
 - ii. " " not barred *xenogama*.

Eurycreon ptoalis, Walk.

Botys ptoalis (*ptousalis*), Walk., 728; *Osiriaca inturbidalis*, ib., Suppl., 1493.

I have not been able to obtain specimens for description, but the species is obviously nearly allied to *E. familiaris*, and probably correctly referable here. It is very similar to *E. familiaris*, but considerably larger and with ochreous-yellow hind wings.

Eastern Australia.

Eurycreon familiaris, n. s.

♂, ♀, 15—16 mm. Head, antennæ, thorax, and abdomen pale brownish ochreous, shoulders darker. Palpi dark fuscous, lower half white. Legs white, anterior pair suffused with dark fuscous above. Fore wings moderate, triangular, costa almost straight, somewhat arched towards apex, apex rounded, hind margin obliquely rounded; light ochreous-brownish, costa somewhat darker; a very small blackish spot on costa at four-fifths; sometimes some scattered dark fuscous scales forming an ill-defined line from this to two-thirds of inner margin, middle third curved outwards, but these are often wholly absent; some obscure dark

fuscous hind-marginal dots; cilia whitish, with a blackish line at one-third. Hind wings light ochreous irregularly suffused with grey, with a faint darker line as in fore wings; hind-marginal dots and cilia as in fore wings, dark line of cilia interrupted.

The single Tasmanian specimen is greyer than those from Sydney.

Sydney, New South Wales; Deloraine, Tasmania; several specimens in November, December, and February.

Eurycreon xenogama, n. s.

♂, 18—19 mm. Head, antennæ, thorax, and abdomen ochreous-whitish, suffused with light fuscous. Palpi externally dark fuscous, lower half white. Legs whitish, anterior pair and middle tarsi suffused with dark fuscous except at apex of joints. Fore wings elongate-triangular, narrow at base, costa sinuate, posteriorly moderately arched, apex rounded, hind margin obliquely rounded; ochreous-whitish irrorated with fuscous, so as to appear pale fuscous; lines slender, ill-defined, dark fuscous, rather irregular; first from one-fifth of costa to one-fourth of inner margin, slightly curved; second from three-fourths of costa to two-thirds of inner margin, rather indented in middle, abruptly bent back from above anal angle to beneath discal spot; a round slightly paler spot in disc before middle, fuscous-margined, and a subquadrate similar discal spot, space between them paler; a row of cloudy dark fuscous dots on hind margin; cilia ochreous-whitish, with an interrupted dark grey line at one-third, and a cloudy grey line at two-thirds. Hind wings ochreous-whitish, fuscous-tinged, faintly suffused with darker towards apex and on a blotch below middle of hind margin; a cloudy dark grey sinuate line beyond middle, in disc abruptly curved outwards into a narrow sinuous loop; a small cloudy grey discal spot; hind-marginal dots and cilia as in fore wings.

♀, 13—14 mm. Head and thorax darker fuscous than in male. Fore wings ochreous-fuscous mixed with dark fuscous; lines and discal spots as in male, but blackish fuscous, much stronger; first line preceded and second line followed by an irregular white margin, discal spots surrounded with white; cilia darker. Hind wings white, towards base of inner margin fuscous-tinged; discal spot and line as in male, but much stronger and blackish; a large blackish apical blotch, and another smaller one on hind margin above anal angle, touching loop of discal line; cilia white, with a blackish basal line, and faint grey posterior line.

The sexes are at first sight very different, the female being considerably smaller, and the markings very much

more sharply contrasted; the markings are, however, exactly the same in form.

Adelaide, South Australia; four specimens (two males, two females) in October.

Eurycreon capnochroa, n. s.

♂, ♀, 12—16 mm. Head, palpi, thorax, and abdomen whitish ochreous, mixed with fuscous and dark fuscous; lower half of palpi white. Antennæ white, annulated with dark fuscous. Legs dark fuscous, apex of joints white. Fore wings moderate, triangular, narrow at base, costa slightly sinuate, gently arched posteriorly, apex tolerably rounded, hind margin oblique, waved, faintly sinuate, rather bowed in middle; pale whitish fuscous, densely irrorated with rather dark fuscous; lines dark fuscous, tolerably distinct; first at one-fifth, rather bent in middle; second from two-thirds of costa to rather beyond middle of inner margin, slightly indented at one-third, sharply angulated inwards at two-thirds to beneath discal spot, sometimes followed by a faint pale suffusion; a dark fuscous dot midway between base and discal spot; discal spot linear-crescentic, ochreous-whitish; hind margin spotted with dark fuscous; cilia white, with two broad dark fuscous lines, obscurely barred, costal cilia marked with three or four quadrate dark fuscous spots. Hind wings with ground colour as in fore wings; first line obsolete, second as in fore wings; a small dark fuscous discal spot; cilia as in fore wings.

The sexes are exactly similar.

Murrurundi, Sydney, and Blackheath (3500 feet), New South Wales; Launceston, Tasmania; Port Lincoln, South Australia; common from November to April.

Eurycreon beatalis, Feld.

Botys beatalis, Feld., cxxxv., 5.

Peak Downs, Queensland; Sydney, New South Wales; two specimens in March.

Eurycreon massalis, Walk.

Scopula massalis, Walk., 792; *Dosara cælatalis*, ib., 829.

♂, ♀, 15—17 mm. Head, palpi, and thorax pale ochreous, in female suffused with reddish ochreous; palpi white at base beneath. Antennæ grey-whitish. Abdomen pale ochreous. Legs ochreous-whitish, anterior pair suffused with dark fuscous. Fore wings

Criophthona finitima, n. s.

♂, 15 mm. Head, thorax, and abdomen pale greyish ochreous, irrorated with dark grey. Antennæ greyish. Palpi dark fuscous, beneath white towards base. Legs white, anterior pair dark fuscous. Fore wings elongate-triangular, narrow, costa slightly sinuate, moderately arched posteriorly, apex rounded, hind margin very obliquely rounded; light grey, finely irrorated with black, towards costa broadly suffused with darker grey; lines broad, cloudy, dark grey, slightly sinuate; first from one-fourth of costa to two-fifths of inner margin, second from five-sixths of costa to four-fifths of inner margin; a small cloudy whitish spot on costa before second line; discal spot small, round, cloudy whitish, dark-margined; an interrupted dark grey hind-marginal line; cilia whitish grey, with an interrupted dark grey line. Hind wings grey, somewhat lighter towards base; cilia grey-whitish.

An inconspicuous species, in form resembling *Sedenia*.
Quorn, South Australia; one specimen in October.

Criophthona haliaphra, n. s.

♂, 13 mm. Head whitish mixed with fuscous. Palpi dark fuscous, beneath white at base. Antennæ whitish, spotted with fuscous. Thorax and abdomen whitish irrorated with dark fuscous. Legs dark fuscous, posterior tibiæ and apex of all joints white, anterior tibiæ with a white band. Fore wings elongate-triangular, costa sinuate, posteriorly arched, apex rounded, hind margin very obliquely rounded; white, with scattered dark fuscous scales; markings ochreous-fuscous irrorated with dark fuscous; an ill-defined basal patch, separated from first line by a narrow space; first line broad, posteriorly suffused, from one-third of costa to two-fifths of inner margin, rather curved; second from five-sixths of costa to four-fifths of inner margin, moderately curved outwards between middle and three-fourths, anteriorly margined by a moderately broad dark fascia, of which the anterior edge is straight; a small round spot in disc, suffused into first line; an indistinct somewhat 8-shaped discal spot, white, margined with dark fuscous; an irregular hind-marginal fascia, separated by a narrow space from second line; cilia with basal third white, bounded by an interrupted black line, remainder grey. Hind wings fuscous-grey, paler towards base; a very ill-defined pale line at three-fourths, anteriorly darker-margined, angulated outwards below middle; cilia whitish, with a dark fuscous line at one-third, and a lighter posterior line.

Sydney, New South Wales; one specimen.

SEDENIA, Gn.

Forehead with a long terminally excavated or truncate conical projection. Ocelli present. Tongue absent. Antennæ three-fourths of fore wings, in male tolerably filiform, evenly ciliated ($\frac{1}{2}$ — $\frac{3}{4}$), rough-scaled above. Labial palpi rather long, straight, porrected, with rough projecting scales, attenuated and somewhat drooping towards apex. Maxillary palpi moderate, with loose projecting scales towards apex. Posterior tibiæ with outer spurs two-thirds of inner. Abdomen elongate, in male with a moderate anal tuft, sometimes with an obliquely erect rounded process on apex of abdomen (*rupalis*); valves exerted. Fore wings with vein 11 moderately long, rather oblique. Hind wings as broad as fore wings; 3, 4, 5 remote; 7 out of 6 near origin, anastomosing with 8 to middle.

Characterised specially by the absence of the tongue, which appears to me wholly obsolete; though neither Guenée nor Lederer notice this character.

- a. Fore wings white *rupalis*.
 b. ,, ,, whitish ochreous *cervalis*.

Sedenia rupalis, Gn.

Sedenia rupalis, Gn., 250.

Murrurundi and Bowenfels (2500 feet), New South Wales; Melbourne, Victoria; Quorn, Port Lincoln, and Kangaroo Island, South Australia; rather common, in October, November, and January.

Sedenia cervalis, Gn.

Sedenia cervalis, Gn., 250, pl. iii., 3; Ld., pl. viii., 4;
Scopula itonusalis, Walk., 794; *S. pictoalis*, ib., 1016.

Sydney, New South Wales; Hobart, Tasmania; Mount Lofty range and Wirrabara, South Australia; common, in October, December, and March.

TRITÆA, n. g.

Forehead with a conical projection. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male slender, filiform, evenly ciliated ($\frac{1}{2}$). Labial palpi moderate, straight, porrected, with dense rough projecting scales beneath, rather longer towards apex, terminal joint concealed. Maxillary

palpi moderately long, somewhat expanded terminally. Posterior tibiæ with outer spurs less than half inner. Abdomen stout, in male with short truncate tuft; valves retracted. Fore wings with vein 11 moderately long, oblique. Hind wings broader by one-half than fore wings; 3 closely approximated to 4 at base, 4 and 5 in male stalked, in female closely approximated towards base, 7 out of 6 near origin, anastomosing with 8 to middle.

I have only seen one poor male, and am not sure of the characters of that sex, but the genus is sufficiently distinguished from its allies by the breadth of the hind wings, which are half as broad again as the fore wings. The genus is truly intermediate between *Eurycreon* and *Scoparia*, and certainly approximates to the ancestral form of *Botydidæ*.

Tritæa ustalis, Walk.

Scopula ustalis, Walk., Suppl., 1477; *S. turbidalis*, ib., Suppl., 1477; *Botys affinitalis*, Ld., 475, pl. xii., 4.

Lederer's figure is exceedingly poor, the fore wings being much too broad.

Duaringa, Queensland; Sydney and Blackheath (3500 feet), New South Wales; Adelaide, Wirrabara, and Ardrossan, South Australia; rather common, in October and March.

SCOPARIADÆ.

Fore wings with veins 8 and 9 stalked, 7 separate, 10 separate. Hind wings with vein 6 from upper angle of cell, 7 stalked with 6, anastomosing with 8 (or very rarely free); 4 and 5 generally from a point or stalked; lower median naked, or sometimes with well-defined pectination. Abdomen in male with valves usually exerted; claspers not developed; uncus generally developed. Maxillary palpi broadly triangularly dilated, porrected, not resting on labial palpi.

I am not yet confident of the limits of this family, but believe it can be constantly distinguished from the *Botydidæ* by the characters as given, especially by the development of the uncus. Should the latter character not prove invariable, the form and position of the maxillary palpi, and the structure of veins 4 and 5 of the hind wings, are additional points. Similarly a majority of characters must be used to separate the family from

the *Crambidæ*, since the pectination of the lower median vein of hind wings is as well developed in *Nyctarcha* as in any Crambid.

- a. Lower median vein of hind wings distinctly pectinated.
1. Vein 1 *b* of hind wings with strong distinct pectination *Nyctarcha*.
 2. Vein 1 *b* of hind wings not pectinated *Eclipsiodes*.
- b. Lower median vein of hind wings not pectinated.
1. Discal area of hind wings above lower median with long hairs.
 - a. Terminal joint of palpi long, with long dense loose hairs *Tetraprosopus*.
 - β. Terminal joint of palpi moderate, with appressed scales *Xeroscopa*.
 2. Discal area of hind wings without long hairs .. *Scoparia*.

ECLIPSIODES, n. g.

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male rather stout, filiform, evenly ciliated ($\frac{3}{4}$), above pubescent and rough-scaled. Labial palpi moderate, straight, porrected, 2nd joint with dense rough projecting scales beneath, longer towards apex, terminal joint moderate, exposed, cylindrical, loosely scaled, tolerably pointed. Maxillary palpi long, as long as 2nd joint of labial palpi, towards apex triangularly dilated, obliquely truncate. Posterior tibiae with outer spurs rather more than half inner. Abdomen moderate, in male with moderate anal tuft; valves exerted, uncus rather long, bent downwards. Fore wings with vein 10 moderately near 9, oblique; 11 widely remote from 10, in middle bent towards 12, very short, not passing cell. Hind wings one-fourth broader than fore wings; 3 from near angle, 4 and 5 from point of angle, 7 from a point with 6, anastomosing with 8 to beyond one-third. Fore wings with small tufts of raised scales on surface. Hind wings with lower median loosely but tolerably distinctly pectinated towards base, 1 *b* not pectinated.

Eclipsiodes crypsixantha, n. s.

♂, ♀, 15—17 mm. Head, palpi, antennæ, thorax, and abdomen dark fuscous; palpi white at base beneath; margins of abdominal segments yellowish. Legs black, apex of joints and median ring of anterior and middle tibiae white. Fore wings moderate, triangular, costa slightly arched, apex rounded, hind margin obliquely rounded; dull dark fuscous, sometimes with a few grey-whitish scales; lines black, formed of spots of raised scales; first from one-fourth of costa to one-third of inner margin, somewhat

curved; second from three-fourths of costa to two-thirds of inner margin, rectangularly bent in middle and curved inwards to beneath discal spot; discal spot transverse, raised, black; a row of blackish dots before hind margin, sometimes followed by a row of grey-whitish submarginal lunules; cilia dark grey, with a dark fuscous basal line. Hind wings clear ochreous-yellow; a well-defined moderately broad dark fuscous hind-marginal band, rather dilated towards inner angle, continued narrowly along costa; cilia grey, with a dark fuscous basal line.

Sydney, New South Wales; Port Lincoln, South Australia; in September, November, February, and March, common but local.

NYCTARCHA, n. g.

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ less than two-thirds of fore wings, in male stout, filiform, evenly ciliated ($\frac{1}{4}$ — $\frac{1}{3}$), above pubescent (*atra*) or rough-scaled (*ophideres*). Labial palpi moderate, straight, porrected, 2nd joint with dense projecting scales beneath, longer towards apex, terminal joint exposed, thick, somewhat expanded with scales towards apex and obliquely truncate. Maxillary palpi long, not much shorter than labial, expanded with scales towards apex, truncate. Posterior tibiæ with outer spurs half inner; legs short. Abdomen rather stout, in male with moderate anal tuft; valves retracted, uncus moderately long. Fore wings with vein 11 moderate, rather oblique. Hind wings rather broader than fore wings; 3, 4, 5 approximated at base, 7 out of 6 near origin, anastomosing with 8 to one-fifth to one-third. Hind wings with lower median and 1b each strongly pectinated towards base.

A peculiar and interesting genus, probably of an early type.

- | | | | | | | |
|----|-------------------------|--------------------------------------|----|----|----|----------------------|
| a. | Hind wings dark fuscous | .. | .. | .. | .. | <i>atra</i> . |
| b. | .. | .. | .. | .. | .. | orange. |
| | 1. | Fore wings with a pale spot on costa | .. | .. | .. | <i>ophideres</i> . |
| | 2. | with six scattered pale spots | .. | .. | .. | <i>persumptana</i> . |

Nyctarcha persumptana, Walk.

Orosana persumptana, Walk., Tort., 459.

♀, 16 mm. Head black, spotted with ochreous-orange on forehead and crown. Labial palpi black, towards base yellow-ochreous; maxillary palpi black, apex pale ochreous. Antennæ black. Thorax black, with two anterior dots and a posterior spot ochreous-orange.

Abdomen black, segmental margins ochreous-orange. Legs black, middle and posterior tibiae broadly banded with ochreous-yellow, apex of all joints whitish ochreous. Fore wings rather short, triangular, costa hardly arched, apex rounded, hind margin rather obliquely rounded; black, with six light yellow ochreous spots; first on inner margin at one-fourth, erect, transverse, reaching more than half across wing; second quadrate, in disc before middle; third small, transverse, on inner margin beyond middle; fourth on costa before two-thirds, transverse, direct, reaching half across wing; fifth minute, on costa close beyond fourth; sixth subquadrate, above anal angle; cilia dark purplish fuscous, terminal half whitish ochreous round apex and on a spot at anal angle. Hind wings bright orange; a very small round black discal spot; a broad blackish hind-marginal band, inner edge somewhat ex-cavated above middle, narrowly continued along costa; cilia as in fore wings.

A strikingly handsome species.

Sydney, New South Wales; one specimen in October.

Nyctarcha ophideres, Walk.

Orosana ophideres (*ophideresana*), Walk., Tort., 459.

♂, ♀, 11—13 mm. Head, palpi, antennæ, thorax, abdomen, and legs dark fuscous; a white line round eyes; apex of joints of maxillary palpi and lower half of labial palpi white; abdominal segments margined with orange-ochreous; tibiae banded with ochreous-whitish, apex of all joints ochreous-white. Fore wings moderate, triangular, costa almost straight, apex rounded, hind margin obliquely rounded; dark fuscous, with scattered silvery-blue metallic scales; lines darker, almost obsolete; first from one-fourth of costa to one-third of inner margin, somewhat curved: second from two-thirds of costa to beyond middle of inner margin, subdentate, rectangularly bent in middle and curved inwards to beneath the obsoletely darker discal spot; a transverse sub-triangular ochreous-whitish spot on costa immediately before second line, reaching nearly half across wing; sometimes some ochreous-whitish dots on hind margin; cilia dark grey, with a blackish line at one-third, terminal portion with a broad whitish patch at apex and sometimes a spot at anal angle. Hind wings bright orange; a moderately large black discal spot, confluent with costal border; a broad blackish hind-marginal band, projecting triangularly inwards above anal angle, and continued narrowly along costa; cilia as in fore wings.

Sydney, New South Wales; several specimens in January and March, frequenting swampy scrub, and flying in the sunshine. Also occurs in India and Madagascar, without variation.

Nyctarcha atra, Butl.

Orosana atra, Butl.

Castle Hill and Lake Wakatipu, New Zealand; not uncommon in December and January, flying on dry grassy mountain slopes, at 2000—3000 feet, hard to see.

SCOPARIA, *Hw.*

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male filiform, evenly ciliated (about $\frac{1}{2}$). Labial palpi moderate or long, tolerably straight, porrected, 2nd joint beneath with long dense projecting scales, longer towards apex, terminal joint moderate. Maxillary palpi rather long, strongly dilated with scales towards apex, obliquely truncate. Posterior tibiæ with outer spurs about half inner. Abdomen moderate, in male with moderate anal tuft; valves exerted, uncus short. Fore wings with vein 11 rather short, tolerably oblique. Hind wings from one-third broader to twice as broad as fore wings; 3 remote from 4, 4 and 5 from a point or stalked, 7 out of 6 near origin, anastomosing with 8 to one-third to one-half. Hind wings with discal area above lower median without hairs.

I have not made a complete examination of the species which I possess of this and the two following genera, which are very numerous; and the characters given above may require some modification. I do not propose now to describe any of these species, as they will all be fully described in a paper shortly to appear in the 'Proceedings' of the New Zealand Institute; I give, however, a list of those described already by other authors, and identified by me as belonging here. I have altogether about sixty species of *Scoparia*, by far the larger number being from New Zealand; none are common to Australia and New Zealand.

Scoparia exhibitilis, Walk.

Scoparia exhibitilis, Walk., 1500.

Sydney, New South Wales; from August to October, common.

Scoparia minusculalis, Walk.

Scoparia minusculalis, Walk.

Larva in moss on tree-trunks, in January.

Bealey River, Akaroa, and Dunedin, New Zealand ; tolerably common in forest, in January and February.

Scoparia minualis, Walk.

Scoparia minualis, Walk.

Christchurch and Otira George, New Zealand ; common in forest, in January.

Scoparia ustimacula, Feld.

Scoparia ustimacula, Feld., cxxxv.. 17 ; *S. conifera*, Butl., Cist. Ent., ii., 493.

Castle Hill, New Zealand ; taken by Mr. J. D. Enys.

Scoparia pongalis, Feld.

Scoparia pongalis, Feld., cxxxvii., 33.

Makatoku and Dunedin, New Zealand ; several specimens in forest in March.

Scoparia diphtheralis, Walk.

Scoparia diphtheralis, Walk., 1501.

Hamilton, Napier, Wellington, Christchurch, and Otira George, New Zealand ; common at light, from December to March.

Scoparia submarginalis, Walk.

Hypochalcia submarginalis, Walk., Cr., 48 ; *Nephopteryx maoriella*, ib., Suppl., 1720.

Generally abundant in New Zealand, from Cambridge to Lake Wakatipu ; from November to March, on fences, rocks, &c. ; very variable.

Scoparia indistinctalis, Walk.

Hypochalcia indistinctalis, Walk., Cr., 48 ; *Scoparia rakaiensis*, Knaggs, E. M. M., iv., 80.

Wellington and Lake Wakatipu, New Zealand ; common, from December to February.

Scoparia cleodoralis, Walk.*Scopula cleodoralis*, Walk., 793.

Sydney and Blackheath (3500 feet), New South Wales; Mount Macedon, Victoria; Mount Wellington and Deloraine, Tasmania; common from November to February.

Scoparia Feredayi, Knaggs.

Scoparia Feredayi, Knaggs, E. M. M., iv., 80; *S. moanalis*, Feld., cxxxvii., 34.

Eketahuna, Wellington, Bealey River, and Lake Wakatipu, New Zealand; not uncommon, from January to March.

Scoparia exilis, Knaggs.

Scoparia exilis, Knaggs, E. M. M., iv., 81.

Christchurch and Lake Wakatipu, New Zealand; not uncommon on dry grassy hills, in October, December, and April.

Scoparia sabulosella, Walk.

Crambus sabulosellus, Walk., Cr., 178.

Generally common in New Zealand, from Hamilton to Invercargill, in dry grassy places, in December and January. Butler has identified with this species a specimen from Chili; I have seen this, which is certainly very similar, but I cannot positively assert that it is identical.

Scoparia trivirgata, Feld.

Crambus trivirgatus, Feld., cxxxvii., 29.

Christchurch and Lake Wakatipu, New Zealand; tolerably common on dry grassy hills, in December, February, and March.

TETRAPROSOPUS, *Butl.*

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male with joints angularly projecting, pubescent. Labial palpi rather long, straight, porrected, 2nd joint with long dense projecting scales beneath, forming a long oblique apical tuft, terminal joint rather long, with dense rather long loosely appressed scales. Maxillary palpi long, strongly dilated with scales towards apex, obliquely truncate. Posterior tibiæ with outer spurs one-third of inner. Abdomen moderate, in

male with short anal tuft; valves exerted, uncus moderate, slightly curved. Fore wings with vein 11 rather short, very little exceeding cell. Hind wings two and a half times as broad as fore wings; 3 rather remote, 4 and 5 from a point, 7 out of 6 near origin, anastomosing shortly with 8 to one-third. Hind wings with discal area above lower median furnished with numerous long hairs.

Tetraprosopus Meyrickii, Butl.

Tetraprosopus Meyrickii, Butl., Ann. Mag. N. H., (5), ix., 1882, 97.

Since placed by Butler in the British Museum collection under *Nephoteryx favilliferella*, Walk., which is a quite different species, belonging probably to *Xeroscopa*.

Blackheath (3500 feet), New South Wales; Mount Macedon, Victoria; Mount Gambier, South Australia; locally abundant in November and December on the trunks of fibrous-barked *Eucalypti*; varies a good deal.

I take this opportunity of protesting (without offence to Mr. Butler's complimentary intentions) against the general use of specific names such as the above.

XEROSCOPA, n. g.

Forehead flat, vertical. Ocelli present. Tongue well developed. Antennæ two-thirds of fore wings, in male filiform, evenly ciliated (about $\frac{1}{2}$). Labial palpi rather long, or long, straight, porrected, 2nd joint with dense projecting scales beneath, longer in front, terminal joint moderate, partly exposed. Maxillary palpi moderate, strongly dilated with scales towards apex, obliquely truncate. Posterior tibiæ with outer spurs about half inner. Abdomen moderate, in male with moderate anal tuft; valves exerted, uncus moderate. Fore wings with vein 11 moderate, rather oblique. Hind wings from one and a half times to more than twice as broad as fore wings; 3 remote, 4 and 5 short-stalked, 7 out of 6 near origin, anastomosing with 8 to one-third. Hind wings with discal area above lower median more or less furnished with long fine hairs.

Besides the two following species, I have about fifteen others, almost all from New Zealand.

Xeroscopa ejuncida, Knaggs.

Scoparia ejuncida, Knaggs, E. M. M., iv., 81.

Bealey River, Mount Hutt, and Lake Wakatipu, New Zealand, at an elevation of 2500—4000 feet; common, in January and March.

Xeroscopa rotuella, Feld.

Crambus rotuellus, Feld., cxxxvii., 30.

Mount Hutt; taken commonly by Mr. R. W. Fereday, in January.

NOTE.

Ennychia melissalis, Walk., is a specimen of the European *Threnodes pollinalis*, S. V.; there is no reason to believe that this species could occur in Australia, and I have no doubt there is an error of locality.

Scoparia objurgalis, Gn., and *S. australialis*, Gn., I have not yet been able to identify satisfactorily.

XVI. *The lepidopterous genus Cocytia.* By ARTHUR
G. BUTLER, F.L.S., F.Z.S., &c.

[Read May 7th, 1884.]

THE genus *Cocytia* was founded by Dr. Boisduval in 1829: he says of it (Mon. Zyg., p. 4), "Je l'ai établi sur un très-bel insecte rapporté de la Nouvelle-Guinée par M. le capitaine Durville"; and he refers it to the *Zygænidæ*.

In 1874 Dr. Boisduval published his "Monographie des Agaristidées" in the 'Revue et Magasin de Zoologie,' pp. 26—110, and he there erected a tribe *Cocytides* for the reception of the single species *Cocytia durvillei*.

In February, 1875, I published "Notes on certain genera of *Agaristidæ*, with descriptions of new species," in the 'Annals and Magazine of Natural History,' pp. 135—144; in this paper I raised the species to the rank of a family *Cocytiidæ*, to be placed between the *Agaristidæ* and *Zygænidæ*, and at the same time I added the description of a second species from the Aru Islands, *C. chlorosoma*.

The family *Cocytiidæ* is characterised by its long erect palpi, unusually developed in the female so as to resemble the palpi, in some species, of the Noctuid genus *Ophideres*; in its antennæ it more nearly resembles the *Castniidæ* than either the *Agaristidæ* or *Zygænidæ*, but even more closely some genera of *Hesperiidæ*; these organs are long, straight, gradually clubbed towards the distal extremity, and then tapering and curved at the tip; the body is as robust as in the most powerful Bombyces, and the form, transparency and coloration of the wings, reminds one vividly of the Sphingid genus *Hemaris*; the neuration, however, though in some respects like that of *Hemaris*, yet shows certain features characteristic of the transparent-winged *Zygænidæ*.

The one genus yet known has, so far, consisted of
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two species, to which I now have to add a third (lent to me for description by my friend Walter de Rothschild); it was obtained by Mr. Veitch's collector, Charles Curtis, at Batchian, and, at Mr. Rothschild's request, I name it *C. veitchii*.

The characters of the three species of *Cocytia* can be best indicated by a key thus:—

- a. Wings hyaline-white, with broad black borders and thickened black internervular streaks gradually tapering from the external border; reddish orange subbasal patch on primaries large *C. durvillei*.
- b. Wings hyaline-white, with narrow black external borders; internervular streaks narrower and emitted abruptly from the external border; reddish orange subbasal patch small and rounded .. *C. chlorosoma*.
- c. Wings hyaline-yellowish, with narrow black external borders; internervular streaks emitted abruptly; reddish orange subbasal patch large *C. veitchii*.

The following are the species:—

1. *Cocytia durvillei*.

Cocytia durvillei, Boisduval, Mon. Zyg., p. 22, pl. i., fig. 1 (1829); Sp. Gén. Lep., i., pl. 15, fig. 1 (1858).

Male and female, New Guinea; male, Port Moresby; female, Ké Dulan; B. M.

2. *Cocytia chlorosoma*.

Cocytia chlorosoma, Butler, Ann. & Mag. Nat. Hist., ser. 4, vol. 15, p. 144 (1875).

Male, Aru, B. M.

We only possess two male examples of this species.

3. *Cocytia veitchii*, n. s.

As large as *C. durvillei*, but the wings of a transparent yellowish colour (not due to scales, as these are absent from the clear portions of the wing-surface), the black external borders narrow as in *C. chlorosoma*, the rays or intermediate streaks being emitted abruptly as in that species, so that the inner edge of the external border is not sinuated as in *C. durvillei*; primaries with the orange subbasal patch as large as in the latter species, and of a similar

form; centre of the abdomen of a more golden metallic-green than in either the New Guinea or the Aru species. Expanse of wings, 89 mm.

Batchian (*C. Curtis*). Coll. W. Rothschild.

It will be seen, from the foregoing description, that this species, though differing from *C. durvillei* and *C. chlorosoma* in its yellower wings, is in other respects intermediate in character.



XVII. *Descriptions of new species of Indian Lepidoptera-Heterocera.* By F. MOORE, F.Z.S.

[Read June 4th, 1884.]

THE species here described belong to the tribe of Bombycites, the first enumerated being an extremely rare form of *Chalcosiidæ*, of the genus *Devanica*, allied to *D. Risa* of Doubleday. An Arctiid of the genus *Rhodogastra*. Some Notodonts, including a new genus with a large apical patch of colour somewhat similar to that on some Indian species of *Phalera*. Of *Liparidæ*, two species of the genus *Lælia*, two of the allied genus *Lælioides*, a fine new *Euproctis*, and a new genus allied to *Stilpnotia*. Of the family *Lasiocampidæ*, a species of the curious genus *Apha* from the Nilgiris, a *Ganisa*, and a *Tagora* from Bombay, several species of the genus *Eupterote*, of which the species are extremely difficult to discriminate. Besides these the *Bombyx collaris* of Guérin and the *Jana lineosa* of Walker have been taken as the types of new genera; and of the genus *Murlida* both sexes are for the first time here characterised. Other species of this numerous family follow, of the genera *Brachytera*, *Sangatissa*, *Messata*, and of the extremely rare *Apona*, remarkable for the great length and plumose character of its antennæ; *Syrastrena*; *Lenodora*; a fine *Gastropacha*, with curiously divaricating markings on the fore wings. Also species of the genera *Trabala* and *Lebeda*. In the family *Limacodidæ* are two species of Walker's genus *Aphendala*.

CHALCOSIIDÆ.

DEVANICA, n. g.

Sephisa,* Moore, Lep. of Ceylon, ii., p. 41 (1882).

Devanica bicolor, n. s.

♀. Fore wing black, crossed by a yellow outwardly-oblique medial band; veins indistinctly lined with blue. Hind wing

* Previously used for a genus of Lepidoptera.

yellow, with a black marginal band, which is broad and truncated at the apical end and very narrow at anal end; base of wing also slightly black. Body, legs, and antennæ bluish-black. Expanse, $1\frac{1}{2}$ in.

Hab. Cachar (*W. Mason*). In coll. British Museum and Calcutta Museum.

This species is nearest allied to *D. Risa* (*Eterusia Risa*, *Dbl.*). It differs from *D. Risa* in its much smaller size, the yellow band on fore wing being placed across the middle, whereas in *D. Risa* it is at one-third from the base; the black marginal band on hind wing is one-third less in width at the apex, and the band also extends to the angle; in *D. Risa* this band is very broad, and is confined to the apical area.

ARCTIIDÆ.

Rhodogastra fraterna, n. s.

Nearest to *R. rhodopa*. Differs in the wings being longer, the costal border of fore wing less convex, and the hind wing more regularly triangular. Brownish creamy-white; the medial area of both wings semitransparent; two black dots at base of fore wing. Thorax creamy-white, with black dots; abdomen above deep red, with lateral row of black spots; legs above reddish; antennæ red. Expanse, $2\frac{3}{8}$ in.

Hab. Bombay (*Leith*). In coll. F. Moore.

NOTODONTIDÆ.

Carea obsolescens, n. s.

♂. Fore wing pale reddish-ferruginous, crossed by a slender indistinct brownish outwardly-oblique ante-medial line, a waved post-medial line, and a submarginal row of brown speckles; cilia purplish-ferruginous. Hind wing ferruginous-white, with slightly darker veins and outer border, and a very slight indistinct lunular spot at end of cell. Thorax, palpi, and legs above ferruginous; abdomen above pale ferruginous.

♀. Fore wing dark reddish-ferruginous; transverse markings indistinct, as in male. Hind wing pale reddish-ferruginous. Thorax, palpi, and legs above dark ferruginous; abdomen above greyish-ferruginous. Expanse, male $1\frac{3}{8}$ in., female $1\frac{1}{2}$ in.

Hab. Bombay (*Leith*); Coonoor (*Lindsay*). In coll. F. Moore.

ZARANGA, n. g.

Fore wing large, elongated, triangular; costal margin arched towards the end, apex rounded; exterior margin oblique and sinuous; posterior margin short; cell broad at its end, extending more than half the length of the wing; first subcostal emitted at one-eighth before end of the cell, second from the end, quadrifid; disco-cellular inwardly-oblique, concave at each end, bent in the middle; a slender forked discoidal veinlet emitted within the cell; upper radial from end of the cell in a line with subcostal, lower radial from middle of disco-cellular; three median branches, middle branch from close to end of the cell, lower at one-third before the end; submedian much recurved. Hind wing short, triangular, apex convex, exterior margin very oblique and sinuous; costal vein much arched from the base, extending to apex, subcostal also much arched and recurved; cell very broad, extending more than half the length of the wing; two slender discoidal veinlets emitted within the cell; two subcostal branches on a footstalk at one-third beyond the cell; disco-cellular concave, radial from the middle; middle median from close to end of the cell, lower at one-third before the end; submedian and internal veins slightly curved. Body moderately stout, thickly clothed with adpressed hairs; abdomen extending beyond hind wings; thorax crested; palpi small, pilose; antennæ bipectinated to tip, basal joint tufted; legs pilose.

Zaranga pannosa, n. s.

Fore wing hoary-black, with a large vinous-brown subapical patch, and a similar coloured patch extending from below the cell to posterior margin, the subapical patch with black-speckled sinuous outer border; the medial interspace between the patches is numerously marked with yellow scales, which more or less form lunular marks; a yellow-speckled spot at base of the wing, a lunular spot on the costa towards the apex, and a row of speckles along exterior margin. Hind wing dusky vinous-brown, the medial area dusky white; a series of black and yellow speckled lunules ascending from anal angle; cilia yellow-speckled. Thorax, head, and legs hoary-black; abdomen vinous-brown, tuft with some yellow hairs; tarsi with white bands; antennæ dark brown. Expanse, $2\frac{3}{4}$ in.

Hab. Umballa District (*Reid*). In coll. F. Moore.

LIPARIDÆ.

Lælia lilacina, n. s.

♂. Fore wing pale lilacine pinkish-grey; costal border and a fascia below the cell pale brownish-ochreous; with a discal

angular row of six small dentate spots, the lowest spot slightly the largest. Hind wing pale dusky greyish-brown, along the costal border lilacine-white. Thorax lilacine-grey; abdomen greyish brown; head, palpi, and legs above pale brownish-ochreous; antennæ greyish-brown, shaft white. Expanse, $1\frac{1}{10}$ in.

Hab. Coonoor, Nilgiris (*Lindsay*). In coll. F. Moore.

Lælia pallida, n. s.

Nearest to *L. angulifera* (*Procodeca angulifera*, Walker). Wings comparatively longer and narrower; pale ochreous-white. Fore wing slightly ochreous along the costal and posterior border, with a discal angular row of minute very indistinct blackish spots. Thorax, head, and legs brighter ochreous; abdomen yellowish. Expanse, $1\frac{1}{10}$ in.

Hab. Bombay (*Leith*). In coll. F. Moore.

Lælioides rubripennis, n. s.

♂. Fore wing pale pinkish-red, the medial area longitudinally from base to exterior margin sparsely speckled with whitish scales; a curved discal series of six indistinct brown-speckled spots. Hind wing white. Thorax, head, palpi, and legs pale red; abdomen whitish. Expanse, $1\frac{2}{10}$ in.

Hab. Burmah. In coll. British Museum.

Læliodes lactea, n. s.

♀. Cream-white. Fore wing with a curved discal series of six indistinct minute black spots, the lowest spot beneath the lower median vein. Thorax creamy white; abdomen greyish-white; front of thorax, head, palpi, and legs ochreous-yellow; antennæ brown, shaft white. Expanse, female $1\frac{1}{2}$ in.

Hab. North Punjab (*B. Powell*). In coll. F. Moore.

Euproctis immaculata, n. s.

♀. Both fore and hind wings pure white. Body slightly greyish white, anal tuft golden yellow; antennæ ochreous-brown, shaft white. Expanse, $2\frac{1}{2}$ to $2\frac{3}{8}$ in.

Hab. Java (*Horsf.*), Sikkim. In coll. British Museum and F. Moore.

This species has much the appearance of a large specimen of *Porthesia virguncula*.

CHARALA, n. g.

♂, ♀. Fore wing much shorter and more regularly triangular in form than in *Stilpnotia* (*S. salicis*); both wings more densely and smoothly clothed with scales; cell broader at the end; sub-costals closer together and the medians wider apart. Hind wing shorter, broader; exterior margin more convex; cell wider, the four medians also somewhat wider apart. Body of male more slender; antennæ more finely bipectinated in male, and with longer branches in female; palpi longer and projected beyond the head; legs more slender and less pilose.

Charala sericea.

Stilpnotia sericea, Moore, Desc. Lep. Coll. Atk., p. 45 (1879).

Hab. Himalayas (Masuri, Darjiling).

LASIOCAMPIDÆ.

Apha flava, n. s.

♂. Dull deep lemon-yellow. Fore wing from the base to the disc suffused with brown, and obliquely crossed by a darker brown angular subbasal line, and a medial line and four sinuous discal lines, beyond which is a submarginal very indistinct brown-speckled sinuous line, this latter line having a contiguous inner dark brown-speckled spot between the median veins, and is terminated at the apex by two dark brown-speckled spots. Hind wing with a transverse very indistinct subbasal line, a medial distinct brown line, and less distinct submarginal sinuous line with two contiguous subanal brown-speckled spots. Body and legs dull brownish-yellow. Expanse, $2\frac{3}{4}$ in.

Hab. Nilgiris. In coll. F. Moore.

Ganisa similis, n. s.

♂. Dark greyish-brown. Fore wing with a darker brown transverse subbasal band, three or four curved discal sinuous lines, followed by a more distinct oblique outer duplex line; a pale grey short linear streak on each vein between the oblique band and outer margin, and a grey-bordered dark brown spot at end of the cell. Hind wing with three darker brown transverse curved medial discal sinuous lines, followed by a submarginal row of indistinct brown-bordered grey spots; cilia dark brown. Expanse, male $2\frac{3}{4}$ in.

Hab. Darjiling. In coll. F. Moore.

Nearest allied to *G. plana*. Differs in its larger size, the fore wing being longer and the duplex line more oblique. On the hind wing the dark line bordering the submarginal spots is obsolete.

Tagora discrepans, n. s.

♂. Yellowish-ochreous. Fore wing with an indistinct transverse subbasal and three or four discal sinuous purple-brown lines, a slightly waved outer discal pale-bordered darker brown line, and a less defined zigzag submarginal line. Hind wing with a nearly straight medial discal transverse prominent brown line, and a less defined zigzag submarginal line. Both wings with the basal area and the interspace between the outer discal line and submarginal zigzag line suffused with pale lilacine-purple, some specimens being almost entirely covered, and nearly obliterating the transverse markings. Expanse, $2\frac{3}{4}$ to 3 in.

Hab. Bombay (*Dr. Leith*). In coll. British Museum and F. Moore.

PALIRISA, n. g.

Wings large, very broad, lanuginose, cilia long. Fore wing short, costa much arched towards end, exterior margin slightly convex; first, second, and fifth subcostal branches emitted together from end of the cell, third from below the second at one-third, and fourth at one-fifth, beyond its base; cell very short; discocellular bent inward near upper end, radial from near the middle; the middle median from near end of the cell, lower at nearly one-half before the end; submedian with a slender lower basal branch. Hind wing broad; costal margin long, exterior margin convex; abdominal margin long; costal vein extending to apex; subcostal with first branch emitted at one-fifth before end of cell; discocellular very oblique, upper end bent inward, radial from near lower end; cell very short, triangular; middle median emitted at one-fourth and lower median at one-half before end of the cell; submedian extending close to the margin. Body long, woolly; palpi thick; antennæ broadly bipectinated to tip in male, less so in female; legs densely pilose.

Type. *P. lineosa*.

Palirisa lineosa.

Jana lineosa, Walker, Cat. Lep. Het. B. M., iv., p. 912; Butler, Types Lep. Het. B. M., v., p. 71, pl. 198, f. 4.

Hab. Silhet.

Palirisa cervina.

Jana cervina, Moore, P. Z. S., 1865, p. 807.

Hab. Darjiling.

Eupterote subdita, n. s.

♂. Dark vinous-brown. Fore wing with similar transverse markings to those in *E. vinosa*, the subbasal being disposed nearer the base, the duplex line narrower, the submarginal line nearer, and the intervening spots absent except the upper and lower. Hind wing with the four discal lines closer together, the duplex line narrower, and the zigzag submarginal line nearer; no intervening spots. Under side dark vinous-brown. Both wings with similar outer transverse markings to the above, the basal and intervening lower areas being dark yellow. Collar yellow. Expanse, 3 in.

Hab. Jubbulpore (*Dr. F. Butler*). In coll. British Museum.

Eupterote vinosa, n. s.

♂, ♀. Vinous-brown. Male: Fore wing with two blackish subbasal, two antemedial, and four discal lines, followed by a broader duplex outer line, and a slender zigzag submarginal line with dark black intervening spots; the outer middle line with clouded external border. Hind wing with four blackish sinuous lines, a broad duplex line, outer spots, and zigzag line. Under side brownish-ochreous; markings less distinct. Female: Upper side with similar but less distinct markings; the submarginal spots indistinct. Expanse, male $3\frac{1}{2}$ in., female $3\frac{3}{4}$ in.

Hab. Jubbulpore (*Dr. F. Butler*). In coll. British Museum.

Eupterote cupreipennis, n. s.

♂. Upper side pale coppery-red. Fore wing with four subbasal transverse black zigzag lines, four discal sinuous lines, followed by a lunulated duplex line with suffused black inner border, beyond which is a submarginal zigzag line with intervening lower and upper spots; between the outer subbasal and inner discal line is a prominent black triangular costal patch. Hind wing with a subbasal and four discal sinuous black lines, suffused inner-bordered black duplex line, and a submarginal zigzag line. Under side paler; both wings with the discal sinuous lines broad, suffused inner-bordered duplex line, and zigzag submarginal line.

♀. Paler; both wings with less distinct sinuous lines, duplex line, and very indistinct submarginal zigzag line. Expanse, male and female 4 in.

Hab. Madras. In coll. British Museum.

Eupterote suffusa, n. s.

♂. Upper side ochreous-brown. Fore wing suffused with vinous-brown towards the base; with two transverse antemedial indistinct blackish sinuous lines, two small medial patches, and four discal sinuous lines, followed by a very contiguous duplex line, less distinct submarginal zigzag line with intervening ill-defined spots. Hind wing with four indistinct transverse sinuous lines, a distinct duplex line, and indistinct submarginal zigzag line. Body above vinous-brown. Under side ochreous-brown. Both wings with paler markings than above. Expanse, 3 in.

Hab. Jubbulpore (*Dr. F. Butler*). In coll. British Museum.

This species has both the fore and hind wings of a more regularly triangular form than in either *E. vinosa* or *E. subdita*.

Eupterote variegata, n. s.

♂. Vinous-brown. Fore wing with a very indistinct subbasal transverse darker line, a prominent blackish medial wide sinuous line and four discal sinuous lines, followed by a duplex line, and zigzag submarginal line with intervening upper and lower spots; bordering the subbasal line is a yellowish patch, the medial area of the wing bordering the medial and discal lines is also yellowish, and the area between the duplex line and submarginal line is prominently yellow. Hind wing with four indistinct discal lines, distinct duplex line and submarginal zigzag line, the interspace between the latter yellowish. Collar and front of thorax yellow. Under side yellow; the costal borders suffused with vinous-brown, the outer markings paler than above. Expanse, $3\frac{3}{8}$ in.

Hab. Jubbulpore (*Dr. F. Butler*). In coll. British Museum.

In this species the wings are comparatively longer than in allies.

Eupterote griseipennis, n. s.

♂. Under side brownish purplish-grey. Fore wing with a very indistinct subbasal, medial, and three or four sinuous brownish lines, a more distinct duplex line with its outer edge dentated, and

an indistinct submarginal zigzag line with intervening spots. Hind wing with three or four obsolescent sinuous lines, a more distinct duplex line with dentated outer border, and an indistinct submarginal zigzag line with intervening spots. Under side greyish ochreous-brown. Both wings with a prominent single broader outer discal line, the other markings obsolescent. Expanse, $2\frac{7}{8}$ in.

Hab. N. India. In coll. F. Moore.

Eupterote dissimilis, n. s.

♂. Upper side greyish-brown. Fore wing with very faint traces of a darker subbasal line, an indistinct medial line and four or five discal sinuous lines, a straight duplex line, and submarginal zigzag line with intervening lower and upper spots, the upper spots grey-speckled. Hind wing with obsolescent discal sinuous lines, indistinct duplex line, and submarginal zigzag line with intervening lower spot. Under side uniformly greyish-brown. Both wings with very faint traces of a single outer discal line and submarginal zigzag line. Expanse, $3\frac{3}{8}$ in.

Hab. N.W. Himalaya. In coll. F. Moore.

Eupterote contaminata, n. s.

♂. Pale dull ochreous-yellow. Fore wing with traces of subbasal and discal transverse pale-stained purplish-red wavy lines, followed by an outer discal straight distinct line, bordering which the area is stained with pale purplish red, defined by the submarginal zigzag line. Hind wing with a distinct purplish-red outer discal line and pale-stained submarginal zigzag border. Under side yellow, with similar but paler markings than above. Expanse, 3 in.

Hab. Bombay (*Dr. Leith*). In coll. F. Moore.

Allied to *E. imbecilis* and *E. Taoensis*.

Eupterote sinuata, n. s.

♂. Pale vinous-brown. Fore wing with two diffused blackish subbasal lines, an antemedial line, four well-defined narrower sinuous discal lines, the antemedial and inner discal being slightly confluent along the veins, followed by a duplex line and very prominent black zigzag submarginal line with intervening pale area and black upper and lower spots, the penultimate lower spot being large and black. Hind wing with a diffused subbasal

blackish line, and four discal sinuous lines, followed by a diffused black duplex line, and prominent submarginal zigzag line with pale intervening area and large penultimate lower spot. Under side paler. Both wings with outer markings as above. Expanse, $4\frac{1}{2}$ in.

Hab. Himalayas. In coll. British Museum.

Nearest allied to *E. undata* (*B. undatus*, Blanchard, Jacquemont's Voy., iv., pl. 24, f. 8).

Eupterote consimilis, n. s.

♂. Differs from *E. similis* in being paler and of a reddish-grey tint. Fore wing with the three subbasal and first discal sinuous lines darker, broader, and almost confluent, the other discal lines more regularly sinuous, the duplex line dentated, the submarginal line and intervening spots more distinct. Hind wing with four curved medial discal sinuous lines, less curved duplex line, and widely separated submarginal zigzag line. Front of thorax ochreous-yellow; head, palpi, and fore legs dark red. Under side yellowish, with purple-brown discal bands as above.

♀. Upper side redder, with similarly disposed markings. Under side yellowish, with discal and submarginal markings as above. Expanse, male and female $3\frac{3}{4}$ in.

Hab. Darjiling (*Grote*). In coll. F. Moore.

Eupterote auriflua, n. s.

♂. Upper side dark yellow. Both wings with two slight brown slender discal transverse lines. Fore wing with a slight submarginal zigzag line and indistinct intervening spots.

♀. Upper side golden-yellow. Both wings with a narrow discal transverse purple-brown band, and a submarginal indistinct brown-speckled zigzag line with intervening upper and lower large brown spots. Under side golden-yellow, with similar transverse discal line and indistinct traces of a submarginal zigzag line. Body darker golden-yellow. Expanse, male $2\frac{1}{4}$ in., female 3 in.

Hab. Malabar (*Watkins*). In coll. F. Moore.

Eupterote Todara, n. s.

♂. Upper side deep yellow. Fore wing with two transverse subbasal very indistinct sinuous lines, two discal lines, and a prominent straight outer discal line, beyond which is a submarginal indistinct zigzag line with intervening prominent brown upper and

lower spots. Hind wing with a very faint trace of a transverse inner discal brown sinuous line, and a prominent straight outer discal line, submarginal line not visible. Under side as above, with a single inner discal sinuous line, straight outer line, and traces of submarginal line and intervening spots. Front of thorax and costal edge of fore wing brownish ochreous. Expanse, $2\frac{5}{8}$ in.

Hab. Nilgiris. In coll. F. Moore.

Eupterote castanoptera, n. s.

♂, ♀. Upper side sienna-red. Male: Fore wing with extremely faint traces of two subbasal and five equidistant transverse sinuous brown bands, followed by a more distinct outer discal duplex line, the outer border of the latter being slightly dentated; beyond is an extremely faint trace of a zigzag submarginal line and intervening spots. Hind wing with extremely faint traces of three medial transverse zigzag lines, a more distinct outer discal curved duplex line, and traces of a submarginal zigzag line. Under side of the same colour as upper side, the duplex lines only being visible. Front of thorax and bands on abdomen yellow. Female: Upper side with the transverse bands more distinct. Under side paler, tinged with ochreous basally, the discal and duplex lines only visible. Expanse, male $3\frac{3}{8}$ in., female $3\frac{3}{4}$ to 4 in.

Hab. Nepal (*Gen. Ramsay*). In coll. F. Moore.

Eupterote nigricans, n. s.

♂. Dark brown. Fore wing with two black transverse subbasal curved lines, three equidistant medial paler sinuous lines, and five discal slightly more distinct zigzag lines, the outer one of the latter bordered externally by an oblique straight duplex darker line, bordering which is a submarginal dentated line with intermediate black spots, the upper spots being grey-speckled; the basal area before the curved line slightly ochreous. Hind wing with slightly ochreous-brown basal area; five transverse discal black sinuous lines, an outer discal darker duplex line, and a submarginal dentated line with intermediate blackish spots. Body dark brown; a distinct ochreous-yellow collar on front of thorax. Expanse, $3\frac{1}{2}$ in.

Hab. Jubbulpore (*Span*); Saugor (*Hunter*). In coll. F. Moore.

Nearest allied to *E. undata*, Blanchard.

Eupterote alterata, n. s.

♂. Ochreous-yellow. Fore wing with a transverse subbasal indistinct purplish-brown slightly waved band, a medial zigzag band, and indistinct traces of four discal sinuous lines, followed by a distinct duplex line, the outer border of which is dentated, the submarginal zigzag line indistinct, the intervening upper and lower spots large. Hind wing with indistinct traces of a medial and three discal sinuous lines, the duplex line very prominent and its outer border indistinctly dentated; an indistinct submarginal zigzag line. Under side brighter coloured; all the transverse lines more prominent. Expanse, 4 in.

Hab. Darjiling (*Atkinson*). In coll. F. Moore.

Eupterote permutata, n. s.

Near to *E. discordans* (Butler, Types Lep. Het. B. M., v., p. 66, pl. 96, f. 6, ♂). Smaller in size, and of a paler yellow colour. Fore wing differs in having only one subbasal transverse indistinct purplish-brown zigzag band, one medial band, and four discal sinuous lines; a single outer discal slender line, and with more distinct spots intervening before the submarginal zigzag line. Hind wing with no apparent lines except a single prominent discal line and indistinct submarginal dentated zigzag line. Expanse, 3 in.

Hab. Bengal. In coll. F. Moore.

Eupterote immutata, n. s.

Upper side pale straw-yellow. Fore wing with two transverse subbasal very indistinct purplish-brown zigzag bands, and traces of three discal similar slender bands, followed by the more distinct duplex line with dentated outer border, the submarginal denticulated line being indistinct, and the intervening upper and lower spots prominent. Hind wing with very indistinct traces of a subbasal and three discal purplish-brown zigzag bands, the duplex dentated line and submarginal denticulated line more distinct. Under side: Both wings with the same subbasal and discal lines as above. Expanse, $3\frac{1}{2}$ in.

Hab. Nepal (*Gen. Ramsay*). In coll. F. Moore.

Nearest to *E. mutans*, Walker (Butler, Types Lep. Het. B. M., v., p. 67, pl. 96, fig. 8), typical specimens of which are under examination, and which differ on the fore wing in having but one subbasal band and three

discal bands, and on the hind wing in having one sub-basal and two discal bands, these bands also being differently positioned across the wings.

Eupterote mollis, n. s.

♂. Pale yellow. Fore wing with two transverse subbasal indistinct purple-brown bands, which are confluent at the costal end, and the colour also extends to base of the wing; a medial zigzag band, and three less distinct discal sinuous lines, the outer bordered by a straight line, beyond which is the submarginal line with intervening upper and lower darker spots, the former spots being bordered with white speckles; some diffused brown speckles also at the apex. Hind wing with four medial transverse indistinct purple-brown sinuous lines and outer straight line; an indistinct submarginal zigzag line with intervening spots. Abdomen with purplish-brown bands.

♀. With less distinct subbasal lines, but with more distinct discal lines and submarginal markings. Expanse, $2\frac{1}{2}$ in.

Hab. Bombay (*Dr. Leith*); Coonoor, Nilgiris (*Lindsay*). In coll. F. Moore.

Eupterote caliginosa, n. s.

♂. Dark brown. Fore wing with some extremely indistinct blackish transverse discal sinuous lines, an oblique straight darker duplex line, and a submarginal dentated line with intermediate blackish spots. Hind wing with a transverse medial darker duplex line, and submarginal dentated line with intermediate black spots. Body entirely dark brown. Expanse, $2\frac{1}{2}$ in.

Hab. Jubbulpore, Central India (*Span*). In coll. F. Moore.

Differs from *E. nigricans* on the fore wing, in the duplex line being comparatively farther from the outer margin; and on the hind wing, in the duplex line being disposed quite across the middle of the wing.

Eupterote lativittata, n. s.

♂. Yellowish ochreous. Fore wing with a broad purplish brown diffused ill-defined transverse subbasal band, and an almost confluent similar medial band, followed by a straight discal line, beyond which are very faint traces of spots, the marginal border of the wing from the zigzag submarginal line being entirely purplish brown; veins brown-speckled. Hind wing with a broad purplish

brown suffused basal and medial band, a discal straight line, zigzag submarginal line with faint intervening spots, the outer border from the submarginal line being entirely purplish-brown. Under side paler yellowish-ochreous. Both wings with a slender purplish brown medial zigzag band, straight discal line, and brown outer marginal band. Expanse, $2\frac{3}{4}$ in.

Hab. Bombay (*Dr. Leith*). In coll. F. Moore.

This species is allied to *E. Canaraica*, Moore (P. Z. S., 1879, p. 410).

Eupterote persimilis, n. s.

♂. Upper side pale brownish-ochreous. Fore wing with extremely faint traces of darker transverse sinuous discal lines, an indistinct straight duplex line, and submarginal zigzag line. Hind wing with extremely faint traces of discal sinuous lines, more distinct curved duplex line, and faint zigzag submarginal line. Under side yellowish-ochreous. Both wings with only a single transverse discal brown line. Thorax yellowish-ochreous in front. Expanse, 3 in.

Hab. Calcutta (*Atkinson*). In coll. F. Moore.

Eupterote dissimilis, n. s.

♂. Pale brownish ochreous. Fore wing with a pale brown subbasal transverse curved line, a medial broader sinuous line, faint traces of three or four sinuous discal lines, followed by a recurved more distinct duplex line, an extremely faint submarginal zigzag line and intervening spots. Hind wing with a pale brown medial transverse sinuous line, extremely faint traces of slender discal lines, and a more distinct straight duplex line, the submarginal zigzag line being almost obsolete. Under side pale yellowish-ochreous. Both wings with a prominent outer discal broad purple-brown line. Front of thorax pale ochreous-yellow. Expanse, $3\frac{1}{2}$ in.

Hab. Deyra Dhoon, N.W. Himalaya (*Austen*). In coll. F. Moore.

Eupterote cinnamomea, n. s.

♂, ♀. Cinnamon-brown; female darkest coloured. Both wings with almost imperceptible traces of transverse sinuous darker-coloured bands; a distinctly formed dusky brown straight duplex line, and submarginal zigzag line with intervening spots. Expanse, male $3\frac{3}{4}$ in., female 4 in.

Hab. Canara, S. India (*Ward*). In coll. F. Moore.

Eupterote similis, n. s.

♂, ♀. Cinnamon-brown. Male: Fore wing with three indistinct brown subbasal zigzag lines, two medial lines, and three discal lines, followed by a straight outer discal slender duplex line, and a submarginal zigzag line with intervening upper and lower spots. Hind wing with two subbasal and three discal indistinct brown sinuous lines, followed by a curved discal duplex line, and a submarginal zigzag line. Under side coloured and marked as upper side. Female: Darker coloured than the male. Both wings with similar but darker lines, and less distinct submarginal zigzag line. Expanse, male $3\frac{3}{8}$ in., female $3\frac{1}{2}$ in.

Hab. Calcutta (*Atkinson*). In coll. F. Moore.

Eupterote decorata, n. s.

♂. Pale ochreous-yellow. Fore wing with five subbasal transverse purple-brown curved lines, and four discal sinuous lines, the second and outer subbasal and the inner discal line the broadest, the two latter being partly confluent across the veins; a broad outer discal duplex line, and a submarginal zigzag narrow line, the apical area being broadly purple-brown. Hind wing with four medial discal sinuous lines, broad duplex line, and distinct zigzag submarginal line. Under side yellow. Both wings with discal sinuous lines and very broad outer line, submarginal line, and apical patch. Expanse, $3\frac{1}{4}$ in.

Hab. Punjab. In coll. British Museum.

Eupterote affinis, n. s.

Nearest allied to *E. consimilis*. Male: Dark brownish ochreous. Fore wing with similar but more distinct transverse zigzag sinuous lines, duplex line, and submarginal zigzag line, the latter with intervening spots. Hind wing with three medial discal sinuous lines, very prominent duplex line, and submarginal zigzag line. Under side reddish-ochreous. Both wings with medial discal sinuous lines and broad outer discal line, the submarginal zigzag line very indistinct. Front of thorax ochreous-yellow. Female: Uniformly reddish-ochreous. Both wings with similar markings to male. Expanse, 4 in.

Hab. N. India. In coll. British Museum.

Distinguished from *E. consimilis* in the fore wing of the male having the medial lines confluent, and on the hind wing in the medial discal lines being situated

further from the base, the inner line also being broader. The under side of the male is also differently coloured.

SPALYRIA, n. g.

♂. Wings short, broad, ample, lanuginose. Fore wing almost straight to near the apex; exterior margin almost erect, posterior margin long; cell extending to one-third the wing; first subcostal emitted at one-sixth before end of the cell, second trifold, third thrown off from below second at one-half, and the fourth at one-fifth from the base; fifth emitted from end of the cell; disco-cellular bent outward near upper end, lower end concave, radial from the upper angle; middle median emitted at one-fifth and lower at one-half before end of the cell; submedian with a slender lower basal branch. Hind wing with the costal margin extending to posterior angle of fore wing; exterior margin very convex; cell one-third the wing; two subcostals on a footstalk at a short distance beyond end of the cell; disco-cellular bent outward near upper end, lower end very long and outwardly oblique, radial from upper angle; middle median at one-fourth and lower at one-half before end of the cell. Body very woolly; antennæ bipectinated to tip in male, serrated in female; palpi short, thick; legs densely pilose.

Type. *S. collaris* (*Bombyx collaris*, Guérin, Delessert's Voy., pl. 27, fig. 2).

Hab. Nilgiris. In coll. F. Moore.

MURLIDA.

Murlida, Moore, Catal. Lep. Mus. E. I. C., ii., p. 422 (1857—9), ♀.

Fore wing comparatively shorter in the male, longer in the female, and less triangular in form than in the corresponding sexes of *Eupterote*. Fore wing with first subcostal from near end, second quadrifid; cell short, less than one-third length of the wing; disco-cellular bent in the middle; two upper medians from contiguous angles at end of the cell, lower at beyond one-third before the end. Hind wing with short triangular cell; disco-cellular very oblique, bent acutely near upper end below the radial; lower median at nearly one-half and middle median at one-sixth before end of the cell.

Murlida lineosa.

Lasiocampa lineosa, Walker, Catal. Lep. Het. B. M., vi., p. 1440 (1855), ♀.

Murlida lineosa, Moore, Catal. Lep. Mus. E. I. C., ii., p. 422 (1857—9), ♀.

♂. Upper side pale yellow. Fore wing with a very indistinct subbasal transverse sinuous slender blackish line, three similar discal lines, followed by a contiguous straight line, beyond which is a zigzag submarginal line with intervening spots, all the spots being small except the penultimate upper and lower one. Hind wing with three medial transverse sinuous similar lines, the outer line extremely indistinct, followed by an outer discal straight but more prominent line, beyond which is a very indistinct zigzag line. Under side slightly paler. Both wings with the markings as on upper side, but much more distinct, the hind wing also having the intervening spots between the outer discal line and the zigzag submarginal line.

♀. Ochreous-yellow. Both wings on the upper side with similar but somewhat less distinct markings. Under side also with similar markings, except that the spots on submargin of hind wing are absent. Expanse, male 3 in., female $3\frac{3}{8}$ in.

Hab. Nepal. In coll. British Museum.

Murlida fraterna, n. s.

♂. Upper side darker yellow than in *M. lineosa*. Fore wing with five equidistant transverse blackish lines, a prominent contiguous discal line, a slender zigzag submarginal line, and prominent intervening black spots, the transverse lines being broader than in *M. lineosa*, and the outer line is broken at upper end into short longitudinal streaks. Hind wing with two extremely indistinct medial discal lines, a prominent outer discal straight line, slender indistinct submarginal with traces of intervening spots. Under side marked as above, the inner lines indistinct.

♀. Darker yellow than in male; markings similar but less distinct. Expanse, male $2\frac{3}{8}$ in., female $3\frac{1}{8}$ in.

Hab. Darjiling. In coll. F. Moore.

Brachytera primularis, n. s.

♂. Upper side pale creamy-yellow. Fore wing with a slender indistinct ochreous-brown subbasal waved band, a more distinct straight oblique outer discal band, and less distinct submarginal zigzag line with two basal and a slight apical intervening spots.

Hind wing with a slender indistinct medial line, a more distinct curved outer discal line, and submarginal zigzag line. Under side as above; the lines more distinct. Head, palpi, and fore legs yellowish-ochreous; antennæ brown. Expanse, 2 in. to $2\frac{1}{4}$ in.

Hab. Coonor, Nilgiris (*Lindsay*); Shevaroy Hills (*Dr. Shortt*). In coll. F. Moore.

Sangatissa albipars, n. s.

♂. Fore wing glossy white, traversed by a longitudinal row of sparsely-disposed brown speckles curving from base of the posterior margin to the apex; a similar row of speckles above the posterior angle. Hind wing dull ochreous-yellow. Thorax ochreous-white; head, palpi, abdomen, and legs ochreous-yellow; antennæ pale ochreous-brown, with whitish shaft. Expanse, $1\frac{3}{4}$ in.

Hab. Bombay (*Dr. Leith*). In coll. F. Moore.

Allied to *S. citrinula* (*Dreata citrinula*, Walker, Catal. Lep. Het. B. M., xxxii., p. 376).

Messata flavida, n. s.

♂. Pale yellow. Fore wing traversed by three brown-speckled oblique nearly straight bands, which proceed from the apex to posterior margin, the inner band most distinct and terminating at one-third from the base, the others at equal distances at their base.

♀. Brighter yellow. Fore wing with the inner speckled band curving towards the base of posterior margin. Thorax and abdomen bright yellow; head and palpi ochreous; pectus and fore legs above chestnut-brown; antennæ ochreous, shaft pale yellow. Expanse, $2\frac{3}{4}$ in.

Hab. Nilgiris. In coll. F. Moore.

Messata castanoptera, n. s.

♂. Dull chestnut-brown. Fore wing crossed by a darker brown ill-defined subbasal band, an oblique straight discal dark speckled-brown narrow band, and a broad marginal band. Hind wing with a transverse narrow medial discal dark brown-speckled band, and a broad submarginal band. Body, palpi, and legs dark chestnut-brown; antennæ pale brown. Expanse, $2\frac{1}{4}$ in.

Hab. Nilgiris. In coll. F. Moore.

Apona Shevaroyensis, n. s.

♂. Dull greyish purplish-brown. Fore wing with four or five very indistinct darker-coloured transverse discal sinuous lines, the outer one followed by a straight oblique pale-bordered prominent line, beyond which the submarginal zigzag-bordered area is darker and of a glaucescent-grey colour; a small dark spot at end of the cell. Hind wing with very indistinct discal sinuous lines and a more distinct outer discal pale-bordered lunular line, beyond which is an extremely indistinct submarginal zigzag-bordered area. Under side duller coloured, the discal sinuous lines somewhat more distinct, the outer oblique lines on fore wing recurved and less distinct, that on the hind wing more distinct. Antennæ dark brown, shaft white.

♀. Somewhat browner in colour; marked as in male. Expanse, male $4\frac{1}{2}$ in., female $4\frac{3}{4}$ in.

Hab. Shevaroy Hills, Madras (*Dr. Shortt*). In coll. F. Moore.

Allied to *A. plumosa* (Moore, P. Z. S., 1872, p. 579). Differs in its much larger size and obliquity of markings.

Nisaga modesta, n. s.

♂. Upper side pale glossy brownish-ochreous; cilia darker coloured. Body and legs dark ochreous-brown. Expanse, $1\frac{1}{2}$ in.

Hab. N. India. In coll. British Museum.

Differs from *N. simplex* in the uniform colour of the upper side, and in the absence of the prominent dark brown-speckled longitudinal streaks between the veins.

SYRASTRENA, n. g.

Wings small. Fore wing elongated, narrow, triangular; cell long, extending to one-third the wing; first subcostal emitted at one-half before end of the cell, second from close to the end, trifid, the fourth from below third near its base, and fifth from below fourth near its base; disco-cellular very slender, inwardly oblique, recurved; two upper medians from end of the cell, second at one-fourth, and first or lower at three-fourths before the end; submedian slightly recurved, with a very slender short basal lower branch. Hind wing with the costal vein arched at the base, and with a precostal curved spur; subcostal two-branched, first branch emitted at one-half before end of the cell and slightly joined to costal; cell triangular, lower end longest; disco-cellular slender,

outwardly oblique; three upper medians on a footstalk beyond end of the cell, first or lower median from close to the end; a submedian and an internal vein. Body short, stout; palpi porrect, thick, pointed in front, projected conically beyond the head; antennæ bipectinated to tip in both sexes; legs hairy.

Syrastrena minor.

Metanastria minor, Moore, Desc. Lep. Coll. Atk., p. 78 (1879).

Hab. Darjiling. In coll. British Museum.

Lenodora signata, n. s.

♂, ♀. Pale dull ferruginous-brown, palest in the female. Fore wing with a small white lunate spot at end of the cell. Expanse, male $1\frac{1}{2}$ in., female 2 in.

Hab. Bengal (*Russell*); Deyra Dhoon (*Austen*). In coll. F. Moore.

The typical species of *Lenodora* (*Lasiocampa vittata*, Walker, Catal. Lep. Het. B. M., vi., p. 1440) differs in the fore wing having a longitudinal white streak extending from base of fore wing through the cell to near the outer margin.

Lenodora fusca, n. s.

♂. Umber-brown. Fore wing uniformly coloured throughout. Expanse, $1\frac{2}{3}$ in.

Hab. Bombay. In coll. F. Moore.

Distinguished by its uniform colour and absence of mark on the fore wing.

Lenodora fasciata, n. s.

♀. Dark umber-brown. Fore wing with an oblique outer discal transverse pale fascia. Hind wing duller brown. Expanse $2\frac{3}{8}$ in.

Hab. Coonoor, Nilgiris (*Lindsay*). In coll. F. Moore.

Gastropacha divaricata, n. s.

♀. Dark purplish-red. Fore wing with four equidistant medial transverse purple-black narrow bands, the inner band erect and waved, the two central slightly angulated beyond the cell and terminating together before the posterior margin; the outer band is

darkest, and is also angulated near its upper end, thence extending very obliquely to posterior margin, where it joins the inner band each of the bands have a suffused indistinct violet-grey border, and there is a violet-grey fascia extending upward from the posterior angle. Hind wing paler red. Thorax, head, palpi, and legs dark purplish-red; abdomen paler. Expanse, $3\frac{1}{4}$ in.

Hab. Darjiling. In coll. F. Moore.

Trabala irrorata, n. s.

♀. Upper side dark olivaceous ochreous-yellow, sparsely speckled with dark purple-brown scales, which are most numerous disposed on the exterior border, sinuously across the inner disc of both wings and subbasally across the fore wing, and also on the posterior border of the fore wing. Both wings with a discal transverse zigzag series of large lilacine-grey spots, which are also thickly speckled with the dark brown scales; fore wing also with the posterior border blotched with lilacine-grey, and with a prominent lilacine-grey spot with dark brown-speckled border in the middle of the cell. Cilia entirely yellow. Under side slightly paler than the upper side; both wings with the discal zigzag spots as above, the exterior borders less sparsely speckled with brown scales; a slight brown-speckled sinuous discal band also on the hind wing; cell-spot indistinct. Body brighter yellow, anal tuft lilacine-white. Expanse, $2\frac{3}{4}$ to $3\frac{1}{4}$ in.

Hab. Java (*Horsfield*); Mergui (*Anderson*). In coll. British Museum and Calcutta Museum.

Lebeda fasciata, n. s.

♂. Pale brownish ochreous. Fore wing with four medial transverse obliquely-curved ferruginous-brown sinuous fasciæ, the two middle fasciæ joined together at their upper end before the costa; a submarginal zigzag row of indistinct blackish grey-speckled spots; a whitish dot at end of the cell. Hind wing with two medial and a submarginal curved transverse diffused ferruginous-brown fasciæ. Under side uniformly paler; with faint darker brown traces of an outer discal and a submarginal fascia on the fore wing, and of the three curved fasciæ on the hind wing. Expanse, 3 in.

Hab. Khasia Hills (*Austen*). In coll. F. Moore.

Allied to *L. ampla* and *L. ferruginea*, from both of which it is quite distinct.

Lebeda purpurescens, n. s.

♂. Purplish-red. Fore wing with four indistinct medial transverse brown sinuous lines, and a submarginal zigzag row of blackish grey-speckled spots; a conspicuous ochreous-yellow subbasal spot. Under side paler; both wings with two darker purplish-red outer discal transverse obliquely straight fasciæ, and a submarginal macular fascia. Expanse, $2\frac{3}{4}$ in.

Hab. Borneo. In coll. F. Moore.

LIMACODIDÆ.

Aphendala tripartita, n. s.

♂, ♀. Allied to *A. transversata*. Differs in being darker coloured; the subbasal band is almost erect, in *A. transversata* this band being oblique, and its upper end extending to the middle of the costa; the exterior band is also oblique, with its lower end terminating within the posterior angle, and the exterior pale band is also erect, with its lower end terminating on exterior margin above the angle. Expanse, male $\frac{7}{8}$ in., female $1\frac{1}{8}$ in.

Hab. Manpuri (*Horne*); Jubbulpore. In coll. F. Moore and British Museum.

Aphendala divaricata, n. s.

♀. Upper side pale purplish brownish-ochreous. Fore wing with a slender dark ochreous-brown band curving upward from posterior margin at one-third from the base to one-third before the apex, and from which a straight erect similar band extends from its costal end to the posterior angle. Body dark ochreous-brown. Expanse, $1\frac{3}{8}$ in.

Hab. Silcurei, Cachar (*W. Mason*). In coll. India Museum, Calcutta.

XVIII. *Life-history of sixty species of Lepidoptera observed in Mhow, Central India.* By R. W. FORSAYETH, Surgeon-Major, A. M. D.

[Read August 6th, 1884.]

PLATES XIV, XV.

DURING my residence at Mhow I have been enabled to make the following observations upon various Lepidoptera. The species have been named and arranged throughout by Mr. A. G. Butler, of the Natural History Department, British Museum, to whom I wish to return my best thanks. The following is a synopsis of the characters of the larvæ and pupæ observed:—

RHOPALOCERA.

- Papilio Erithonius*, L.—LARVA thick, abrupt, sluggish. Small hood. Concealed double erectile horn on hood. PUPA suspended by thoracic band and caudal ligature on leaf.
- Delias eucharis*, Drury.—LARVA vermiform, sparingly hirsute. PUPA suspended by thoracic band and caudal ligature on leaf.
- Terias Æsiopæ*, Mén.—LARVA vermiform, naked. PUPA pointed head, flattened thorax, suspended as above noted on leaf.
- Tirumala Limniace*, Cram. LARVA juliform, naked; two thoracic and two caudal horns. PUPA suspended by tail. Gold spots.
- Limnas Chrysippus*, L.—LARVA juliform, naked; six long fleshy horns on body. PUPA suspended by tail. Gold band and puncta.
- Junonia Orithyia*, L.—LARVA armed with numerous hairy spines. Head bifid. PUPA suspended by tail, rough, yellow and purple.
- J. Cœnone*, L.—LARVA armed with numerous hairy spines. Head bifid. PUPA suspended by tail, rough, yellow and purple.
- Precis Lemonias*, L.—LARVA armed with numerous hairy spines. Head bifid. PUPA suspended by tail, rough, yellow and purple.
- Hypolimnias avia*, Fabr.—LARVA armed with numerous hairy spines. Head entire, with two horns on vertex. PUPA suspended by tail. Projections along abdomen and dorsum of thorax.
- Melanitis Ismene*, Cram.—LARVA oblong; head with two spined horns. Spindle-shaped body. PUPA smooth, suspended by tail.
- Symphædra thyelia*, Fabr.—LARVA, body surrounded by numerous long fleshy horizontal arms furnished with hairs. PUPA suspended by tail. Angular. Gold spots and lines.
- Pyrgus Galba*, Fabr.—LARVA vermiform. Head hairy, on a neck. PUPA fastened by spine at tail, in a leafy case. Greenish white efflorescence on body.

Pamphila Mathias, Fabr.—LARVA vermiform. Head triangular, on a neck. PUPA fastened on grass stem by thoracic band and caudal ligature. Smooth, with pointed head.

SPHINGES.

Daphnis nerii, L.—LARVA ocellated. Short soft caudal horn. PUPA of ordinary form. COCOON of silk and earth on or near surface of ground.

Polytychus dentatus, Cram.—LARVA marked with puncta. Fleishy caudal horn. PUPA ordinary. COCOON: Earthen cell; subterraneous.

Acherontia Styx, Westw.—LARVA green. Yellow lateral striæ. Fleishy pointed caudal horn. LARVA brown and white. Dark lateral striæ. Dark brown row of patches on dorsum of thorax. Fleishy pointed caudal horn. PUPA ordinary. COCOON: Earthen cell; subterraneous.

Chærocampa celerio, L.—LARVA ocellated. Long acuminate caudal horn. PUPA: Head of pupa keel-shaped. COCOON: Silk, earth, and leaves, on surface of ground.

C. thyelia, L.—LARVA ocellated. Short acuminate caudal horn. PUPA: Head keel-shaped. COCOON: Leaves and silk, on surface of ground.

C. Oldenlandia, Fabr.—LARVA ocellated. Long acuminate caudal horn. PUPA: Head keel-shaped. COCOON: Leaves, or earth and silk, on surface of ground.

Protoparce orientalis, Butl.—LARVA marked with lateral striæ. Long acuminate caudal horn. PUPA with large detached maxillary sheath. COCOON: An earthen cell; subterraneous.

Clanis cervina, Walk.—YOUNG LARVA: Large acuminate head. Strong pointed caudal horn. Lateral striæ. MATURE LARVA: Rounded head. Short fleshy caudal horn. Lateral striæ; rough skin. PUPA, ordinary form. COCOON: An earthen cell; subterraneous.

C. Deucalion?, Walk.—LARVA with lateral striæ. Short soft caudal horn. PUPA, ordinary form. COCOON: An earthen cell; subterraneous.

BOMBYCES.

Trilocha albicollis, Walk.—LARVA sphingiform, naked. COCOON: Firm yellow silk, oblong-oval, on leaf.

Dabarita subtilis, Walk.—LARVA smooth, bladder-headed. COCOON: Boat-shaped, silk, firm, on leaf.

Chilena strigula, Walk.—LARVA hairy; three long tufts. COCOON: Strong silk, oblong-oval, arboreal.

Trabala Vishnu, Lef.—LARVA hairy; two head tufts. COCOON: Silken, arboreal, irregular shape.

Megasoma venustum, Walk.—LARVA hairy; thoracic brush and patch. COCOON: Strong silken, oblong-oval, arboreal.

Lebeda Buddha, Lef.—LARVA hairy; thoracic brush and patch. COCOON: Strong silken, oblong-oval, arboreal.

Nioda fusiformis, Walk.—LARVA hairy, tufted; thoracic brushes. Caudal arrow-headed plumes. COCOON: Silk and hairs, arboreal; hammock-like.

Psalis securis, Hübn.—LARVA hairy; head tufts; dorsal brushes. COCOON: Silk, arboreal, oblong-oval.

Euproctis lunata, Walk.—LARVA hairy; dorsal brushes. COCOON: Bags of silk and clay, under but near surface of ground.

- Pseudomesa incerta*, Walk.—LARVA: Short scanty hairs; no brushes or tufts. COCOON: Thin silk hammock.
- Perina nuda*, Fabr.—LARVA sparingly hirsute; large head; no brushes or tufts. No COCOON. PUPA suspended by silk fibres on leaf.
- Trisula variegata*, Moore.—LARVA: Scanty and long hairs; fleshy grub-like. COCOON: Sand and stones bound together with strong silk, on surface of ground.
- Alope ricini*, L.—LARVA hairy, in whorls; no tufts or brushes. COCOON: Silk and hairs, arboreal, hammock-like.
- Cretonotus interruptus*, L.—LARVA hairy, in whorls; no tufts or brushes. (No notes of COCOON.)
- Arcas lacticea*, Cram.—LARVA hairy, in whorls; no tufts or brushes. COCOON: Silk and earth, on and partly under surface of ground.
- Lacides ficus*, Fabr.—LARVA sparingly hirsute; hairs longish; legs normal. COCOON: Earthen cell; subterranean. No efflorescence on PUPA.
- Miresa albipuncta*, H.-S.—LARVA slug-like, spined, stinging. COCOON hard, oval, egg-like; subterranean.
- Aphendala tripartita*, Moore.—LARVA slug-like, spined, stinging. COCOON hard, oval, egg-like; subterranean.
- Parasa lepida*, Cram.—LARVA slug-like, spined, stinging. COCOON hard, oval, egg-like, on the trunk and branches of the mango tree.

NOCTUÆ.

- Spingomorpha chlorea*, Cram.—LARVA: Anterior pair of prolegs small, naked, semi-looping; concealed dorsal bar. COCOON silk and clay; subterranean. No efflorescence on PUPA.
- Achea melicerta*, Drury.—LARVA: Anterior pair of prolegs rudimentary, naked, semi-looping; concealed dorsal bar. COCOON leaf and silk, arboreal. White efflorescence on PUPA.
- Ophiodes separans*, Walk.—LARVA: Anterior pair of prolegs small, naked; movement not noted; no concealed dorsal bar. COCOON leaf and silk, arboreal. No efflorescence on PUPA.
- Homoptera solita*, Walk.—Two anterior pairs of prolegs obsolete, looping; no bar. COCOON leaf and silk, arboreal. No note of efflorescence.
- H. continua*, Walk.—LARVA: 1st pair of prolegs obsolete, 2nd rudimentary; semi-looping. COCOON leaf and silk, arboreal. White efflorescence on PUPA.
- Cosmophila indica*, Guén.—LARVA semi-looping (no other notes). COCOON arboreal, rolled leaf. No note of efflorescence.
- Ercheia diversipennis*, Walk.—No figure. I think it was a semi-looper. COCOON leaf and silk, arboreal. No note of efflorescence.
- Selepa celtis*, Moore.—LARVA hairy; movements normal; feet normal. COCOON boat-shaped, silk, on a leaf. No note of efflorescence.
- S. curviferella*, Walk.—LARVA hairy; movements normal; feet normal. COCOON of silk and clay; subterranean. No note of efflorescence.
- Tegna hyblælla*, Walk.—LARVA maggot-like, translucent, naked, soft. Legs normal. COCOON dense, leathery, seed-like. On a leaf, under a silk net.
- Glottula dominica*, Cram.—LARVA sparingly hirsute; short hairs; legs regular. COCOON: Earthen cell; subterranean. No efflorescence on PUPA.
- Heliothis armiger*, Hübn.—LARVA naked, sphingiform. COCOON: Earthen cell; subterranean. No efflorescence on PUPA.

- Prodenia retina*, Guén.—LARVA naked, sphingiform. COCOON: Earthen cell; subterraneous. No efflorescence on PUPA.
- Plusia chrysitina*, Martyn.—LARVA naked, sphingiform; two anterior pairs of prolegs obsolete; looping; no concealed dorsal bar. PUPA in net of silk, in roll of leaf. No efflorescence.
- Celena canorufa*, Walk.—LARVA naked, sphingiform, almost semi-looping. PUPA in earthen cell; subterraneous. No efflorescence.
- Remigia frugalis*, Fabr.—LARVA naked, semi-looper. PUPA in earthen cell; subterraneous. No efflorescence.

GEOMETRÆ.

- Hypochroma dispensata*, Walk.—LARVA naked, looping. PUPA on surface of ground under a thin net.

PYRALES.

- Scopula strenualis*, Walk.—LARVA maggot-like, naked, soft, translucent. PUPA in rolled leaf, under a fine net.
- Botys molusalis*, Walk.—LARVA maggot-like, naked, soft, translucent. PUPA in rolled leaf; no COCOON or net; fastened by caudal ligature.

NYMPHALIDÆ.

EUPLEINÆ.

Limnas Chrysippus, Linn.

Mhow, August 30th, 1879.

Larva found feeding on the leaves of a shrub with fleshy leaves, exuding quantities of a milky juice on being torn, and with a compound purple flower, called by the natives "Ankra." The larva is furnished with six long, fleshy, smooth arms. Legs 6, 8, 2. Colour and markings shown in figure.*

During September I procured several specimens, but failed to rear a single imago; some specimens dying, others being the prey of a large dipterous parasite like a blue-bottle fly.

Oct. 5th. Got two more larvæ. One changed into a chrysalis the same evening or during the night. Suspended by anal extremity only. Of a fleshy ground colour, with a medial brown and gold stripe, and gold puncta about head and thorax.

Oct. 22nd. One of the specimens last noted became an imago this morning.

A common butterfly about here.

* It not being possible to reproduce all Mr. Forsayeth's numerous figures, a selection of the most important has been made by Messrs. Butler and Moore.—E. A. F.

Tirumala Limniace, Cramer.

Mhow, September 12th, 1881.

Found the larvæ on a species of creeper or vine with a stout woody stem and greenish yellow bark; leaves broad, smooth, and pointed at extremity. This vine grew close to a tree in my garden, and clung to its branches. All the specimens I bred were obtained from this one plant.

An outline sketch of the larva is given, showing the four smooth black fleshy "horns," two anteriorly and two posteriorly. The colour of the body is a pale yellowish green, ribbed with black transverse lines. Black markings exist on head, as shown in figure to the left of larva.

The larvæ possess no irritating powers; they curl up and simulate death for some moments when handled. A fine web attaches them by the prolegs to the leaf on which they are at the time feeding; this peculiarity they possess in common with the larva of *Papilio Erithonius*.

The pupæ are attached by the tail only; at first of a green colour, but in a day or two numerous patches of gold of the most brilliant lustre appear on the body and head, and a crescentic line of dots in the situation marked "a" in sketch.

The imagines appeared from Sept. 26th to Oct. 20th from two different broods of larvæ found on the same plant. Of these two were females and five males. The latter possess a curious pouch on the under side of posterior wings a little below their centre. It opens from the upper side of the wing, and contains a fine granular powder-like plumbago, quite inodorous. Front pair of legs rudimentary in both sexes. The males also possess a dense tuft of long yellow hairs like a brush, at each side of last segment of abdomen, but underneath the cuticle. I never saw them protruded, and am unacquainted with their use.

The species did not seem to me a common one in the locality, and I met with but few others than those frequenting the above noted plant in my garden. Their flight or habits present nothing noteworthy. They are not very strong on the wing.

SATYRINÆ.

Melanitis Ismene, Cramer. (Pl. XIV., figs. 2—2 b).

Mhow, October, 1879.

Got the larva from a native. It feeds on grass. In a few days it became a pupa.

Sept. 16th, 1881. Found a specimen of above larva to-day. Legs 6, 8, 2. Front aspect of head figured at Pl. XIV., fig. 2 a.

Sept. 17th. Found a chrysalis of this species on a grass stem.

Sept. 21st to Oct. 7th. Found several of these larvæ on a species of large grass growing in clumps of about four feet in height; leaf broad, long, and lanceolate.

Oct. 22nd. Three imagines out to-day. Front legs extremely small and delicate, would hardly be noticed on a casual inspection. Basal and terminal joints of palpi very small; middle large and curved. Club of antennæ very slender and graduated to a point. The wavy shading of brown on under surface of wings is much deeper in some specimens than others; the former are also the larger, and markings underneath are somewhat different. Posterior costæ of wings scalloped.

Oct. 23rd. Another imago out to-day.

Oct. 24th. I saw some of these flying near dusk after sunset in grass jungle when no other butterfly was to be seen, or had been visible for more than an hour previously. The flight is rather jerky, and movements curiously furtive; the insect perching with wings in erect position, thus resembling a dry leaf, and being very difficult to detect amongst bushes, &c., in consequence. It is evidently well aware of this, as, when pursued, it invariably makes a short flight and then settles suddenly, thus hoping to elude capture, in which ruse it is frequently successful.

Larva and pupa figured on Plate XIV., figs. 2, 2 b).

NYMPHALINÆ.

Junonia Orithyia, Linn.

Mhow, August 27th, 1881.

Larva found on a small labiate herb in a field close to my house. Head and body of a very dark shining black, shading into brown when seen by reflected light. Head on a short neck, latter of an orange colour for a short

distance; caudal extremity also tipped with orange. Body covered with perpendicular spines armed with strong radial hairs, which, however, have no irritating effect on the human skin. Head bifurcated; reddish spot in centre of face; a small spinous process on each upper angle of eye. Legs 6, 8, 2.

Pupa suspended by tail; naked; wing-covers of a muddy yellow; rest of body of a purplish colour, variegated by lines of a dull creamy white. Slight projections of an angular nature along abdomen.

A pupa formed on August 30th became an imago on September 7th.

Junonia CEnone, Linn.

Mhow, October 1st, 1881.

About this date and the end of September I found several larvæ precisely similar to those described above as of *Junonia Orithyia*, but without the orange tip on tail. They formed a pupa also identical in shape and markings. The larvæ were found on a different herb to those of *J. Orithyia*. The imagines proved to be quite distinct in colour and markings, though if brown was substituted for the azure-blue ground of *Orithyia*, their general appearance would be very similar. At the time I made no examination as to sex, and was under the impression that the present species was closely connected with, or a different brood of, that described above as *J. Orithyia*.

Precis Lemonias, Linn.

Early in October, 1881, I found a larva on same plant as that on which I found the specimens of August 27th (*Junonia Orithyia*). It has the orange neck and also a slight orange patch of same colour above anal legs, and seems identical with larvæ of *J. Orithyia*. Pupa also identical in appearance. On October 21st the imago came out, and I noted at the time, on cursory examination, that it was the same as *J. Orithyia*, except that under surface of secondaries had a reddish tinge, and were without ocelli underneath.

With regard to the three species last described, viz., *J. Orithyia*, *J. CEnone*, and *Precis Lemonias*, I am not aware if the larva of each has been separately bred and described. If such has been done, the error which

I have made will be apparent. Personally I must express my disbelief that the larvæ of the three species can be so similar as to be mistaken one for the other. Mr. A. G. Butler informs me that Horsfield and Thwaites "bred all three," but he does not say if the larvæ have been figured or described, and if they are so very similar as stated in my notes.

Hypolimnas avia, Fabr.

Mhow, October 9th, 1881.

Larva found on a small herb with a purple flower. I could not ascertain the name.

The larva somewhat resembles that of *Junonia Orithyia*, but the head is entire, of a red colour, and armed with two fleshy horns covered with short spines. The body is also armed with similar processes. Though the imagines are numerous in this locality I have only come across a single larva.

The pupa also resembles that of *J. Orithyia* in form and colouring, but of course much larger in size. It is suspended by the tail only, and has spinous projections along the centre of abdomen and dorsum of the thorax.

A favourite haunt of the imagines is fields of the yellow-flowered Rameli, but I have never found a larva on this plant.

Symphædra thylia, Fabr. (Pl. XIV., figs. 3, 3 a).

Mhow, November 5th, 1879.

Larva brought by a native, who stated that it fed on the "Tendu" tree, a large tree somewhat resembling the ash. General colour a light grass-green; a row of purple spots along centre of back. Margin of body armed with long, horizontal, fleshy processes, covered with fine green hairs of a non-irritating character. Legs 6, 8, 2. Movements regular.

Nov. 12th. Changed to a chrysalis last night. Green colour; angular, with dark and gold spots and lines. Suspended head downwards; no thoracic band.

Subsequently, in November, I obtained several more larvæ and pupæ, and on Dec. 1st I note that "another larva has become a pupa during the night."

Jan. 6th, 1880. "Imago of last noted specimen came out this afternoon. The chrysalis was not kept in the sun or exposed to its influence."

The larva is shown, poorly figured, at Pl. XIV., fig. 3; the pupa suspended from twig at fig. 3 a.

PAPILIONIDÆ.

PIERINÆ.

Terias Æsiope, Mén. (Pl. XIV., figs. 1, 1 a).

Mhow, October 5th, 1881.

Found the larva on the leaves of a seedling of a species of yellow-flowered leguminous tree, with a flower like broom. The larva being small, and exactly similar in colour to the leaf on which it feeds, is by no means easy of detection. It is vermiform in shape, green with a lateral white line on either side. Legs 6, 8, 2. Movements regular.

Pupa attached by tail, and by a thoracic sling, in the horizontal position. Wing-cases shaped like a keel; head prolonged into a point. Colour at first green; afterwards turns a dingy brownish green colour.

Imagines emerged on October 14th, but I cannot say how long the pupal stage lasted, not having precise notes on this point.

The species is tolerably common in the locality, generally flying low over green herbage in gardens and cultivated ground.

Larva and pupa figured on Plate XIV., figs. 1, 1 a.

Delias eucharis, Drury.

Mhow, Nov. 22nd, 1881.

I am not certain of the food-plant of the larva, having found only one, and that was fastened up, just about to change to pupa. The chrysalides are, however, generally found on leaves of *Butea frondosa*. They have also been found on Mahwa.

The pupæ are fastened by a thoracic brace and a caudal ligature to the under side of leaves. They are of two colours, one as shown in figure; the other with similar markings, but of a deep glazed brown on the bodies, and with wing-cases of a light shade of dull sap-green.

PAPILIONINÆ.

Papilio Erithonius, Linn.

Mhow, September 17th, 1881.

I first found this curious larva on a species of orange or sweet lime tree, a large shrub with green fleshy leaves and thorny branches, common in Indian fruit gardens. Subsequently I found them on a small green herb, growing in grassy patches amongst cultivated fields.

General colour of larva a soft velvet-like grass-green. A white line runs along either side just above the legs. The abdomen is of a greenish white colour. Legs 6, 8, 2. Two small fleshy acuminate tubercles on the upper side of terminal segment, and also on the hood-like first segment. Between these latter, on pressure between finger and thumb, a double horn, soft and erectile, of a pink colour, shoots out and quivers slightly. These processes are not perceptible when the larva is at rest; they seem to be propelled outwards as a snail extends its tentacles; they are rather yellowish at the base and reddish towards extremities. When extrusion takes place a rather pungent, aromatic, but certainly not disagreeable, odour is given out. The larvæ seldom shoot forth these processes on being handled or irritated, but only on pressure being made. When the apparatus is withdrawn no trace of an aperture is perceptible.

The first segment forms a species of hood, partly concealing the head. On the dorsum are two crescentic patches, consisting of rows of ocelli. The young larva differs greatly from the mature caterpillar, having numerous processes, armed with stiff hairs or spines, along either side and head, and being of a totally distinct colour.

The larvæ appear invariably to attach themselves to the leaf on which they are feeding by a fine, almost invisible, web. On removing a larva from the leaf the web is dragged away by the feet, and then is easily seen. I have also noticed that they devour their exuviae, at least I never could find a cast skin in the cages in which I bred the larvæ from early youth to maturity.

When about to change its condition the larva attaches itself to a leaf by the anal feet, and supports the thorax by a strong silken band, the dorsum invariably being inferior, and the position that of a person reclining

supine in a hammock; this is shown in the sketch above noted, taken from life.

The pupæ are of two colours, green and brown, but identical in form; the green specimens predominated in those I bred, in the ratio of five to three. I am unable to say if these colours of the pupæ denote different sexes in the imagines, but think it probable. It is certainly not due to food, the larvæ of both being fed on the same shrub.

A pupa of the morning of September 12th became an imago at 11 a.m. on September 27th. I bred eight specimens; on September 17th all had changed to pupæ, and early in October to imagines; but I have not the precise dates. None of the larvæ were infested with ichneumons. The imagines are tolerably common in Mhow, and are generally seen in gardens or amongst cultivated fields. They fly at an ordinary pace and are not difficult to capture.

HESPERIIDÆ.

Pamphila Mathias, Fabr.

Mhow, August 27th, 1881.

Larva found on long coarse green meadow grass. Head triangular, on a neck; a brown line along the margin of head. Body grass-green, with light yellow bars across back. A whitish line along either side above the origin of legs. Legs 6, 8, 2.

Sept. 3rd. Two larvæ have become pupæ; they lie along a blade of grass, attached by a band across thorax, and also at tail. Head generally points upwards. Body of a translucent green colour, quite naked and unenclosed in a covering of any description.

Sept. 13th. Both pupæ have become imagines to-day. They are a species of *Hesperidæ* very common about here, flying briskly by day, and settling on leaves of trees at dusk.

Oct. 9th. Another imago out to-day; same history as above.

Pyrgus Galba, Fabr.

Mhow, Sept. 15th, 1881.

Larva found on a small herb, in a rolled leaf. General colour green, finely striated transversely. Head dark brown, covered with short hairs. Neck marked with

orange and black, and sprinkled with small white dots. Legs 6, 8, 2.

The larva lies inside a roll formed by a single leaf turned over on itself. The posterior part of the body was incurved as if it was about to assume the pupal condition. When taken out of its habitation and placed on a fresh leaf the larva soon forms another residence by drawing over the edge of the leaf towards the centre by means of silk ligatures, in the usual manner of leaf-rollers.

Pupa situated in a leafy case, made by binding leaves together with a slight silken web, after the manner of some Noctuæ; it also has the remarkable greenish white efflorescence on its surface, which I have hitherto observed as a peculiarity characteristic, with few exceptions, of the arboreal Noctuæ—*i. e.*, those species which make a cocoon of leaves and silk on or above ground on herbs, shrubs, &c.

The pupa attached in cocoon by spine at tail.

Oct. 8th. Imago out to-day. Upper wings very dark green, with white or very pale yellow markings; under surface yellow, with faint brownish markings.

SPHINGIDÆ.

CHÆROCAMPINÆ.

Chærocampa celerio, Linn.

Mhow, July 23rd, 1881.

I have observed two rather distinct varieties of this larva. The first were brought to me on above date. General colour green; telescopic neck. Two ocelli on each side of thorax. The anterior consisting of a yellow ring, enclosing a green disc, on which are five or six dark-coloured puncta. The posterior on next segment is a plain yellow disc.

The second variety I obtained on Sept. 15th. General colour brown, lighter on sides; a dark broad patch of the same colour runs along the dorsum. On the borders of this patch is a stripe of very pale lilac, marked with short black horizontal lines. Small yellow puncta are scattered along the sides above origins of legs. Spiracles yellow. Large ocellus on 4th segment, consists of a deep blue-black ring enclosing a yellow field, in the centre of which is a patch of deep brown with five blue puncta in it. The smaller ocellus on next segment is

formed by a yellow disc, margined by a deep blue band. Horn on last segment black at apex, graduating into a reddish tint at base.

Both varieties were identical in shape, fed on the same herbs—a common balsam, and another plant with large palmate leaf, of which I do not know the name. The pupæ and imagines also proved to be similar. I bred several of both in separate cages.

The larvæ bind dead leaves, bits of earth, &c., with silken ligatures, loosely together on the surface of the ground; under these they change to pupæ. The latter have a curiously keel-shaped head, spine at anus, and metallic markings on a pearly ground, something like that seen in papier-maché work. This pearly sheen is best developed on the front aspect of the wing-covers.

The imagines on and after issuing from the cocoons discharge a quantity of brown watery fluid from the anus.

I bred several imagines from July to October. I have notes only of the periods of four, *viz.* :—

Formed cocoon.	Became pupæ.	Imagines.
1. July 24th.	July 28th.	Aug. 13th.
2. Ditto.	Ditto.	Ditto.
3. July 26th.	?	Aug. 16th.
4. Aug. 30th.	?	Sept. 21st.

Chærocampa thyelia, Linn.

Mhow, Sept. 26th, 1881.

The larva, of which I have found only a single specimen, I got wandering in my verandah; probably it feeds on the convolvulus often called "railway creeper" in India. Ground colour a rich grassy green. The head and front segments are retractile; last segment armed with a short spine. The lateral margins of the body are ornamented with ocelli, seven in number on each side. The anterior ocellus consists of a pale pink circle, surrounding an area of blue, in which are small white puncta. The remaining ocelli have the pink margin enclosing a semicircular patch of brown, without puncta.

The pupa is keel-headed, resembling those of *C. celerio* and *C. Oldenlandia* in shape and colouring. The larva undergoes its change in a cell made on the surface of the ground under leaves.

Chærocampa Oldenlandiæ, Fabr.

Mhow, July 23rd, 1879.

Found the larva on a species of balsam common in gardens here. They are also found on a plant which grows in damp shady places, with a large palmate 7-divided leaf on a fleshy stem springing from a rhizome. Fruit, soft berries, sessile round stem. The larva has sometimes a green instead of a purplish ground colour.

The larvæ make cocoons on the surface, or partly below ground. One specimen I noted proceeded as follows:—"The larva has made a depression in the earth at one corner of the cage, and has pulled a leaf of the plant on which it was feeding down over it, fastening it with silk, a net of which material loosely woven forms the roof of the cell. On the portion of the net not protected by the leaf are mounted small lumps of earth so as to completely hide the larva underneath. It must have placed these lumps in position after forming the net by pushing them through the interstices from within, as when I first noticed it the larva was inside, and only a few scattered lumps on the outside of the net; afterwards I found the net quite covered with earth, yet the larva could not have emerged, the network being too closely woven."

The pupa is very similar to that of *Chærocampa celerio*, but the peculiar pearly markings are deficient or very dull.

The periods of some larvæ are shown as follows:—

Larva went into cell.	Pupa formed.	Imago came out.
1. July 27th.	July 30th ?	Night of Aug. 12th.
2. ,, 28th.	,, 30th.	Morn of Aug. 16th.
3. Aug. 2nd.	Aug. 5th.	Morn of Aug. 25th.
4. ,, 2nd.	,, 5th.	? (probably same time).
5. ,, 22nd.	} Devoured by dipterous parasites like "oak-flies."	
6. ,, 22nd.		
7. ,, 25th.		? Sept. 16th.

Daphnis nerii, Linn.

Mhow, July 24th, 1879.

Larva found on a species of oleander indigenous here. I also found it on a shrub with a rosaceous flower resembling the orange blossom. General ground colour

a light grass-green; a white line on each side, with minute white round spots on each segment except the last, and a single spot only on each side of second last segment. A beautiful large ocellus on 3rd segment at each side, with deep blue margin, shading into turquoise towards a pale blue centre. The spine on last segment yellow ochre-colour, of a soft structure, and curving downwards and backwards. Legs 6, 8, 2.

July 26th. A larva about to become pupa. Previous to change they become of a dull sap-green colour, belly ochre, losing all their characteristic markings. Cocoon made on or partly beneath surface of earth out of particles of clay and fine sand held together by strong silk.

Aug. 13th. Pupa of July 26th became an imago this evening. I bred other imagines as late as January in the succeeding year.

Aug. 3rd, 1881. A larva formed cocoon this evening; the imago came out on August 24th.

SPHINGINÆ.

Protoparce orientalis, Butler.

Mhow, August 27th, 1879.

This larva feeds on a species of convolvulus which commonly ornaments the trellis-work of verandahs in Indian houses and at railway stations; hence vulgarly known to Europeans as "railway creeper." The larva is abundant wherever this plant is growing; ground colour a grassy green; a strong and large "horn" on last segment of a yellow colour. The spiracles are generally surrounded by coloured margins, varying in different specimens. In some I noted the outer circle was dark brown, surrounding an inner one of yellow, inside which was a red field. In others only the first spot presented three colours; the remainder were merely brown at centre and yellow outside. The semi-horizontal lines above the spiracles are sometimes dark brown with white underneath, or simply greenish white lines only.

One of these larvæ was infested by two thread-worms resembling some species of *Filaria*, about as thick as fine sewing-cotton, and attaining a length of four inches. One I found on the larva when captured, the second a day or two afterwards in the cage in which the same

larva was confined. I presume they inhabited the larval intestine; or possibly, like the *Dracunculus* in the human subject, the muscular tissues. This is the only case in which I have observed such an occurrence.

The larva, when about to change, burrows to some depth below the surface of the ground, forming an oval cell, the walls of which harden so that it can be dug up intact, and inside which it becomes a pupa. No silk of any kind is used in forming the cocoon or cell.

The pupa is provided with a separate sheath for the long maxillæ, as shown in the figure; it is of a reddish chestnut-brown colour. Immediately after casting the larval exuvium the pupa is of a translucent green colour; after a time the envelope hardens, and turns to a bright chestnut tint.

I bred numbers of the larvæ from July to September. They appeared to me to be about the commonest species of *Sphinx* found in the vicinity, and are reared without difficulty.

ACHERONTIINÆ.

Acherontia Styx, Westw.

Mhow, October 5th, 1881.

Of two larvæ figured by me, I have some doubt as to which is the larva of *A. Styx*, as will be seen from the history detailed below.

On above date I got several of both these larvæ in abundance in one field of "Tilli" (? jessamine). In the whole country I found them in only this one situation. That they were two distinct species of larvæ I am certain, having observed specimens in various stages of growth. They burrowed under ground, forming cells of earth of an oval shape, in which they changed to pupæ; similar in all particulars to that figured. The two species of larvæ were bred in separate cages, and, on comparing the pupæ of each with the other, I could detect no difference. Before the imagines could come out I had to pack up my specimens *en route* for England, and did not keep the cocoons and pupæ of each species distinct.

On arrival in England I was unable to unpack my cases until early in September. I then found three imagines dead after emerging from pupa-cases. Other pupæ were devoured by parasites, and two were crippled in emerging, being probably killed by shocks to the box in which they were packed. All the imagines, so far as

examined by me, appeared to be the same, but, owing to their imperfect condition, this may admit of doubt (?).

That the larvæ were different I cannot doubt, and, as Mr. A. G. Butler informs me that there are two species of Indian "death's-heads," I believe the two larvæ in question represent those two species. It is, of course, possible that all the pupæ of one larva died, and the imagines found represented only one species; but this is not probable, as I had about the same number of pupæ in each case.

Curiously, in an old note-book dated Nasirabad, August 20th, 1877, I find that I there bred several "death's-heads" from "large green caterpillars of some *Sphinx*"; and further, "When the moths are touched they raise the wings, and move the abdomen up and down, making a creaking noise, and ejecting an orange-coloured fluid from the anus. The abdomen seems to contract and expand when the insect makes the above sound."

SMERINTHINÆ.

Clanis cervina, Walk. (Pl. XV., figs. 1, 2).

Mhow, August 25th, 1881.

This larva feeds on the leaves of "Palas," *Butea frondosa*. I have always found it on the small bushes, not on the trees, and only in this one situation. The shape of the young larva differs somewhat from that of the full-grown one, as will be evident from inspection of the figures. The shape of the head especially is very distinct; also the size and shape of caudal spine. General colour a grass-green; white lines along the sides. Small yellow puncta on the enormous head.

I had the greatest difficulty in rearing these larvæ, and, although I procured numerous specimens, yet I was singularly unfortunate. In the first place I found it almost impossible to preserve the "Palas" leaves fresh for even an hour or two in the cages, either the twigs in water or in damp earth. Then the larvæ, after reaching maturity, either died without any apparent cause, or developed parasites, or rotted in the cocoons after becoming pupæ, or even before they had changed. Finally, when by dint of perseverance I had got a few larvæ to all appearance safely under ground, I got orders for home, and had to pack up all specimens as I best could for the journey. These four larvæ retired under ground

in October; on March 3rd following I opened the cells of earth carefully and found them still unchanged. I next examined them in England on August 28th, 1882, and found two larvæ dead, unchanged, one dead pupa, and the third changed to an imago,—dead, of course,—and wings rather undeveloped owing to want of room to expand while packed up in cotton wadding.

The pupa is of the ordinary form of the order, without detached maxilla-case (Pl. XV., fig. 2). The larva, young specimen (Pl. XV., fig. 1 *a*), front of head (fig. 1 *b*). The mature larva (Pl. XV., fig. 1).

Amongst the numerous larvæ which I have bred not one gave me a tithe of the difficulty which I encountered with this species. They seemed to die on every possible opportunity, such as changing skin, &c., and I frequently despaired of ever obtaining a pupa. Possibly the best chance of obtaining perfect specimens would be by digging, in the winter months, under the "Palas" bushes; but the wild boar and bears generally anticipate one in endeavours of this kind after "grubs."

Clanis Deucalion?, Walk.

Mhow, July 9th, 1879.

Found a large larva of some *Sphinx* wandering amongst grass. General ground colour light yellowish green. White lines running at a slight angle from dorsum to edge of abdomen. A short blunt horn on dorsum at caudal end. Buried itself the same day at noon.

Took it out of earth on July 21st. The pupa was made in a large oval earthen cell below surface of ground. Imago came out the night of August 7th or morning of the 8th. By the great size of the abdomen it would seem to be a female.

This specimen possessed the most extraordinary vitality. It recovered four times from poisoning by chloroform after apparent death on each occasion; it also recovered after being twelve hours in a cyanide bottle. The same thing occurred after chloroform and twelve hours in a box with camphor. Finally I had to inject chloroform into abdomen, pinch the thorax, and leave it over cyanide all night. This eventually killed it.

Figure (outline) of larva, the only specimen I have met with. Figure of pupa and imago on page 1, sketch-

book No. 6. The specimen itself was destroyed by mites or lost, I forget which.

Polyptychus dentatus, Cramer.

Mhow, September 3rd, 1879.

These large larvæ are found on leaves of the "Lasora" or "Gondi," a tree of considerable size, something like the English oak. General ground colour a fine rich green with puncta, as shown in the figure, which was taken from a larva about to change, and presenting a pinky brown ground colour instead of the green normal tint noted above. They are easily reared and pretty abundant, but I have never caught any wild imagines.

The above specimen, with two others, burrowed under ground same day. On Sept. 6th I dug it up, and found the larva shrivelled in size inside a cell of earth of an oval shape; the colour now of a dull greenish brown. It remained unchanged until Sept. 8th, when I note "that it changed to pupa during the night or early this morning," "larva-skin quite moist and fresh." The pupa was of a fine chestnut-brown, and shape as figured.

Sept. 22nd. First imago out to-day. General ground colour of body and wings a bistre-brown. Thorax peppered with white; wave-like markings on wings of a deep velvety brown tint; body mouse-coloured; legs naked, creamy white; under wings plain brown colour; body very large. They simulate death when touched, falling down and contracting their limbs, and will remain in any posture in which they may be placed for an indefinite length of time.

ARCTIIDÆ.

Alope ricini, Linn.

Mhow, August 17th, 1881.

I have always found this larva on a climbing convolvulus with purplish flowers, commonly grown on verandahs here.

Head of a deep black colour; body very dark brown; a brown line down centre of back with a yellow margin on each side; a similar but fainter line along each side of body, interrupted at junctions of segments. Body thickly covered with tufts of brown hairs in whorls, tipped with dirty white.

The cocoon is frequently made in the form of a horizontal hammock (but sometimes vertical), spun of fine silk, in which the hairs of the body are interwoven; a dark spot generally marks each end of hammock. Pupa slightly adherent by caudal end to hammock.

The larva figured I found on September 5th, 1881, and describe it as somewhat like that of *Alope ricini*, but stripe down back of a muddy yellow; an irregular line of dirty white along sides; head black, upper lip and palpi white. General colour of body a light brown; without hair, except small scattered filaments on back and on sides above the legs.

On Sept. 7th I record that "To my astonishment, on looking at this larva to-day, I find it covered with hair. On searching the cage I found the mystery explained by a cast skin. It is the *Alope ricini*; curious its casting all the hairs first, so many days before it threw off the skin."

Those larvæ noted spun cocoons as follows:—July 29th, August 22nd, August 26th; imagines came out August 13th, September 7th, September 12th.

Cretonotus interruptus, Linn.

Mhow, November 2nd, 1881.

Small hairy larva; Indian ink-brown colour; whitish yellow line along back; similar marks along lateral margins; whorls of hair on each segment; head slightly divided between eyes on vertex. No notes of pupa.

Arcas laticinea, Cramer.

Mhow, September 20th, 1881.

Larva found on a shrub with fleshy stem and leaves, from which a milky juice exudes on fracture, called "Ankra" by the natives. Body clothed with tufts of long shining black hair in whorls. In the earlier stages the larvæ have a light reddish brown patch on the dorsum; they afterwards become a deep shining black all over, but in reflected light a brown shade appears about the base of the hairs. They are very active in their movements. The hairs do not seem to irritate or penetrate the human skin when the larva is handled.

Cocoons made of silk with earthy particles adhering, on and partly under the surface of the ground.

LITHOSIIDÆ.

Lacides ficus, Fabr.

Mhow, September 7th, 1881.

Larva found on the leaves of "Piple," "Pakar," or "Pakal," a species of *Ficus* somewhat like *F. religiosa*, but without the long attenuated apex of the leaf of the latter. The larvæ are also found on the leaves of *F. religiosa*. Head shining black; body dark velvety brown, dotted with red papillæ, from which issue weak white hairs. A bright yellow patch exists on lateral margin of segment between pectoral and ventral legs; a similar patch also between last ventral and anal legs; pads on ventral and anal legs are very large. Legs 6, 8, 2. The colouring of the larvæ varies in different stages of growth, the younger larvæ having yellow markings along back and orange on neck.

Pupa armed with five or six small spines at apex. Colour rich glossy chestnut. Cocoon in one instance was made on surface of earth, but as a rule they are made under the surface; composed of silk, into meshes of which earth is woven.

The imagines are active, and equally endowed with powers of flight. The male has bipennate antennæ, female filiform. The larvæ are easily bred and tolerably abundant.

LIMACODIDÆ.

Miresa albipuncta, H.-S. (Pl. XIV., fig. 8—8c).

Mhow, August 2nd, 1879.

The larva is found plentifully on the leaves of "Palas" shrubs (*Butea frondosa*); most abundantly on the fresh growth which springs up from stumps cut away the previous season. It is quite conspicuous on the upper sides of the leaves, and makes no attempt whatever to conceal itself or elude observation. On being handled a stinging pain is felt, and an irritable rash produced on the part touched, similar to that caused by nettles. The pain lasts for about ten minutes, with considerable itching, but leaves no ultimate ill effect. The larvæ are very sluggish, and do not attempt to escape when handled. On being touched by the hand or by another insect they move the head from side to side as if endeavouring to sting the assailant with their hairs.

The pectoral legs are very small. There are one pair of prolegs apparently on each segment posterior to the pectoral legs; the anal legs are not well marked. The prolegs are membranous and very difficult to distinguish, the movements being snail-like or vermiform, by waves. The head is under a hood formed by the 1st segment, and is not visible even when the larva is feeding; it can, however, be protruded voluntarily by the larva.

The pupa is formed in a small oval, very dense, shell-like cocoon (Pl. XIV., fig. 8 c) near surface of ground, or on under side of leaves in some few instances. Those made in confinement were always attached by base to wooden floor of the cage, and covered over with sand or earth from one to two inches in depth. The shape of the pupa is peculiar, the body being curved, and wing-cases extending almost to the extremity of the abdomen. (Pl. XIV., fig. 8 a).

The larva is figured at Pl. XIV., fig. 8, and one of the eight large dorsal spined arms magnified at fig. 8 b.

Aphendala tripartita, Moore. (Pl. XIV., fig. 14).

Mhow, August 16th, 1879.

Larva not common. Found on "Palas" (*Butea frondosa*), on date-palm, and on a shrub which I am unable to name. Habits similar to those of *M. albipuncta*. Head under a hood formed by 1st segment. The spines possess the property of irritating the human skin, and the movements and anatomical characteristics of prolegs are the same as in the species above mentioned. The largest larva I obtained was $1\frac{3}{8}$ in. long, nine chrome-yellow spiracles, and ten lilac spots along each side; the same number of spots along centre line of dorsum. There are four rows of fleshy spines, armed with poisonous hairs on dorsum and lateral margins. Stinging powers severe. The membranous prolegs are best seen when the larva is forced to crawl along an edge, such as that of a card or a paper-knife; the prolegs are then tolerably defined as they grasp the edge at each side to keep the larva from toppling over.

The cocoons are similar to those of *Miresa albipuncta*, and are made under the surface of the ground. The larvæ are infested by a large dipterous parasite somewhat like, but larger than, the common house-fly.

Larva figured at Plate XIV., fig. 14.

Parasa lepida, Cramer.

Mhow, November 24th, 1879.

The larva, which is tolerably common, feeds on the leaves of the well-known mango-tree of India.

The description given of *Miresa albipuncta* applies to this species so far as concerns the legs; pectoral legs six. Prolegs merely membranous folds, so indistinguishable one from another that I could not count them, or even see them, unless the larva was in motion, when they appeared as waves commencing at the thorax and ending at the anus, the mode of progression resembling that of a snail. A blue line runs down centre of dorsum, with a paler blue line along either side of body. At the posterior (anal) end of the lateral lines is a black tuft; two similar tufts exist at the anus. Two red tufts adorn the dorsum of thorax, also two on dorsum of second last segment; rows of green tufts also run along dorsum and lateral margins. Some of the spines in the inferior lateral line of tufts terminate in short white hairs, and have a small whitish process in the centre of the tuft.

The cocoons and pupæ resemble those of *M. albipuncta*, but are invariably made on the trunk or branches of the mango-tree, unconcealed in any way. The texture is very dense and hard, but brittle like an egg-shell. I have not noticed any stinging powers in the case of this larva.

LIPARIDÆ.

Psalis securis, Hübn.

Mhow, August 25th, 1881.

Larva found amongst long meadow grass, on which it feeds. Head dark brown; broad lemon-yellow band along each side of body. On dorsal surface of the central segments are four dense tufts of short deep brownish orange hairs; two head and one tail tuft of long dark brown or blackish hairs; other thinner tufts of hair of a whitish colour on each segment at sides of body. Front legs six, black; posterior eight, sienna-red; caudal two, ditto. Black velvet line down centre of back, bordered on either side by a yellow band of small oblong marks, varied by a bright orange mark on every fourth yellow patch.

Cocoon of silk, attached by greater length to stem of grass. An opening defended by hairs exists at inferior extremity for egress of imago. Head of pupa towards this aperture.

From a cocoon spun on Sept. 1st an imago came out on night of Sept. 11th. It occupied, when at rest, the position shown in the sketch, the front legs stretched out in advance of the head, and was sluggish and not easily excited to move during the day.

Parasitic on this larva is a large yellow-bodied insect like a sawfly, with long antennæ, which are perpetually in a state of tremulous motion. A single parasite occupies a whole pupa.

Euproctis lunata, Walk. (Pl. XIV., figs. 5—5 c).

Mhow, September 23rd, 1879.

The eggs, covered with down from the abdomen of the female, are deposited in oblong masses on the twigs of *Acacia Gummi-arabice* and allied species (Pl. XIV., fig. 5 a). The larvæ feed on leaves of above tree, also on *Zizyphus jujuba* and garden rose.

The larvæ hatched from a mass of eggs on Sept. 23rd, changed skin for the first time on Sept. 27th, again on Oct. 6th, and a third time on 15th to 18th of October. I noticed that all the larvæ were not the same size. On Oct. 29th some had begun to spin cocoons of a loose web-like character, singly and gregariously in the corners of the cage. Nov. 5th: Most of the larvæ had spun cocoons on this date, and by Nov. 11th almost every one had done so. The cocoons are soft silken bags formed under surface of earth, but close to it, and with particles of clay adherent to them.

Pupæ with small caudal spine. Male smaller than female, and distinguished by its larger antenna-cases.

The imagines, when touched, fall down and simulate death. General colour white, with black oblong patch at centre of primaries.

Male smaller than female, with large doubly-plumed antennæ. In the female the antennæ are smaller, but otherwise resemble those of male. The extremity of female abdomen is also furnished with a large mass of silky down, absent in the male, and used to clothe the egg-masses after deposit on twigs of the food-plant. In the female the mouth is rudimentary; I could find no

trace of maxillæ. The labial palpi were 3-jointed, middle largest, terminal very small. The legs were feathered. No spines on anterior tibiæ; two spines at extremity of middle tibiæ; two spines at centre, and also at extremity of the posterior tibiæ. In the male, mouth and legs same as in female, except that the anterior tibiæ are furnished with a thick tuft of hair, in which is concealed a strong, jointed, ensiform spine.

Larva and male and female pupa figured at Pl. XIV., figs. 5, 5 b, 5 c.

Nioda fusiformis, Walk. (Pl. XV., figs. 5—5f).

Mhow, September 6th, 1881.

Found two of these curious larvæ on a Babul (*Acacia* sp.) tree. Legs 6, 8, 2. General ground colour bluish grey. A double line of red dots (tubercula) studded with hairs exist along each side of body. On the dorsum a broad black line runs from the brush-like thoracic plumes to the base of the caudal plume. On the dorsal surface of the two segments immediately preceding the caudal plume are two tubercles of a red colour, and without hairs. The head is adorned by two long plumes of black hairs; a similar plume, but consisting of hairs of three different lengths, ornaments the last segment; the pennate extremities of these hairs are very singular and elegant. On each side of the thoracic segments is a short plume of similarly feathered black hairs, mixed with longer simple white hairs. On the dorsum of thorax and of 1st abdominal segment are four thick shaving-brush-like tufts of vertical short white hairs; the three thoracic are separated by a short interval from the fourth tuft.

Sept. 7th. Both larvæ spun small hammocks or cocoons of whitish silk mixed with the hairs off their bodies, and having an opening at one end for escape of the imago, similar to those of *Psalis securis*. The larva skin remains in cocoon at one end. Pupa: Front clear milky white colour; back marked with brown. It is attached by caudal point to cocoon. Very fine hairs sparsely scattered on body.

Sept. 16th. One imago out this morning. In posture and general appearance resembles *P. securis*.

Larva, details of hairs, and pupa (Pl. XV., figs. 5—5f).

Pseudomesa incerta, Walk.

Mhow, September 5th, 1881.

Larva found on the leaves of Pipal, Babul, and Ber trees. Colour light brown with creamy variegations and dark markings, as shown in figure; belly and lower margin of body of a greenish brown. Along dorsum a double row of tubercles exist armed with minute spines; sparse tufts of hair of simple character exist along lateral margins of segments. All the hairs and spines are simple, and possess no irritating properties.

The pupa is suspended back downwards in a hammock of very thin and openly-worked silk; it is attached to the net by caudal spine. A tuft of black hair exists on the head; hairs also along dorsum of thorax. The remainder of body is thinly clad with short white down. Colour a dull dark purple brown. The wing-covers appear short in proportion to remainder of body, especially in female pupæ, which are also much larger than the male.

The male imago is active, and with plumose antennæ and fully-developed wings. The female is much larger in size, with rudimentary wings, simple filiform antennæ, and an enormous abdomen clothed with very short light fawn-coloured hair. It is extremely sluggish in its movements, seldom even moving from one position for days. The females are extremely prolific, laying great numbers of eggs in semiglobular masses attached to leaves, &c., and covered with fine down torn from their bodies. They live for about a week, and then, having deposited all their eggs and stripped themselves bare of down, die, shrivelled, naked and atrophied objects—but the shadow of their former selves.

The larvæ vary in size; I have found some about one-third longer and three times as bulky as that figured. They are occasionally infested with a minute red tick-like parasite.

Perina nuda, Fabr. (Pl. XIV., figs. 7—7 *b*; Pl. XV., figs. 6 *a*—6 *d*).

Mhow, August 29th, 1881.

The larva feeds on the Gular (*Ficus* sp.), but I have also found it on the Pipal (*Ficus religiosa*). It is very

sparingly hirsute, having feeble white hairs along the lateral margins of body, also springing from the yellowish velvety tubercles on body, and from two of the red tubercles on head; the hairs do not irritate the human skin.

The pupæ bear a considerable resemblance to those of butterflies, suspending themselves by a few irregularly decussating fibres of silk on the under side of a leaf, and are uncovered by a net or cocoon of any description. The tension of the silken cords generally inverts to a slight degree the edge of the leaf, but not sufficiently to conceal the pupa when the leaf is viewed from below. The surface of the pupa next the leaf is of a pale yellowish white, but its outer surface is coloured with yellow, green, and brown.

The male imago is very active, clear-winged, and with large plumose antennæ. The female much larger, with white wings and body, very sluggish, and dull in disposition. The imagines do not seem common here; I have never captured them at light. The females are very inactive at all times, but the males attempt to escape from the breeding-cages even in the daylight, on the least disturbance being made; they are not, however, diurnal in their habits.

Ova, larva, and pupa figured on Pl. XIV., figs. 7, 7 *a*, 7 *b*.

Pl. XV., fig. 6 *b*, shows the posterior or medial leg of both sexes. Only two spines exist at extremity of tibia, none at its centre. Legs sparingly covered with hair.

Pl. XV., fig. 6 *c*. Anterior tibia of male, with hinged appendage fitting into hollow on one side.

Pl. XV., fig. 6 *a*. Palpus, magnified; the two basal joints largest; clothed with hair; joint between terminal and medial portions not well defined; basal joint about as long as the two others combined.

Pl. XV., fig. 6 *d*. Apex of male abdomen, with integument removed to expose internal organs.

The maxillæ are very slender, and about the length of the head. Palpi not conspicuous, somewhat recurved. Antennæ of the male broadly pennate; of the female also pennate, but much narrower than in the male.

Trisula variegata, Moore.

Mhow, August 28th, 1881.

The larva, of which I have only seen a single specimen, was stated to have been found on the leaves of a Pipal tree (*Ficus religiosa*). It was thick, fleshy, and "grub-like," of a dull sap-green colour, and the body scantily clothed with moderately long hairs.

The cocoon was made of sand and small stones firmly bound together with silk of very strong texture, in a corner of the cage, partly under the surface of the earthen or sandy layer in its bottom.

The pupa has a curved caudal spine, and is of a rich chestnut-colour. It did not appear to be fastened within the cocoon.

The imago came out on October 6th. I have not met with another specimen.

LASIOCAMPIDÆ.

Chilena strigula, Walk. (Pl. XIV., figs. 6—6 b).

Mhow, September 17th, 1881.

Larva found feeding on leaves of a small thorny bush, somewhat like *Acacia*. General colour black and yellow. Body adorned by tufts of hair on each segment, short along dorsum and margins, except one long tuft of black hairs tipped with white on terminal segment, and two similar tufts on 2nd and 3rd segments; other shorter hairs of an orange colour on body, as in figure. Legs 6, 8, 2.

Cocoon formed of strong silk attached by long axis to stem of shrub; inferior extremity arranged to open for extrusion of imago.

Pupa of a dark chestnut-brown colour, without spines; truncated at its caudal extremity.

Imagines came out about middle and end of October.

Figures of larva, pupa, and cocoon on Plate XIV., figs. 6, 6 a, 6 b.

Trabala Vishnu, Lefebvre.

Mhow, September 12th, 1881.

Larva feeds on the leaves of the pomegranate, rose, and probably other shrubs. It somewhat resembles in

general appearance that of *Lebeda Buddha*, but is without the peculiar bunch of short hairs on dorsum of thorax which exists in the latter species. General ground colour is that known as "old gold." The lateral tufts of hairs are also of the same colour, but the two head-plumes are black. Head pink, marked with yellow striæ; spots on back are blue and studded with scanty short black hairs; belly a yellowish green, marked with pink and brown bars transversely. Body elsewhere is covered with a smooth fleece of short golden fur. Legs 6, 8, 2, pink. It is one of the handsomest larvæ I have met with, and tolerably easily reared.

The cocoon is formed on a twig of the food-tree; spun of yellow silk intermixed with hairs of larva. It is firmly attached by silk and hair wound round the twig above and below the cocoon. The peculiar shape is shown in figure. An opening exists at inferior end of cocoon, through which the skin of the larva is extruded after the change to the pupa. In some cases I have noted that an opening in the form of a slit appeared to exist in each end of the cocoon.

The pupa is of a yellowish red colour, quite smooth and devoid of spines or hair, except at caudal end, where there is a tubercle armed with minute spines, to which silk is fastened in order to attach pupa inside the cocoon. The shape of the neck and thorax of pupa is remarkable.

The male imagines are green, with large pennate antennæ. The under wings are extended horizontally, and at an angle of about forty-five degrees from the centre line of the body when the insect is in repose. The upper wings remain in their usual situation, meeting along the internal costæ in central line of dorsum. This is shown in the figure of the male drawn during life.

The female is larger than the male, and of a yellow colour, so presents a great contrast to the opposite sex. A wild specimen, which I found dead near some recently-deposited eggs on a tree, was much larger than those which I bred from the larva in captivity. This was no doubt due to deficient food supply. The eggs of the female are attached to leaves, and covered with down and white hairs from the vicinity of the anus of the mother.

The younger larvæ have silver instead of gold-coloured

fur. The imagines are very sluggish, and are indisposed for flight during the day.

Megasoma venustum, Walk.

Mhow, August 27th, 1881.

Larvæ very common on leaves of Babul and Ber trees in Central India; they vary in their markings at various stages of growth, so that figures, unless all taken at the period of most complete development, will be found to differ considerably. The full-grown specimens are characterised by \simeq semi-lunar double markings on the dorsum, as in figure. At the ends of these markings minute red papillæ exist armed with spines, but having no irritating properties. At the anterior commissure of the semi-lunar markings a light blue spot exists. General colour of larva a greyish brown. Tufts of long simple hairs at lateral margins of segments, with shorter dilated hairs amongst their roots. Two peculiar transverse patches of short coloured hairs ornament the dorsum of the thorax. When the larva is irritated these patches open out from within, and display deep blue-brown hairs, with a line of reddish orange in front of each. When quiescent these patches are denoted by a mere line of blue, with red in front and white behind. Abdomen of larvæ black, with a yellowish-white spot on each segment.

I have found full-grown larvæ as above, but without the \simeq markings; these are very rare, and on being bred developed the same imagines as the other specimens.

The cocoon is hammock-shaped, formed on a twig of the *Acacia* tree, attached along whole length of one side, and is formed of strong whitish or brown silk. On its external surface are coloured bars, formed apparently by the attachment of the short hairs on the dorsum of the thorax of the larva. The cocoons are generally formed in a perpendicular position, the head of the pupa being upwards.

Pupa rather cylindrical in shape, clothed with fine hairs, of a brownish-red colour. Female much larger than male.

Imagines, both male and female, extremely sluggish by day, and even by night the female does not appear to move about. The wings of the female are occasionally

but partly developed, and I have bred specimens which did not leave the pupa-case, but remained attached to it by abdomen, filling it with eggs before having had intercourse with a male. The mouth appears rudimentary and useless. Wings large and extending beyond extremity of abdomen. On issuing from pupa-case the abdomen is full of perfectly-developed eggs with *hard* shells. Should the female be confined alone the eggs will be deposited, but will not produce larvæ; on admitting the male fertile eggs will be produced. But how does the seminal fluid penetrate the dense shells of the eggs and reach to the bottom of the mass of eggs contained in the ovaries? The whole abdomen of the female is simply a conglomerated mass of eggs, no room being required for digestive organs, as the imago never feeds from birth to death.

Seven-eighths of the larvæ I bred proved to be females. The male imago has wings much shorter than abdomen, but is capable of flight, is very sluggish, and simulates death when handled. When examined immediately after issuing from pupa-case the extremity of the abdomen is seen to be furnished with an easily detachable tuft of fine hair of a light brown colour, tipped with dark brown.

Lebeda Buddha, Lefebvre (Pl. XV., figs. 3—3 b).

Mhow, August 22nd, 1881.

The larva feeds on the leaves of the Mahwa tree, and bears a considerable resemblance in appearance and habits to that of *Megasoma venustum*, but the markings on the back are quite distinct, being irregularly oval velvety brown patches, containing four blue papillæ armed with long hairs. They never have the)((half-moon) marks so characteristic of *M. venustum*. General ground colour of larva dark grey. A narrow crimson line across dorsum of 2nd segment, behind a tuft of dense short hair; lateral margins clothed with tufts of long simple hairs of a whitish brown colour. Very few hairs with expanded extremities are to be seen, except in the dense dorsal tuft, and two or three in dots along the lateral margins. These larvæ are apparently much more rare than those of *M. venustum*, and I had difficulty in feeding them, as, strange to say, they obstinately

refused any leaves of Mahwa, except those of the identical tree on which they were found.

The pupa and cocoon are very similar to those of *M. venustum*, but the latter is not marked with cross-bars outside, or quite so hammock-like, and it is of thinner silk.

The male imagines have abdomen longer than wings, and a curious porcine aspect about head and thorax. The females resemble those of *M. venustum*, except in colouring. Both sexes rather more active than those of former species, but evidently very closely allied.

Figure of male imago, pupa, and larva (Pl. XV., figs. 3, 3 a, 3 b).

BOMBYCIDÆ.

Trilocha albicollis, Walk. (Pl. XV., figs. 10, 10 a).

Mhow, August 14th, 1881.

Larva feeds on the leaves of Pipal (*Ficus religiosa*). General ground colour a soft pale brownish grey, diversified with pale ochre-brown puncta and markings. A soft spine on dorsum at caudal end.

Cocoon of a cylindrical shape, attached by one side to leaf, and also secured by a web of loose silk netting above it; it is formed of yellow silk, and is of firm texture.

Pupa not particularly noted.

From a cocoon made on August 18th the imago came out on August 25th. Body and wings of a soft pale French grey. Antennæ plumose, hooked at the end. The wings are extended horizontally when at rest. The medial and posterior legs are without spines.

Figures of larva on a Pipal leaf and cocoon (Pl. XV., figs. 10, 10 a).

NOTODONTIDÆ.

CAREINÆ.

Dabarita subtilis, Walk. (Pl. XIV., figs. 4—4 b).

Mhow, October 15th, 1879.

The larvæ feed on the leaves of a tree called "Jaman" by the natives. They have a very peculiar appearance, owing to the large bladder-like expansion of the 1st segment of thorax. This appears capable of contraction and dilation at will; in the latter condition the head is almost concealed within it.

The cocoons are formed of strong yellow silk, of an

ovoid-oblong form, somewhat boat-shaped. Generally spun on the surface of a leaf.

Pupa smooth, and without spines at caudal end.

The imagines, both male and female, are active, and similar in general appearance. Antennæ long and filiform. Maxillæ coiled, as long as thorax. Labial palpi recurved, 3-jointed; terminal smallest. Scales on body and wings very firmly attached, except under the thorax. The 1st joint of the posterior tarsi is of extraordinary size; it is clothed with fine hairs, which when removed display a covering of small scales; on removing these latter a strong brush of white hairs, arising at the inferior extremity of the tibia, are seen at "a."

I cannot conceive the utility of the curious brush described above, as it is so firmly bound down by the scaly integument into the hollow of the tarsal joint that, except through accident, I should hardly have discovered it. The 1st joint of the tarsus is hollowed out on one surface in order to allow the brush to lie in its concavity. I find no notes as to whether this is a sexual peculiarity. I have a note that the anterior tibiæ in a female were found to possess the hinged joint which was noted in the males, but I am not certain that this is always the case.

The larva and male and female pupa are figured on Plate XIV., figs. 4, 4 a, 4 b).

GLOTTULIDÆ.

Glottula dominica, Cramer.

Mhow, August 20th, 1879.

Larva feeds on the spongy interior of the large, acuminate, single, fleshy leaves, from one to two feet long, of a plant grown in gardens here, bearing a white flower on a compound branching stalk; I am ignorant of its name. The larva lives in concealment, mining in the intercellular tissue between the two surfaces of the leaf.

Pupa formed in a subterranean earthen cell. No white efflorescence on surface.

Imago (male?) has two brushes at base of abdomen. Maxillæ very short.

The eggs are deposited on the surface of the leaf, in a spiral form, and are sparsely clad with short hairs.

APAMIIDÆ.

Prodenia retina, Guenée.

Mhow, September 4th, 1881.

Larva found on a purple-flowered climbing convolvulus (railway creeper). It has a curiously abrupt truncation of caudal extremity. General colour a pinky brown; pinkish line down centre of back. A double row of spots exists on each lateral margin; the superior row consists of triangular patches, black above, with a yellow line at base, except the third patch from the head, which is altogether black in colour. The two anterior patches have more yellow at base than any of the others. The inferior row of patches is wholly of a black velvet colour. Legs 6, 8, 2. Progression regular.

The larva buried itself under earth Sept. 4th, closing the hole by which it entered with a plug of damp clay. The cocoon is formed of a cell of earth some inches below surface.

Pupa a bright chestnut-colour, with two small spines at apex.

Imago came out on September 20th.

Perigia centralis, Walker; *Celæna serva*, Walker;
C. cano-rufa, Walker (Pl. XIV., fig. 11).

Mhow, October 12th, 1881.

The larvæ were obtained in great abundance, and in various stages of growth, on the leaves of Rameli, a plant cultivated for the sake of its oil in this locality (see Pl. XIV., fig. 11). The movements are almost semi-looping in character, yet the larva has sixteen legs.

I have not recorded the characteristics of cocoon and pupa, but I believe the change took place in small earthen cells below surface of the ground, and that the pupæ were of the usual chestnut-colour, without any white efflorescence on surface.

HELIOTHIDÆ.

Heliothis armiger, Hübn.

Mhow, October 1st, 1881.

Larva feeds on the flowers of *Zinnia elegans*, indigenous in this locality. It burrows into the centre of the mass of pistils, which it devours, going from flower to flower,

and not touching the leaves. There are darker varieties of the larva than that figured, but otherwise identical.

The pupa is formed in a cell of clay below the surface of the ground, similar to those made by some Noctuæ. Apparently no silk is used in its formation. The pupa is of a light yellowish chestnut-colour; body smooth; at the caudal end are two spines separated at base, and meeting at apices.

PLUSIIDÆ.

Plusia chrysitina, Martyn (Pl. XIV., figs. 13, 13 a).

Mhow, October 8th, 1881.

Larva found on a flowering cereal called "Rameli," grown in cultivated lands in this vicinity, and now in bloom. Owing to the colour of the larva it is very difficult to detect by the eye, but numbers are easily procurable by beating into an umbrella. Two front pairs of prolegs absent. Movements looping.

Pupa made in a delicate net of silk within a partially-rolled leaf. It is coloured as shown in figure (Pl. XIV., fig. 13 a), and has no white efflorescence.

The imago, of which I bred but one, has a crested thorax, and large golden patches on the upper surface of anterior wings.

Figure of larva on a stem of Rameli, also of pupa, Plate XIV., figs. 13, 13 a.

GONOPTERIDÆ.

Cosmophila indica, Guenée.

Mhow, October 4th, 1881.

Small larva found on Razal, a plant with an edible flower, in my garden. Semi-looping in progression.

Pupa contained in a cocoon in a partially-rolled leaf.

HOMOPTERIDÆ.

Homoptera solita, Walk. (Pl. XIV., fig. 9).

Mhow, October 7th, 1881.

Larva found on the leaves of seedlings of a leguminous tree. Movement looping. Two front pairs of ventral legs deficient; remainder normal (Pl. XIV., fig. 9).

Pupa made in a leafy cell, lined with loose silken web.

Head superior. Attached to cocoon by apical spines (Pl. XIV., fig. 9 *a*).

Imago has a stout body, with crested thorax. General colour brown, with wavy marks on wings. The anterior legs are so thickly covered with hair, on tibiæ and upper tarsi, that I could not make out the spines, but I fancied that there were two weak ones at extremity of tibia. Maxilla well developed; labial palpi appear to have the two last joints about equal in size. Antennæ filiform.

Homoptera continua, Walk. (Pl. XV., fig. 9).

Mhow, September 14th, 1881.

Larva found on a small thorny shrub. General ground colour green; whitish along the dorsum. A yellow line divides each eye into two portions; a yellow line, on which are blue puncta, runs along the lateral margins of body. Legs: pectoral, six; ventral first pair obsolete, second pair rudimentary, third and fourth normal; anal legs, two. Semi-looping.

Pupa made in a leafy case, lined with spiders' web-like silk. The pupa is attached inside cocoon by the apical spines, and is covered with a white efflorescence.

I bred two imagines. General colour dark brown; one with plain wings, the second with two white transverse, carpet-pattern-like, bands across the upper wings, and a crested thorax.

Figure of larva on Plate XV., fig. 9.

HYPOGRAMMIDÆ.

Ercheia diversipennis, Walk.

Mhow, September 24th, 1881.

Larva found on grass. General colour a pale soft grey on superior surface; abdominal surface is of a fine deep pink or lake tint.

Cocoon made by binding down a leaf on itself, a piece of grass also attached.

Selepa celtis, Moore (Pl. XV., fig. 4).

Mhow, October 10th, 1881.

I found on a shrub, called by the natives "Bahera," two curious little brownish larvæ. They have their heads surmounted with several exuviæ of the heads of

the larva in its younger stages, and remind one very comically of the typical Jew "old clothes" man.

I omitted to sketch the larvæ before they had changed, but I believe they were clothed with short thin brown hair. Legs normal.

Cocoon formed of silk, somewhat like a boat overturned, with apparently an opening at one end, and curiously adorned by three larval "skulls" on its top like a sepulchral tumulus (see Plate XV., fig. 4).

Selepa curviferella, Walk. (Pl. XV., fig. 8).

Mhow, September 15th, 1881.

The larva feeds on the leaves of Gular, a species of *Ficus* common in India. General ground colour a yellowish orange. The head and three patches on dorsum black. White puncta also exist on the dorsal aspect of each segment. Abdomen of a yellow colour. Legs 6, 8, 2.

Cocoon generally subterraneous; of an oval form, composed of silk, with earthen particles adherent to its outside. Some larvæ, which I had confined by tying a muslin bag around a bunch of leaves actually growing on the tree, made cocoons on the leaves; but this was no doubt owing to the exigencies of their situation.

The above plan, when it can be carried out,—for instance, on one's own premises,—I found an excellent one, the larva getting its food in the best condition for nourishment, and under the nearest approach to natural conditions. It will, of course, only suit such larvæ as make cocoons on the leaves or stems of the food-plant. The objections are that in some cases the larvæ eat their way through the muslin bag and so escape, and that also they seem rather more liable to detection by lizards, &c., than when able to roam over a larger compass.

Figure of larva on Plate XV., fig. 8.

Tegna hyblælla, Walk. (Pl. XIV., fig. 10).

Mhow, August 15th, 1881.

The larva is very common on the leaves of Gular trees in my garden; it is naked and "maggot-like." When handled it ejects a yellow fluid from the mouth, and endeavours to escape by lowering itself by a filament of

silk to the ground. It spins a net on the leaf, partially curling it up, and sometimes rolling it; but as a general rule the margins of the leaf are merely approximated, and a cobweb-like net spun across from side to side, beneath which the larva feeds on the internal parenchyma of the leaf. A single larva will thus destroy several leaves, and when the former are numerous the tree which they infest soon presents a blasted appearance. At the end of October and early in November I found a second brood of these larvæ on the same trees.

The cocoon is of a dense leathery nature, and resembles a flat brown seed. It is made under a thin net of silk on one of the leaves inhabited by the larva, or in its immediate proximity.

This larva, in its appearance, habits, &c., seems to me to present a strong resemblance to that of *Scopula strenualis*, a leaf-roller. I have not compared the imagines, but I hazard the opinion that the life-history of each indicates a closer relation than that at present supposed to exist between them.

Figure of larva on Plate XIV., fig. 10.

OPHIUSIDÆ.

Sphingomorpha chlorea, Cramer. (Pl. XV., figs. 7, 7 a).

Mhow, September 3rd, 1881.

Larvæ rare in this locality. Found on leaves of a thorny shrub-like acacia, but having white bark. I only obtained three specimens during the whole season; they are very beautifully marked. Ground colour a light grass-green, with white spots and figures all over the dorsum and sides, the most noticeable being of an)(shape, and running along the centre line of back. At the spot marked "A" in figure is a transverse bar of an orange colour in the centre, and deep blue at each extremity, but visible only when the larva is in motion. The movement is semi-looping, and the habits of larva somewhat similar to those of the loopers. Front legs six, sienna-red colour; prolegs eight, but front pair much smaller than the remainder; anal two.

The pupa is formed in a cocoon of silk and clay under the surface of the ground, not attached by caudal end, and of a dull reddish brown colour, without any white efflorescence. Body unarmed.

The larvæ (three) went under ground on Sept. 6th: the imagines came out on Sept. 23rd and 24th. Curious collar on neck. Thorax clothed with hair, under which are large expanded, somewhat pear-shaped, scales. Antennæ in repose lie along back close to central suture of wings; they are long and filiform. Enormous plumes of hair on legs, especially anterior legs of males.

Figure of larva and pupa Plate XV., figs. 7, 7 a.

Achæa melicerta, Drury.

Mhow, August 28th, 1881.

The larva found feeding on the flower of the garden rose, also on the leaves of *Zizyphus jujuba* or Ber. General ground colour a velvety purplish grey. Rows of black puncta on side and dorsum; two red papillæ on dorsum near caudal end; two white puncta on dorsum just above anal legs. When the larva is in motion a velvety black patch with three white puncta on its posterior margin is seen on dorsum of thorax. Eyes white; two white dots on vertex. Movement semi-looping. Legs, six; prolegs, anterior pair rudimentary, remainder normal.

Cocoon formed by binding leaves together with silk into an oval cell; the interior is lined with fine silk. The pupa is fastened inside cell by anal hooks; it is covered with a coat of bluish white efflorescence, easily rubbed off, the pupa itself being of a greenish brown colour. Some specimens in confinement made cocoons of silk and gravel, &c., on the surface of earth in box, but this is not the natural mode. Inside male abdomen are dense brushes of fine long yellow golden hairs.

Ophiodes separans, Walk.

Mhow, September 7th, 1881.

Larva found on the leaves of Guava tree. General colour a pale soft grey; faint markings of light brown on body; a deep brown mark between each proleg on abdomen. No peculiar concealed patch on dorsum of thorax. Legs six; prolegs eight, but anterior pair smaller than the others.

Cocoon made by fastening two adjacent leaves together in such a natural manner that it would at first glance seem as if they had grown in that position; between the

surfaces of the leaves, bound together with a few silken ligaments, lies the pupa.

Pupa of a deep brown, almost black colour, fastened in cocoon by the numerous fine, hooked, apical spines. It is without any of the white efflorescence generally seen on the pupæ of those Noctuæ which make their cocoon of leaves and silk on the plant upon which they feed.

REMIGIIDÆ.

Remigia frugalis, Fabr.

Mhow, October 19th, 1881.

The larva is found on grass. The two anterior prolegs are obsolete. Movement looping. When the body is curved in the act of looping two black transverse bars become visible on dorsum of thorax, posterior to the last pair of legs.

I find that I have neglected to note the character of cocoon or pupa, but from memory I am under the impression that the transformation took place in an underground earthen cell.

Imagines of a general ground colour of brown; a transverse bar on upper wings near the posterior costæ. One specimen has densely plumed posterior legs; the other two are naked.

BOARMIIDÆ.

Hypochroma dispensata, Walk. (Pl. XIV., figs. 12, 12 a).

Mhow, October 14th, 1881.

Larva found on leaves of *Zizyphus jujuba*. Legs 6, 2, 2. Three anterior pairs of prolegs obsolete. Movement looping. Vertex bifid when viewed from above and behind.

Cocoon made on the surface of the ground, net-like, very thin silk, and the meshes large and open like those of a fishing-net; quite useless for purposes of concealment of pupa.

Pupa rather attenuated towards apex of abdomen.

Imago with delicate ashen-white wings, with fine black linear markings. The posterior costæ of the under wings project beyond those of the front wings. The position of the wings when the imago is at rest is horizontal, and they are partly extended at a considerable angle from the central line of body.

Figure of larva and pupa on Plate XIV., figs. 12, 12 a.

BOTIDIDÆ.

Botys molusalis, Walk.

Mhow, September 5th, 1881.

Larva feeds on a small nettle-like annual with a soft serrated leaf. It is naked and "maggot-like," body soft and translucent, of a delicate grass-green colour. Head black, and black marks on lateral margins of front thoracic segments. Legs 6, 8, 2.

The larva rolls over the leaf on which it feeds by attaching cables to the edge of one side, and then to the midrib; on tightening these the half leaf is formed into a tube, the whole operation being carried out in a rapid and very interesting manner. The larva then goes inside the roll, and completes the fortification under its protection.

The pupa is of a chestnut-colour, and is located inside the roll last inhabited by the larva, attached by a caudal ligature. No net is spun around it, nor is it enclosed in any description of cocoon.

Scopula strenualis, Walk.

Mhow, August, 1881.

The larvæ, which are abundant in some situations, feed on the leaves of the common Bambu of India. They bind the two edges of the long acuminate leaves together, or sometimes several leaves in a bundle, thus forming a long narrow cylinder, in which the larva lives and eats. One end of this cylinder is after a time filled with excrement; it is then deserted and a new one made. The larvæ appear to devour the inner parenchyma, and thus preserve the cylinder as a habitation while it also affords food. They are "maggot-like" in appearance, smooth, of a greenish yellow colour, and with sienna-red heads. Legs 6, 8, 2.

On searching many cases on the Bambu tree itself I found two pupæ inside one of the cylinders, under a fine network of silk of open texture, and also fastened down by the apex of abdomen. Eyes of pupa black; body a pale chestnut.

On Sept. 7th I removed a number of larvæ inhabiting fresh cylinders from the tree (without disturbing them from their habitations), and placed the whole on the top of soft earth, in a box covered with muslin to prevent

their escape. I judged the larvæ to be near their transformation. In a day or two I removed the dried-up cases, and examined the earth in the box; I found that the larvæ had buried themselves under ground, making a loose cocoon of earth and silk woven together.

Nov. 5th following, "I examined the cocoons, and found the larvæ unchanged in each, shrivelled up, dry, and dead. I can now find no larvæ on the Bambu in my garden."

Why should these larvæ have gone under ground in preference to undergoing their transformation in what would appear to be the natural situation, *viz.*, inside the cylinder, the cylinder being in each case available for the purpose?

Compare this larva and its habits with the larva of *Tegna hyblælla*; the resemblance appears to me to be great, yet the latter is placed amongst the Noctuæ.

EXPLANATION OF PLATES.

PLATE XIV.

- FIG. 1. Larva of *Terias Æsiope*.
 1 a. Pupa of ditto.
 2. Larva of *Melanitis Ismene*.
 2 a. Front view of head of ditto.
 2 b. Pupa of ditto.
 3. Larva of *Symphædra thyelia*.
 3 a. Pupa of ditto.
 4. Larva of *Dabarita subtilis*.
 4 a. Male pupa of ditto.
 4 b. Female pupa of ditto.
 5. Larva of *Euproctis lunata*.
 5 a. Mass of eggs of ditto.
 5 b. Female pupa of ditto.
 5 c. Male pupa of ditto.
 6. Larva of *Chilena strigula*.
 6 a. Cocoon of ditto.
 6 b. Pupa of ditto.
 7. Pupa of *Perina nuda*.
 7 a. Larva of ditto.
 7 b. Ova of ditto, magnified and in section.

- FIG. 8. Larva of *Miresa albipuncta*.
 8a. Pupa of ditto.
 8b. Dorsal spine of larva of ditto, magnified.
 8c. Cocoon of ditto.
 9. Larva of *Homoptera solita*.
 9a. Pupa of ditto.
 10. Larva of *Tegna hyblæella*.
 11. Larva of *Celæna cano-rufa*.
 12. Larva of *Hypochroma dispensata*.
 12a. Pupa of ditto.
 13. Larva of *Plusia chrysitina*.
 13a. Pupa of ditto.
 14. Larva of *Aphendala tripartita*.

PLATE XV.

1. Full-grown larva of *Clanis cervina*.
- 1a. Young larva of ditto.
- 1b. Front of head of young larva of ditto.
2. Pupa of ditto.
3. *Lebeda Buddha*, male.
- 3a. Pupa of ditto.
- 3b. Larva of ditto.
4. Cocoon of *Selepa celtis*.
5. Larva of *Nioda fusiformis*.
- 5a. Feathered hairs of caudal plume of ditto.
- 5b. Side tufts of ditto.
- 5c. White hairs of side plumes of ditto.
- 5d. Dots on body of ditto.
- 5e. Hair of front plume of ditto.
- 5f. Pupa of ditto, front and back view.
- 6a. Labial palpus of *Perina nuda*.
- 6b. Posterior and medial leg of ditto.
- 6c. Anterior tibia of ditto.
- 6d. Male organs of ditto.
7. Larva of *Sphingomorpha chlorea*.
- 7a. Pupa of ditto.
8. Larva of *Selepa curviferella*.
9. Larva of *Homoptera continua*.
10. Larva of *Trilocho albicollis*.
- 10a. Cocoon of ditto.

XIX. *Further additions to Mr. Marshall's Catalogue of British Ichneumonidæ.* By JOHN B. BRIDGMAN, F.L.S.

[Read July 2nd, 1884.]

FROM several circumstances I have had but little time during the collecting season of 1883 and the past winter to devote to Entomology, consequently the present list does not contain all the novelties I have met with; the remainder I hope to be able to include in next year's list. At present there seems to be no diminution in the additions to the number of continental or new species hitherto overlooked in this country.

Besides the entomologists mentioned in my previous papers, I am this year indebted to Mr. W. H. B. Fletcher for a great many bred ichneumons, and many of them are new to our fauna and some new to Science; perhaps the most important occurrence was that this year he has been fortunate enough to breed the male and female of *Pezomachus Hopei*, Gr. This is the first time that the two sexes of any one of Gravenhorst's subapterous *Pezomachi* have been bred; the male proved to be one of Gravenhorst's species of *Cryptus*. To Mr. Fletcher, and the other entomologists who have so kindly assisted me, my best thanks are due.

ICHNEUMONIDÆ.

ICHNEUMONIDES OXYPYGI.

Ichneumon heracliana, n. s.

Abdomine rufo apice nigro, pedibus nigris, femoribus posticis plus minusve basi nigris; annulo antennarum albo. ♀.

Head narrow behind the eyes; cheeks not buccated; apex of clypeus depressed, widely rotundate, rather deeply separated from the face, shining, moderately punctured (punctures rather scattered); face rather more closely punctured; below the ocelli rather coarsely punctured, much smoother behind them. Antennæ about half the length of the insect, subconvoluted; basal joint of flagellum nearly twice as long as wide; 6th quadrate, the intermediate

joints diminishing in length. Mesothorax and scutellum distinctly higher than the metathorax; punctures on mesothorax rather fine and somewhat scattered; punctures on scutellum scattered and barely visible. Metathorax rugose, areæ five, supero-medial triangular, apex rounded, sides slightly curved outwards, behind incurved, spiracles rather short, ovate, the posterior face divided into three areæ; laterally the costæ terminate in a short blunt projection. Abdomen, the first three segments punctate, punctured more sparingly on the 1st than on the other two; the remaining segments polished, with traces of very fine puncturing; gastrocæli small and not very distinct; 2nd segment rather longer than wide, remainder transverse, apex of the 2nd the widest; aculeus just protruding. Hind coxæ without the brush, finely and rather closely punctured. Areolet of wings subrhomboidal, the nervures not quite touching above, the outer nervure in its greater part transparent; recurrent nervure received just behind the middle. Legs moderate.

Black. Antennæ, 8th to 12th joints whitish, the extreme joints sometimes more or less stained with brown; apex of antennæ pale beneath; stigma fuscous. Abdomen red; base of petiole, the 5th and following segments, black. Legs, apex of front femora, tibiæ, and tarsi piceous; hind femora varies from black extreme base red, to red extreme apex black; the rest of the legs are black-brown; coxæ black. Length, 8 mm.

This insect belongs to Holmgren's Section 7. B, and at first sight is somewhat like *I. gasterator*, Steph.

These ichneumons, unfortunately all females, were bred by Mr. W. H. B. Fletcher, of Worthing, from *Depressaria heracliana*; he was uncertain from what locality the larvæ came. I have also taken one specimen at Lynn. I have no doubt but that the species recorded by Mr. Parfitt in his list of Devonshire ichneumons as bred by Mr. D'Orville from the same host, and doubtfully named *I. gasterator*, Steph., by Rev. T. A. Marshall, is this species.

ICHNEUMONIDES PLATYURI.

Platylabus pumilio, Holm.

Holm., Ichn. Suec., 319, 8, ♀.

I detected this insect among some taken by the Rev. E. N. Bloomfield in the neighbourhood of Guestling.

ICHNEUMONIDES PNEUSTICI.

Phæogenes cicutella, Siebold.*Phæogenes jucundus*, ♂, Wesm., Ichn. Miscel., 65.*P. cicutella*, Brischke, Ich. d. Prov. W. u. O-Preuss, 56, ♂, ♀.

Under the head of *P. jucundus* Wesmael described a male *Phæogenes* which he had received from Siebold under the name of *I. cicutella*, and remarked that he was not at all certain he was right, but if he was not Siebold's name must have the priority. Herr Brischke says that the female of *jucundus* does not belong to *P. cicutella*, and describes the two sexes of the latter, re-establishing Siebold's name.

Mr. W. H. B. Fletcher bred two males from *Orthotelia sparganella* taken in the New Forest; there was a third specimen, which unfortunately escaped.

CRYPTIDÆ.

Cryptus pygoleucus, Gr., ♂; *Agrothereutes Hopei*, Gr., ♀.

From *Eupæcilia ambiguana* Mr. W. H. B. Fletcher has been fortunate enough to breed *Agrothereutes Hopei* and *Cryptus pygoleucus*, this is the first time there is any record of these being bred together, and from their great similarity they are certainly the same species. Brischke bred on two occasions *Agrothereutes Hopei* from *Psyche* cases (*P. viciella*), and because Siebold bred *Hemimachus albipennis*, Ratz., also from *Psyche* cases, and because they were somewhat alike in colour, came to the conclusion that *A. Hopei* was the female of *H. albipennis*; but it is now certain that this is incorrect. The Rev. T. A. Marshall, in his Catalogue, has given *H. albipennis* as a synonym of *H. avidus*, Först.

Prof. C. G. Thomson, in Opusc. Ent., describes a species as *Spylocryptus dispar*, the male of which is *C. pygoleucus*, Gr., and the female *Pezomachus* (*Agrothereutes*) *abbreviator*, Gr. These, I believe, are only associated from structural resemblance, and not improbably this view is correct; there may be more than one species mixed up with *C. pygoleucus*, which is a very variable species, or, as Brischke says, probably *A. Hopei* may be only a variety of *A. abbreviator*. I do not think this very likely, because *Hopei* is common, and I have never seen a specimen with any black on the thorax; and if they

were only varieties, one having the thorax black, the other red, I think specimens with intermediate coloration would be not uncommon.

Gravenhorst describes a variety of *P. abbreviator* with a red scutellum, and Vollenhoven figures, in 'Pinacographia,' *A. batavus*, Voll., which appears to me to be only one of Gravenhorst's varieties. I have only seen three or four specimens of *A. abbreviator*, but the variety with the red scutellum I have not yet seen.

As Gravenhorst first described *C. pygoleucus* and *P. Hopei* in the Supplement, I think the name given to the male must stand, and Förster's genus *Agrothereutes* must be transferred to the "has beens." The insect belongs to Thomson's subgenus *Spylocryptus*.

OPHIONIDÆ.

Anomalon cylindricum, n. s.

Abdomine rufo, apice et segmento secundo dorso nigris, pedibus fulvis, coxis nigris, tarsis posticis linearibus.

Head not dilated behind the eyes; clypeus subangulated, terminating in a point; face rather closely punctured; forehead more coarsely punctured, with a mesial elevated line running down from the anterior ocellus. Antennæ somewhat shorter than the insect. Thorax, mesothorax finely punctured, in front of the scutellum a few fine transverse rugæ, scutellum scarcely depressed, with a fine raised ridge at the sides and obliterated behind; metathorax with a distinct deep central groove, the upper part bounded by prominent costæ, which run downwards and outwards; below fainter ones run transversely. Legs slender; joints of hind tarsi cylindrical. Abdomen slender; aculeus half the length of the 1st segment. Wings, the recurrent discoidal divided above the middle, the recurrent nervure interstitial, transverse anal divided just above the middle.

Face and mouth yellow; the upper boundary of the yellow on the face forms a **W**; a reddish blotch behind the eyes. Antennæ black. Thorax black. Abdomen red; a dark streak on the back of the 2nd segment; the 5th and following segments black; front and middle legs fulvous; front coxæ, greater part brownish black; middle coxæ black; hind legs, coxæ, and trochanters brownish black; femora, tibiæ, and tarsi brownish red; femora above and towards the apex of the tibiæ fuscous; base of wings and stigma testaceous. Length, 14—16 mm.

Two specimens in Mr. Fitch's collection, one bred from *Euchelia jacobææ*.

This species appears to me to be undescribed, and comes next to *A. rufum*, but differs from that species in coloration; it is also like *A. perspicillator*. Of this Gravenhorst described the male only, and he says, "antennæ scarcely more than one-half the length of the body;" in this species it is decidedly three-fourths the length of the insect. Brischke (Die Ichn. d. Prov. W. u. O-Preuss) says somewhat half as long as the body; it is just possible that this may be the female of *perspicillator*, but I think it is not.

Anomalon anxium, Wesm.

Wesm., Bull. Acad. Roy. Brux., vol. xvi., pt. ii., p. 130, 10.

Mr. Fitch has sent me a male *Anomalon* which I believe to be this species; it was bred by Mr. Elisha from *Eupœcilia udana*, April 31st, 1884.

Anomalon anomelas, Grav.

Grav., I. E., iii., 683; Brischke, Ichn. d. Prov. W. u. O-Preuss, 30.

This species was sent to me by Mr. Harwood, of Colchester.

Anomalon arquatum, Grav.

Grav., I. E., iii., 668, 123.

This pretty species was bred by Mr. G. C. Bignell from *Teniocampa gothica*. It belongs to Holmgren's Sect. 1-ma. B. b., transverse anal nervure not divided.

Anomalon minutum, n. s.

Abdomine rufo, dorso fusco, pedibus fulvis, coxis posticis, nigris, aculeo segmento primo longitudine.

Head and thorax very coarsely punctured; eyes slightly hairy; head a little wider than the thorax; behind the eyes not dilated; forehead with a slight thin line; face towards the clypeus narrow, smooth, and shining, upper part with a few coarse scattered punctures; clypeus rounded; teeth of mandibles subequal, the lower one slightly the shorter; clypeus obsoletely separated from the face. Antennæ about two-thirds the length of the body, filiform. Mesothorax obsoletely trilobed; scutellum depressed in the middle; metathorax rugose; no areæ. Abdomen long and slender; 1st

and 2nd segments of equal length, linear; spiracles of the 1st slightly projecting, remainder compressed; aculeus rather shorter than 1st segment. Legs slender; hind tarsi slightly thickened; basal joint four times as long as wide. Recurrent discoidal nervure of wings joining cubital before the middle and divided above the middle; recurrent nervure not interstitial; transverse anal nervure not divided.

Face, mouth, lower part of cheeks, two spots on vertex, yellow. Legs red; hind coxæ black; hind trochanters partly and apex of hind tibiæ fuscous; front coxæ and trochanters of male sometimes yellow; base of wings reddish, stigma piceous. Abdomen red; back of all the segments fuscous, and sides also of hinder ones; aculeus red, apex fuscous. Antennæ reddish beneath. Male and female. Length, 4.5—5 mm.

Bred by Mr. W. H. B. Fletcher from *Chrysocoris festaliella* taken in the New Forest.

This species is much smaller than any with which I am acquainted, and has a longer aculeus; the slightly hairy eyes place it intermediate between *Anomalon* and *Trichomma*, whilst the absence of the transverse anal nervure puts it into Foerster's genus *Agrypnon*.

Campoplex bucculentus, Holm.

Campoplex bucculentus, Holm., Mon. Oph. Suec., 36,
4, ♂, ♀.

C. melampus, Foerst., Mon. d. Gatt. Camp., 783,
6, ♂, ♀.

C. bucculentus, Holm., Skand. art. af Ophion Camp.,
49, 18, ♂, ♀.

Mr. W. H. B. Fletcher took a female *Campoplex* at Deal in the middle of August, which is certainly *C. melampus*, Foerst.; this Holmgren says = *C. bucculentus*, Holm.

Limneria Elishæ, n. s.

Abdomine nigro; femora postica nigra, tibiis posticis, apice et ante basin, nigris; areola nulla; aculeo segmento primo paulo brevior.

Head, seen above, transverse, sides almost parallel; face parallel, with white pubescence; clypeus slightly separated from the face; apex rounded; mandibles rather wide, teeth subequal. Antennæ about as long as the insect. Thorax one-third longer than high; metathorax long, supero-medial area pentagonal, longer than wide, lateral area not or imperfectly subdivided; sides of post-petiole

rounded, rather longer than wide; 2nd segment one-third longer than wide; the 3rd subquadrate; aculeus about one-sixth the length of the abdomen, the whole of the latter covered with fine white pubescence. Wings without an areolet; transverse anal nervure of lower wing not divided.

Black; mandibles and base of wings yellow; coxæ black, trochanters yellowish; extreme base of middle and basal half of hind ones black; front femora reddish; middle ones, base piceous, apex reddish; hinder pair black; tibiæ pale reddish; hinder ones, apex and mark before the base dark; tarsi pale reddish straw-colour; apical portion of the joints more or less fuscous. Male and female. Length, about 3 mm.

This little *Limneria* appears to me to be very distinct from any described species; it was bred by Mr. G. Elisha, after whom I have named it, from either *Ornix scoticella* or *Nepticula aucuparia*.

Limneria gracilis, Grav. ?

Abdomine subcompressa; pedibus fulvis, coxis posticis nigris, tibiis posticis apice et ante basin nigris, tarsis posticis nigris, basis rufis; aculeo longitudine sextæ partis abdominis.

Head above transverse, behind the eyes rather narrow; clypeus not separated from the face; teeth of mandibles of equal length. Antennæ shorter than body; 2nd joint of flagellum rather shorter than the 1st. Thorax cylindrical, much longer than high, nearly twice as long; mesopleura with punctures running into wavy aciculations, disc shining; metathorax long, with five areæ above; supero-medial area elongate, variable in length, not closed behind. Abdomen slender; post-petiole about twice as wide as the petiole, and about one-third shorter; sides somewhat parallel in the male, and more rounded in the female; 2nd segment one-third longer than wide; the 3rd in the female subquadrate, longer than wide in the male; aculeus about one-sixth the length of the abdomen. Areolet of wings petiolated or subsessile; recurrent nervure received beyond the middle; transverse anal not divided.

Black; mandibles, base of wing, apex of scape of antennæ sometimes, front coxæ of female, front and middle ones of male, and trochanters, except the basal joint of hind pair, yellow; femora red, hind ones often at the base and apex more or less fuscous; front and middle tibiæ pale testaceous, hind pair white, sometimes more or less clouded, apex and before the base black; front tarsi reddish, extreme apex fuscous; middle tarsi rufo-fuscous, base paler; hind pair nigro-fuscous, base pale. Stigma varies from

piceous-yellow to pale brown; nervures dark. Male and female. Length, 3·5—5 mm.

I at first thought this insect was a variety of *L. virginialis*, Gr., but, on going through this group of *Limneria*, a closer examination proves that it is distinct; the female appears to be undescribed. I received several specimens bred from *Gracilaria stigmatella* by Mr. W. H. B. Fletcher. I have also seen specimens bred by Mr. G. Elisha from the same host, and I have taken it myself at Wimbledon and in the neighbourhood of Norwich. It differs from *L. virginialis* in its smaller size, and in having the hind femora generally more or less fuscous at the base and apex, the front coxæ of the female and front and middle coxæ of male yellow; the post-petiole is slender, rather longer than wide, in *virginialis* it is subquadrate with distinctly projecting spiracles; the supero-medial area of the metathorax is long and narrow, in the other species it is transverse.

Limneria cylindrica, Brischke.

Brischke, Die Ichn. d. Prov. W. u. O-Preuss, 53.

Bred by Mr. W. H. B. Fletcher from *Gelechia inopella* from Freshwater, Isle of Wight, beginning of October, 1883.

Limneria robusta, Woldst.

Woldstedt, Mélanges biologique, ix., 639, ♂, ♀.

This very distinct *Limneria* has been taken in the neighbourhood of Shere by Dr. Capron, and I have also taken it in Norfolk. In colour it resembles *L. difformis*, and like it has the transverse anal nervure divided; the metathorax is almost without superior areæ, having only a transverse ridge distinct; the 3rd segment of the abdomen is transverse, and the aculeus about one-half the length of the abdomen.

Limneria ovata, Brischke.

Brischke, Die Ichn. d. Prov. W. u. O-Preuss, 44, ♀.

Dr. Capron sent me, last year, a *Limneria*, taken at Shere, which I have little doubt is this species. It is in colour like *L. difformis*; the transverse anal nervure is divided; the areæ of the metathorax distinct, five in

number; the 3rd segment of the abdomen is transverse; aculeus quite half the length of abdomen; the head is narrow and transverse; and the stigma very pale.

Limmeria ruficornis, n. s.

Antennæ subtus, abdominis medio pedibusque rufis, coxis posticis nigris, aculeo exserto.

Head somewhat narrow behind the eyes; face transverse, sides parallel, covered with silvery pubescence; clypeus not separated from the face; teeth of mandibles of equal length. Antennæ of male about the length of the insect, of female rather shorter. Thorax longer than wide; metathorax rather long, supero-medial area hexagonal, longer than wide, lateral area sometimes divided, sometimes not so; the petiole as long or a little longer than the post-petiole, and about half the width; post-petiole longer than wide, and varies in shape; 2nd segment about one-third longer than wide, rather longer in the male than in the female; 3rd subquadrate; aculeus exserted about one-third the length of the 1st segment. Legs slender. Areolet of wings sessile or subsessile; recurrent nervure received in or just beyond the middle; transverse anal nervure not divided.

Black; basal half of antennæ, as well as scape beneath, pale yellowish red, more or less of the apex the same colour; mouth and mandibles yellow; base of wings and a spot before them pale yellow; apex of 2nd, 5th, and remaining segments of abdomen pale red; 3rd and 4th the same colour, the 3rd more or less black at the base. Legs pale red; front and middle coxæ yellow, hind coxæ black, apex reddish yellow; trochanters yellow; stigma very pale piceous.

? Var. One male. Antennæ darker; apex of 2nd, 3rd, and 4th segments of abdomen reddish.

Male and female; length, 4·5--5 mm.

Bred by Mr. J. E. Fletcher from *Elachista cerussella*. The ? var. I took at Brundall, near Norwich. This insect comes very near *L. longipes*, but the antennæ is differently coloured, as are the coxæ and trochanters; the insect is also much smaller, and the head is not so large. I believe it is a good species.

Limmeria rufata, n. s.

Abdominis medio pedibusque rufis, trochanteribus flavis, coxis posticis nigris, ♂, ♀.

Head transverse, narrow behind the eyes. Antennæ about as

long as the body; face covered with silvery pubescence. Metathorax with five superior areæ; supero-medial pentagonal, scarcely longer than wide, open behind; postero-medial not concave. Post-petiole of 1st segment shorter than the petiole and two and a half times wider, one-third longer than wide; sides sometimes parallel, sometimes rounded, a slight longitudinal furrow at the base of the post-petiole more or less distinct; 2nd segment about one-third longer than wide; 3rd transverse; aculeus about one-third the length of the abdomen. Areolet of wings varies from almost sessile to petiolated, the outer nervure generally imperfect; recurrent nervure received beyond the middle; transverse anal nervure of hinder wing not divided. Claws of tarsi simple.

Black; apex of 2nd segment of abdomen, the whole of the 3rd and the 4th, more or less red. Legs red; front and middle coxæ generally slightly fuscous at the base and yellowish at the apex, hind coxæ black; trochanters yellow, hinder ones generally with a fuscous spot within; extreme base of hind tibiæ yellowish, apex slightly fuscous; apex of tarsal joints more or less fuscous; last joint of middle tarsi fuscous; mandibles yellow; stigma and nervures brown; base of wings yellow. Length, 4—5 mm.

Bred by Mr. C. J. Boden and Mr. W. H. B. Fletcher from *Choreutes scintillulana*.

This insect seems to me very near *Limneria cognata*, Brischke.

Limneria reticulata, n. s.

This insect, I have no doubt, is mixed up with *L. exareolata*, Ratz. The description in Ratzeburg (Die Ichn., iii., 87) is very meagre, barely more than that of coloration; whilst Holmgren's Mon. Oph. Suec., 96, will do equally for this species or *exareolata*. The difference lies in the punctures of the mesonotum and mesopleura. The species I have retained the name for has the mesopleura distinctly and coarsely punctate; in *reticulata* indications of punctures are barely visible, and the mesonotum is only reticulate, whilst in *exareolata* the reticulations are coarser and punctate, the male more strongly so than the female. Holmgren makes no mention of the antennæ of the male, which are unusually long.

This species was bred by Mr. W. H. B. Fletcher, in both sexes, from the larvæ of a Tortrix which he found on the flowers of *Cornus* in 1884. The other species—*L. exareolata*—he bred from *Coccyx ustomaculana*.

Mesochorus facialis, n. s.

Testaceous; abdomine nigro, medio testaceo.

Head narrow behind the eyes; teeth of mandibles subequal; face transverse; lower part of face by the side of the eyes and between the eye and base of mandible rather coarsely aciculate. Thorax smooth and shining, rather densely covered with fine white pubescence; metathorax with five complete areæ; mesopleura smooth and shining, with here and there a hair-pit in the middle. Abdomen, the sides of 1st segment with scarcely a trace of a raised ridge, the whole abdomen smooth and shining, with scarcely a trace of pubescence; 2nd segment rather longer than wide; 3rd slightly transverse; aculeus not quite so long as the 1st segment. Legs moderate. Wings, internal cubital nervure not interstitial, external radial not straight, transverse cubital received just before the middle, transverse anal not interrupted.

♂. Pale testaceous; greater part of antennæ fuscous; lateral lobes of mesonotum with a fuscous streak, a fuscous blotch on the anterior part of middle lobe; anterior part of upper surface of metanotum blackish. Abdomen black; extreme apex of 1st segment, sometimes base also, a large central blotch on 2nd and 3rd segments, testaceous-yellow, and obscurely so the apex of 3rd and sides of remaining segments. Legs testaceous-yellow; hind tarsi pale, apex dark, extreme base slightly fuscous; extreme apex of tarsi fuscous; stigma fuscous.

♀. Like the male, but the upper part of the head and thorax is darker; the breast and mesopleura are dark.

Male and female; length, 4 mm.

This pretty little species belongs to Holmgren's Sect. I. D. b. **.

Bred by Mr. G. C. Bignell from *Apanteles popularis* at the beginning of June, 1884.

TRYPHONIDÆ.

Eclytus fontinalis, Holm.

Holm., Mon. Tryph. Suec., 128, 2; Voll., Pinac., pl. 32, fig. 4; Brischke, Ichn. d. Prov. W. u. O-Preuss, 42.

This species was first sent to me by Mr. W. H. B. Fletcher, who bred it from *Padisca solandriana*. I have since seen a specimen captured by Mr. G. C. Bignell in the neighbourhood of Plymouth this year.

Mesoleius sepulchralis, Holm.

Both sexes of this fine species were bred by Dr. Osborne, of Milford, Ireland, from *Zareea fuscata* (Ent. Mo. Mag., xx., 145). Holmgren, who named and described the species (Disp. Syn. Mesol. Scand., 10, 20; Kongl. Sv. Vet. Akad. Handl., B. 13, No. 12), was only acquainted with the female. The male is very similar, but differs in the following points:—The face, clypeus, and mandibles are white, as are the tubercles before the wings, the front and middle coxæ, and trochanters; the middle coxæ are black above, and the hind trochanters white beneath; the base of the hind tibiæ is white almost to the middle; the anterior tibiæ and tarsi are entirely white, or rather white slightly stained with ochre, and the apical joint of the hind tarsi is whiter than in the female.

Cteniscus triangulatorius, Grav.

Tryphon triangulatorius, Grav., I. E., ii., 205, 133 (var. 1).

Exenterus triangulatorius, Holm., Mon. Tryph. Suec., 235, 21.

This insect has been taken by Mr. G. C. Bignell in the neighbourhood of Plymouth.

Exochus Fletcheri, n. s.

Niger; facie, ♂ flava, ♀ macula flava; pedibus rufis, coxis nigris.

Head smooth and shining; face a little narrower below the antennæ than above, moderately protuberant, covered with coarse punctures; a moderately deep V depression above the antennæ (these about half the length of insect); head narrow behind the eyes; head, thorax, and abdomen covered with scattered white pubescence. Thorax smooth and shining, with fine scattered hair-pits; mesothorax faintly trilobed; scutellum subdepressed; lateral area of metathorax not divided; supero-medial area much wider behind than in front. Abdomen regularly covered with coarse punctures; apical margins smooth and shining; 1st segment about as long as wide, bicarinated; keels extending from base to middle; the lateral margins with distinct keels; the spaces between the central keels and to the apex smooth; remaining segments transverse. Femora incrassated. Wings without areolet; transverse anal nervure interrupted below the middle.

Black; face and apex of cheek between eye and mandible yellow, with a central oval fuscous blotch. Male. Upper part of face of

female yellow, interrupted below by an oval fuscous blotch; a spot on vertex and base of wings yellow. Legs fulvous; coxæ black; front trochanters sometimes slightly fuscous at the base; middle and hinder trochanters blackish, more or less reddish at the apex; extreme base of tibiæ yellowish; tarsi slightly fuscous-stained; base of 1st joint of hind tarsi yellowish, apex fuscous, as well as remaining joints. Two males, one female. Length, 5 mm.

This small *Exochus* belongs to Section B. aa. ff. ii. kk. ll. m. of Holmgren's Disp. Meth. Exochorum Scand., and differs from the description of *E. frontellus*; it is smaller and has no yellow before the wings.

Bred by Mr. W. H. B. Fletcher, of Worthing, after whom I have the honour to name this very distinct species, from larvæ of *Gelechia notatella* taken at Wicken Fen.

PIMPLIDÆ.

Pimpla strigipleuris, Thoms.

Thoms., Opusc. Ent., 747, 5, ♂, ♀; Entom., xvii., 69.

Bred by Mr. W. H. B. Fletcher from *Depressaria heracliana*.

Pimpla similis, n. s.

Nigra, pedibus rufis, coxis anterioribus nigris, stigmatе nigro-fusco.

This insect in size and shape is extremely like *P. brevicornis*, but the thorax is entirely free from sculpture, the abdomen a little more strongly punctured; the legs, except the front coxæ, are clear red, the apical portion of last joint of tarsi is fuscous; the wings are clearer, the antennæ are longer, and the stigma is dark brown with a pale base.

I have taken a female at Brundall, near Norwich, and Mr. W. H. B. Fletcher has bred both sexes from *Ephippiphora scutulana*.

Glypta lineata, Desvignes.

Desv., Brit. Mus. Cat., 78, 18.

Var. 1. Female. Thorax entirely black.

I have taken this variety in the neighbourhood of Norwich.

Lissonota errabunda, Holm.

Holm., Mon. Pimp. Suec., 58, 27.

Taken by Mr. W. Bennett in the neighbourhood of Guestling.

XX. *Notes on the life-history of Porphyraspis tristis, a palm-infesting Cassida from Brazil.* By A. SIDNEY OLLIFF.

[Read September 3rd, 1884.]

THE *Cassida* which I now have the pleasure of exhibiting in all its stages was recently received by Lord Walsingham in a small collection of insects formed by Mr. John Cameron Grant in the neighbourhood of Bahia. My attention was first called to this insect by observing the curious excrementitious covering, closely resembling an inverted bird's nest in miniature, with which the larva protects itself from the heat of the sun. The species proves to be the *Porphyraspis tristis* of Boheman,* and is found not uncommonly feeding gregariously on the tender portions of the leaves of the cocoa-nut palm, to which it is said to do considerable damage. The larva of this insect was brought before the notice of the Society at a recent meeting by Dr. David Sharp, who does not, however, appear to have recognised the merdigerous nature of its covering.† The larvæ of many of the *Cassididæ*, as well as certain species of *Crioceridæ*, are well known to form for themselves a covering of their excrement; but I am not aware that any account has been published of a coleopterous larva making a nest-like habitation for itself, with the exception of *Porphyraspis palmarum*, Boheman, figured and described by Candèze in his excellent paper on the Metamorphoses of Exotic Coleoptera.‡ This larva forms a nest, which it carries on its back, very similar in appearance to that of *P. tristis*, and is found on a palm, supposed to be a species of *Thrinax*, in the island of San Domingo.

I am inclined to think that this nest-forming habit

* 'Monographia Cassididarum,' i., p. 95 (1850); Wagener, MT. Münch. Ent. Ver., v., p. 53 (1881).

† Cf. infra, Proc. Ent. Soc. Lond., 1884, p. xviii; 'Zoologist' (3) viii., p. 391 (1884).

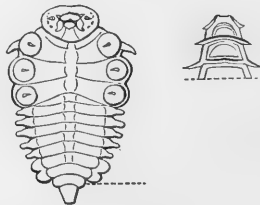
‡ Mém. Soc. Liège, xvi., p. 390, pl. v., fig. 5 (1861).

will prove to be common to all the larvæ of the genus *Porphyraspis*, as I have in my possession nests very like those of the two above-mentioned species, which were received from Brazil in a dried condition with numerous specimens of *P. rugosus*, Boheman.

The covering of the larva of *P. tristis* is composed of a number of filaments greatly resembling vegetable fibres; it is broadly oval in form, varying from 4—9 mm. in breadth according to the size of the larva, and is of a dirty reddish brown colour. This structure is carried on the back of the insect, and is supported by a forked anal appendage such as is found in the larvæ of the genus *Dolichotoma* and other *Cassididæ*. Candèze failed to detect an appendage of this kind in the larva of *P. palmarum*, but says that in that species the filaments composing its covering are firmly attached to the upper surface of the 8th abdominal segment.

The following is a brief description of the larva of *Porphyraspis tristis*:—

Ovate, strongly convex above, flattened below, considerably broader in front than behind, pale yellowish white. Head vertical, moderately large, rather longer than broad when viewed from above, slightly emarginate in front, furnished with a few long bristly hairs near the anterior angles, the median line strongly impressed. Antennæ very short, 3-jointed; the two basal joints transverse, the apical much narrower, and provided with two or three bristly hairs. Ocelli six on each side; four near the base of the antenna, forming an oblique series, and two just behind these a little nearer the lateral margin. Labrum rather large, transverse, bilobed. Mandibles rather short and robust, obtusely bifid at the



LARVA OF PORPHYRASPIS TRISTIS.

apex. Thoracic segments broad, clothed with minute hairs near the sides. Abdominal segments much narrower than those of the thorax, all of about equal length, but gradually decreasing in breadth towards the apex; segments 1—5 with a moderately large

fleshy protuberance on each side; these protuberances are narrowed towards the apex, and are furnished with a few short bristly hairs; the 6th and 7th segments with the protuberances much larger and rounded externally; the anal segment is provided on its upper surface with a forked appendage, which is bent forwards in the direction of the head; the sides of this appendage are chitinous, and are held together by narrow membranous cross-pieces; by its combined strength and lightness it seems admirably adapted for carrying the heavy covering of excrement. Stigmata eight on each side, arranged as in the European *Cassididæ*. Legs short and robust, provided with a few rather long bristly hairs; claws simple, strongly curved. Length of adult, $4\frac{1}{2}$ mm.

Compared with the larva of *Porphyraspis palmarum*, as figured by Candèze, this species is much broader behind. It also differs in having the head larger and the protuberances on the 6th and 7th abdominal segments rounded externally instead of tapering to a point.



XXI. *The water-beetles of Japan.* By DAVID SHARP.

[Read September 3rd, 1884.]

IN the 'Transactions' of this Society for 1873 will be found a paper on this subject, and a supplement thereto was published in the volume for the ensuing year, 1874. The present paper, together with the two just alluded to, will be found to enumerate all the water-beetles of the families *Haliplidæ*, *Dytiscidæ*, *Gyrinidæ*, and *Hydrophilidæ* at present detected in the Japanese islands.

Mr. Lewis' recent visit to Japan has demonstrated that the coleopterous fauna of those sunny islands is richer comparatively than the corresponding regions of Europe; but the water-beetles form apparently an exception to this rule, and the fauna in this department is in variety and number of species at present inferior to that of our own part of the globe. It is probable, however, that this is to a certain extent due to the fact that water-beetles require special modes of collecting, and are thus apt to be neglected, and also to the fact that they are comparatively more numerous, or at any rate more accessible in northern lands: as an instance of which it may be mentioned that Lapland is very rich in these insects. The fauna of the northern portions of the Japanese Archipelago is as yet not so well known to us as that of the southern parts, and, when it has been well explored during favourable seasons, it will probably be seen that the poverty of Japan in water-beetles is not so great as it at present appears.

A detailed comparison of the water-beetle fauna of Japan with that of other regions would therefore be at present premature; but I can scarcely omit to point to the fact that as yet but one species of the great genus *Hydroporus* has been detected there, while in Britain it is represented by thirty-six species; and North America is also very rich in it.

The total number of *Dytiscidæ* known from Japan is at present only about forty species, while in Britain we have 105.

HALIPLIDÆ.

Haliplus ovalis.

Testaceus, vertice, prothoraceque anteriori in medio fusco-maculatis; elytris seriatim fortiter punctatis, maculis nigris quadratis disjunctis ornatis. Long. $3\frac{3}{4}$ — $4\frac{1}{4}$ mm.

Var. Testaceus, immaculatus.

This species is most nearly allied to the European *Haliplus fulvus*, Fab., but is smaller, the space separating the eyes is rather less, and the serial punctures on the elytra are considerably coarser. The spots on the wing-cases are usually more quadrate and less linear than they are in *H. fulvus*, but both species vary so much in their markings that little importance can be attached to this.

Niigata, Tokio, Yokohama, and Kashiwagi.

Haliplus sharpi.

Haliplus sharpi, Wehncke, Stett. Ent. Zeit., 1880, p. 74.

Hakodate; two examples from a stagnant pool.

Haliplus japonicus.

A small series of exponents indicates that the two specimens from which the species was described (Trans. Ent. Soc. Lond., 1873, p. 55) were immature examples of an immaculate variety. The individuals now obtained are spotted in a somewhat indistinct manner, with about ten small quadrate black marks arranged so as to form two angulate transverse series, one on the middle, one behind it; the head is black.

DYTISCIDÆ.

Hydrovatus acuminatus.

Hydrovatus acuminatus, Motsch., Et. Ent., 1859, p. 42.

Two examples; Suruga (near Sazaki) and Otsu. Also in China and Malaya.

Bidessus frontalis.

Breviter ovalis, convexus, ferrugineus, nitidus, antennis extorsum, abdomine elytrisque fuscis, his ad apicem et ad latera

vage testaceo-signatis, fortissime punctatis; clypeo anteriori marginato. Long. $1\frac{1}{2}$ mm.

This is a very distinct species of remarkably short form, and, owing to its margined clypeus, is to be placed in Group 1 of my arrangement of the species of this genus. The thorax is only finely punctate, and has a very distinct plica on each side; the punctuation of the elytra is very coarse, and there is a basal plica continuous with that on the thorax and of about the same length.

Yokohama, and Sakai near Osaka, June 7th, 1881.

Hyphydrus japonicus.

Hyphydrus japonicus, Sharp, Trans. Ent. Soc. Lond., 1873, p. 54.

H. frontalis, Sharp on Dyt., p. 381.

Mr. Lewis having brought back a considerable series, I am unable to distinguish *H. frontalis* from *H. japonicus*, and consider they are but one species varying considerably in punctuation. All the females belong to the opaque form, there being no examples like *H. japonicus* ♀ *a*, or *H. frontalis* ♀ of my monograph. The tubercle on the 1st ventral segment of the male is probably subject to being worn down as the result of some attrition.

Hyphydrus læviventris.

Hyphydrus læviventris, Sharp on Dyt., p. 381.

Yokohama, Tokio; apparently rare. Only two males have been found; one of them has a carina on the 1st ventral, so that it is probable the presence of a peculiar dull space instead of this carina (as described in the monograph) is the result of the latter being worn down by attrition.

Cœlambus vittatus.

Ovalis, convexus, nitidus, ferrugineus, prothorace basi capiteque utrinque nigricantibus, elytris lineis nigris longitudinalibus ad basin discretis, ad apicem fere confluentibus; subtus pectore abdomineque nigerrimis, nitidis; antennis extrorsum fuscis; elytris ad basin parce fortiter punctatis, punctis subtilioribus immixtis, ad apicem dense punctatis. Long. 5 mm.

Mas, unguiculo anteriore tarsorum anticorum crassiore, magis curvato, subabbreviato.

This is very closely allied to *Dytiscus impresso-punctatus*, but has a much more scanty punctuation, and the under surface is shining; it is equally near to *Cœlambus chinensis*, but is more closely punctate, and has black lines on the wing-cases.

This is apparently rare, only four examples having been met with. Junsai, August 29th, 1880; Uyeno, Tokio, in the latter part of autumn.

Deronectes anchoralis.

Oblongo-ovalis, subdepressus, subopacus, subtus nigricans, capite in medio prothoracisque lateribus testaceis, supra testaceus, capitis vertice prothoraceque anterieus et late in basi nigris, elytris nigro-lineatis, lineis confluentibus hic inde maculis interruptis testaceis; antennis pedibusque testaceis, illis extrorsum, his tarsis nigricantibus. Long. 5—5½ mm.

Mas, tarsis anterioribus fortiter dilatatis, unguiculis longissimis, fere rectis.

This species belongs to Group 4 A of my monograph, and may be placed near *Dytiscus depressus*, Fab., though not closely allied to any other species; the male is very remarkable on account of its elongate claws, which are quite as long as all the rest of the tarsus. The punctuation of the surface is excessively dense, and the sutural series of punctures on each wing-case is very distinct; the thorax is rounded at the sides and narrowed behind, and the denticle near the extremity of each elytron is very evident in each sex.

A good series of this species was found at Chiuzenji the fourth week in August, 1881; they were found amongst weeds in the very strong-running stream which feeds the lake there.

Deronectes simplicipes.

Oblongo-ovalis, nitidus, testaceus, prothorace anterieus nigricante, basi maculis duabus plus minusve conjunctis nigris, elytris lineis confluentibus nigris, hic inde maculis testaceis interruptis ornatis; prosterno, pectore abdomineque nigris, antennarum palporumque apicibus fuscis; prothorace lateribus obliquis haud rotundatis, angulis posterioribus rectis. Long. 4 mm.

This species should be placed next *Hydroporus sardus*, Har. Its surface is very nearly smooth; there is, however, a punctuation along the anterior margin, and more

at the base, the punctuation of the wing-cases is extremely indistinct, and there are two more or less distinct longitudinal series of impressed punctures. The confluent black lines leave the base and apex pale, as also some lateral spots, and one or two on the disc. The sexual characters are very slight, but there is apparently a slight dilatation of the front and middle tarsi of the male.

A series of eighteen specimens was found in rivers and streams at Sapporo.

Deronectes hostilis.

Oblongo-ovalis, nitidus, testaceus, prothorace utrinque plaga fusca, elytris lineis nigris, hic inde maculis pallidis interruptis, ornatis; prosterno pectore abdomineque nigris; antennarum palporumque apicibus fuscis; prothorace lateribus curvatis, angulis posterioribus obtusis. Long. $4\frac{1}{2}$ mm.

Mas, tarsi anterioribus dilatatis unguiculis elongatis.

This is very similar to *D. simplicipes*, but has the sides of the thorax differently shaped, the black marks of the upper surface are less extensive, and the male feet more largely developed.

A single example was received from Japan by Mr. Lewis in 1874. The locality, South Kiushiu.

Hydroporus natrix.

Late ovalis, subdepressus, subopacus, niger, fronte in medio, prothoracis fascia transversa elytrisque guttis rotundatis testaceis, antennis pedibusque fusco-testaceis; supra subtilissime punctulato, punctisque majoribus sparsis, prætereaque in elytro singulo seriebus duabus punctorum. Long. 3— $3\frac{1}{2}$ mm.

Body entirely without pubescence; antennæ pale yellow, infuscate externally; the upper surface with pallid marks, *viz.*, a large round spot on the middle of the head, four such spots placed transversely at the base of the wing-cases, a second transverse series of four spots (of which, however, the two inner are most frequently absent) across the middle, two other spots (also frequently wanting) behind these, and a small one quite at the extremity; the thorax has a transverse pale fascia of variable width across the middle.

This species belongs to Group 3 of the genus, but cannot be placed in any of the subsections of that

group defined in my work on the *Dytiscidæ*; the under surface has on the breast and basal abdominal segment numerous extremely coarse punctures, the prosternal process is broad and tricarinate, there is a rudimentary abbreviated longitudinal impression near each side of the thorax, so that the insect must be placed between Sections A and C of the group referred to. No conspicuous sexual distinctions can be observed.

Found at Chiuzenji, in the lake, on the south side, the fourth week of August, 1881; a large variety with all the spots largely developed was found, in three examples, at Sapporo.

Hyphydrus rivalis.

A small series of this well-known insect was met with at Sapporo, and a single example at Awomori. These Japanese individuals differ scarcely at all from the North American variety *Hydroporus obesus*, Lec.

Agabus insolitus.

Oblongo-ovalis, depressus, nigerrimus, nitidus, antennis, palpis pedibusque anterioribus rufis, pedibus posterioribus piceis, elytris versus latera guttulis duabus pallidis; corpore superne obsolete reticulato, fere lævigato, prothoracis margine laterali crasso. Long. $5\frac{1}{2}$ mm., lat. 3 mm.

This is a very abnormal species for a member of the genus *Agabus*, the coxal lines being but little turned outwards behind, and the swimming-legs slender, and it has more the aspect of a *Platynectes* or *Agabinus*; it is, however, connected to a certain extent with the more ordinary *Agabi* by means of *A. optatus*, and the characters therefore are not sufficiently definite to justify the establishment for it of a genus distinct from the polymorphic *Agabus*. The outlines of the thorax and elytra are continuous, the hind angles of the former slightly obtuse, the reticulation of the wing-cases is almost obliterated, but the subserial punctures, though fine, are distinct and numerous; there is a pale spot on each near the side beyond the middle, and a second close to the apex. The prosternal process is broad and flat, its anterior portion strongly margined; the wing of the metasternum is very slender, the rather large hind coxæ and the basal ventral segments are finely strigose. The

legs are slender, the femoral setæ very small. The front and middle tarsi of the male are almost undilated, but are furnished beneath with very evident glandular pubescence.

A single example of the male sex was found in Higo in 1882.

Agabus optatus.

Ovalis, parum convexus, niger, nitidus, antennis, palpis tarsisque rufis, pedibus piceis, elytris versus latera guttula parva pallida; corpore supra densissime omnium subtilissime reticulato. Long. $6\frac{1}{2}$ mm., lat. $3\frac{1}{2}$ mm.

Notwithstanding the fact that the coxal lines are less directed outwards behind than usual this species may be placed in the same group as *A. japonicus*, from which species it is readily distinguished by its smaller size and the uniform black colour; the prosternal process is only moderately broad, but is flat and distinctly margined; the swimming-legs are slender, their tibiæ glabrous on the infero-external face; the hind coxæ are rather large, the wing of the metasternum moderate.

A single female example was found in Kiishiu in 1874 (*Mr. Wada*).

Platambus fimbriatus.

Ovalis, angustulus, convexus, nitidus, rufus, abdomine apicem versus picescente, supra subænescens, capitis maculis magnis, prothoracis lateribus, elytrorumque marginibus laterali basalique late flavis; elytris politis, punctis seriatis magnis impressis. Long. 7 mm., lat. $3\frac{1}{2}$ mm.

This insect is narrower than *Dytiscus maculatus*, and readily distinguished by the very broad lateral and basal margins of the upper surface, and by the very large impressed punctures on the elytra.

The series of nine examples shows very little variation, and the male characters are very slight, there being only an extremely slight incrassation of the front and middle tarsi.

Found at Chiuzenji in the fourth week of August, and in the lake at Hakone.

Copelatus japonicus.

Oblongo-ovalis, depressus, fusco-piceus, capitis prothoracisque marginibus dilutioribus, elytrorum marginibus laterali basalique,

antennis pedibusque testaceis ; corpore supra subtiliter punctulato, thorace versus angulos posteriores strigulis brevissimis impressis ; elytris striis argutis sex, externa posterius parum abbreviata, striaque submarginali modice elongata. Long. 6 mm., lat. 3 mm.

The male has the front and middle tarsi a good deal dilated, and in the female the sculpture at the hind angles of the thorax is coarser. The species belongs to Group 10, and is not closely allied to any other. The only two individuals found are immature ; one was obtained in Kiishiu (*Mr. Wada*), the other has no locality recorded.

Rhantus erraticus.

Ovalis, subdepressus, subopacus, subtus niger, supra testaceus, capite nigro-variegato, prothorace in medio plaga transversa nigra, elytris creberrime nigro-irroratis, antennis pedibusque anterioribus testaceis, femoribus basi nigricante, pedibus intermediis nigris geniculis tarsisque rufis ; corpore superne densissime minus subtiliter rugoso. Long. 13 mm., lat. 6 mm.

This species resembles greatly a large flat *Colymbetes pulverosus*, but it has the peculiarity of being dull above owing to a much less obsolete sculpture than exists in the males of other species of this genus. The male has the front and middle tarsi a good deal incrassate, and the claws of the anterior feet are elongate and simple. The female is unknown.

A single example occurred at Yumoto, August 24th, 1881.

Dytiscus marginalis.

The occurrence of this species in Japan, which was previously somewhat doubtful, has been certified by the capture of one female example at Chiuzenji and another at Sapporo.

Dytiscus sharpi.

Dytiscus sharpi, Wehncke, Stett. Ent. Zeit., 1875, p. 500.

This species was met with, though only in four or five examples, at Uyeno, in Tokio, December, 1880. The female before me is of much interest, as, though the peculiar sulcation seen in so many of the species of the genus *Dytiscus* is not present, yet there are on the external part of the elytra three or four slight grooves or striæ, being, as it were, the rudimentary condition or

commencement of this sexual peculiarity. The female differs from the male also in having the thorax finely punctured all over, as in the corresponding sex of *D. punctulatus*, the punctures being, however, less dense than in *D. punctulatus*.

Hydaticus therrmonectoides.

Breviter ovalis, anteriùs attenuatus, convexus, ferrugineus, elytris nigro-irroratis, irrorationibus post medium in fascias duabus nigras condensatis. Long. 10 mm., lat. 6 mm.

The unique specimen, a female, seems to indicate a *Hydaticus* of peculiarly short form, somewhat similar to a *Therrmonectes* or *Rhantaticus* in appearance, to be placed near *Hydaticus ponticus*. There is no black marking on the head and thorax; the elytra show very indistinct longitudinal lines of yellow among the black specks; the hind legs are remarkably short. The upper surface has a distinct fine punctuation, but unless this be characteristic of the female there is no sexual sculpture. The species may be readily distinguished from *H. rhantoides* by the broad shape and the different markings on the wing-cases.

Found on the Wada Pass.

Sandracottus hunteri.

A single example of this well-known species has occurred in Higo.

GYRINIDÆ.

Gyrinus japonicus.

Gyrinus japonicus, Sharp, Trans. Ent. Soc. Lond., 1873, p. 55.

G. curtus, Regt., Ann. Soc. Fr., 1882, p. 168 (nec Motsch.).

This has been brought from Yokohama by Mr. Lewis, and the series now found shows that the species should be placed in the section with dark epipleuræ, although in certain examples a faint rusty colour is apparent on the middle of the basal portion of these parts. The species is remarkable on account of a very distinct sexual sculpture existing in the female, a large portion of each wing-case being covered in that sex by a patch

of very fine alutaceous sculpture, rendering the surface opaque, except that at the suture and at the apex it is rather broadly, at the outer margin narrowly, shining. The individuals from Yokohama have the epipleuræ quite dark, while the specimens formerly brought from Nagasaki possess the faint rufescent tinge above mentioned, but clearly all are one species.

Gyrinus curtus.

Gyrinus curtus, Motsch., Bull. Mosc., 1866, i., p. 165 ;
Sharp, Trans. Ent. Soc. Lond., 1874, p. 417 ;
nec Regt., Ann. Soc. Fr., 1882, p. 168.

This species belongs to the group with red epipleuræ, and I think Motschulsky's name was really intended for it. The sexual sculpture of the female, so apparent in *G. japonicus*, is in *G. curtus* much more indistinct.

Nagasaki and Sapporo.

Gyrinus gestroi.

Gyrinus gestroi, Regt., Ann. Soc. Fr., 1883, p. 165.

Mr. Lewis captured a series of this species near Yokohama at the commencement of winter, and also met with it near Sendai, and at the Ogura Lake in July.

Orectochilus regimbarti.

Elongato-ovalis, fusco-niger, supra undique subtiliter punctato-tomentosus, infra epipleuris pedibus abdomineque late ferrugineis ; labro lato rotundato, medioeriter elongato. Long. $8\frac{1}{2}$ —9 mm., lat. 4 mm.

Mas, elytris sutura parum elevata, ad apicem fere recte truncatis.

Fem., elytris sutura valde elevata, apice in medio angulariter producto.

This species is very distinct from any other with which I am acquainted. The labrum is just about twice as broad as it is long ; the thoracic punctuation is extremely indistinct, and that on the elytra quite fine, and more scanty in the male than in the female. The male anterior tarsi are only moderately dilated.

I have named this distinct species in honour of Dr. Maurice Régimbart ; by the assistance of his carefully

executed plates it is now possible to determine with certainty the species of this very difficult family.

Found in the lake of Chiuzenji about the end of August, 1881.

Orectochilus agilis.

Anguste-ovalis, fusco-niger, elytrorum margine externo angustissime, epipleuris pedibusque, ferrugineis, supra æqualiter punctato tomentoso, capite lævi; subtus piceus; elytris apice subrecte truncato, angulis externis obtusis; labro sat producto, rotundato. Long. $6\frac{1}{2}$ mm., lat. 3 mm.

This is another species very distinct from any yet described, being about the same size as *O. villosus*; it is much less convex, more regularly oval, and it is at once distinguished by the yellow margin of the wing-cases; the outer apical angle of the wing-case is not broadly rounded, as in *O. villosus*, but the hind margin, being nearly straight, the side meets it so as to form a slightly obtuse angle. The male front tarsi are a good deal dilated, and the outer apical angle of the tibia is rounded.

A good series was taken in the river at Kumamoto about the end of May, 1881, but most of the examples are very immature. Rough weather had occurred, and the specimens had taken refuge under weed on the beach.

Orectochilus punctipennis.

Ovalis, angustus, convexus, supra niger, subænescens, nitidus, undique punctato-tomentosus, punctatura minus obsoleta, subtus piceus, abdomine flavescente, pedibus testaceis, labro sat producto, rotundato; elytrorum apice oblique truncato, angulo externo rotundato-obtuso. Long. $5\frac{1}{2}$ mm., $2\frac{5}{8}$ mm.

Closely allied to *O. villosus*, auct., rather smaller and narrower and scarcely so convex, but at once to be distinguished by the (for this genus) unusually coarse punctuation of the elytra; the outer apical angle of the wing-cases is also less broadly and completely rounded than it is in *O. villosus*. The dilatation of the male front feet is rather less than it is in *O. villosus*, the apex of the tibia is similarly formed. The only two examples found are both rather immature, and show, especially the female, slight traces of some longitudinal depressions on the posterior part of the wing-cases.

Ogura Lake, July 1st, one female; Tokio (*Mr. Tanaka*), one male.

HYDROPHILIDÆ.

Hydrocharis libera.

Ovalis, convexa, nigra, antennarum basi testaceo; dense subtiliter punctato, elytris seriebus punctorum impressis conspicuis; prosterno posterius mutico, metasterno posterius apice spinam brevem in medio formante; femoribus posterioribus fere impunctatis. Long. 19 mm., lat. 10 mm.

This species is excessively similar to the European *H. caraboides*, auct., but is readily distinguished by the middle of the prosternum being without spine, by the impunctate femora, and by the projection of the metasternum in the middle behind forming a longer free spine. This latter character will distinguish the species from *H. affinis*, besides the colour differences in the legs, palpi, and inflexed margin of the wing-cases.

Five examples were found at Hakodate towards the end of September, 1880.

Hydrocharis affinis.

Hydrocharis affinis, Sharp, Trans. Ent. Soc. Lond., 1873, p. 58.

H. flavipes, var., Sharp, *op. cit.*, p. 59 (nec Steph.).

Mr. Lewis has now secured a series of about a dozen examples of this species. Though very closely allied to the European *H. flavipes*, I think it will prove distinct, the size being very much greater, the thorax more transverse, the striation on the wing-cases always distinct, and the middle of the prosternum rather differently formed, being shorter in proportion and less produced behind, more obtusely rounded in front. The specimen recorded as being possibly a variety of *H. flavipes* is, I am satisfied, now that I have had an opportunity of comparing it with a series of *H. affinis*, only a small, ill-developed, immature individual of that species.

Found in Ogura lake, near Nara, towards the end of June, and at Niigata in September; I have also a specimen of the species from Castlenau's collection labelled Shanghai.

Hydrophilus rufipes.

The species recorded in Mr. Lewis' catalogue of Japanese Coleoptera as *Sternolophus fulvipes*, Motsch., is this species, common in Eastern Asia; what *S. fulvipes*, Motsch., may prove to be I am still unable to determine.

HYDROCYCLUS, n. g.

Gen. *Hydrobio* affinis; corpus rotundatum convexum, palpi maxillares, sat elongati, thoracis longitudine, crassiusculi, articulo pseudo-basali recto, articulo ultimo præcedente longiore; mentum magnum, planum, anterius rotundatum, dense sculpturatum. Mesosternum processu elevato, posterius excavato. Pedes tenues, haud natatores, tarsi posteriores subtus pubescentes, haud ciliati.

This rather curious form can only be placed near *Hydrobius*, from which it is readily distinguished by the elongate palpi, and by the clothing of the under surface of the hind feet; the mesosternal process is peculiar; it is rather broad, placed transversely with a subacuminate free extremity, and from its hollowed posterior face emits a very slender process, which connects between the middle legs with a narrow prolongation of the metasternum. The basal halves of the femora are densely and finely pubescent; the antennæ are nine-jointed, with short club; one of the anterior tibial spurs is elongate and much curved.

The Chinese genus *Hydrocassis*, Fairm., is probably an allied form, having, according to the description, a different mesosternal structure.

Hydrocylus lacustris.

Rotundato-ovalis, piceus, antennarum basi, palpis, tibiis tarsisque rufis; supra fortiter punctato, capite thoraceque punctis inæqualibus mixtis; elytris fortiter seriatim punctatis, interstitiis alternis fortiter, apicem versus subasperate, punctatis, margine laterali distante serrato. Long. 7 mm., lat. 5 mm.

Head coarsely punctured, behind with fine punctures between the larger ones, these latter in the middle not extending to the front margin. Thorax very transverse, distinctly margined all round, with numerous distinct irregularly-placed punctures, and with other very fine, more numerous, punctures between these. Elytra with regular series of coarse punctures, which behind and at the sides become striæ, and the alternate interstices bear coarse

punctures, which on the posterior part become more or less asperate.

This is a lake species, occurring in water of low temperature, and has been found at Hakone and Chiu-zenji, but is apparently rare.

Hydrobius pauper.

Oblongo-ovalis, niger, supra nigro-æneus, antennarum basi, palpis tarsisque rufis; supra crebre punctatus, elytris præterea seriatim punctatis, interstitiis etiam punctis interjectis irregularibus parum conspicuis. Long. 7 mm., lat. $3\frac{1}{2}$ mm.

This species is very closely allied to *H. fuscipes*, auct., more especially to the form recently distinguished by Thomson as *H. picicrus*, but, compared with the latter, it is found to be rather narrower, to have the punctuation of the upper surface rather finer, and on hinder half of the elytra more scanty, and the striæ less marked; it is, however, most satisfactorily distinguished by the pubescence and punctuation of the hind femora, which is very much diminished in the present species, being confined to a smaller area, and on that area much less dense, and indeed is almost altogether wanting on the posterior portion of the femur.

Mr. Lewis has brought only a few specimens, and the only recorded locality is Oyama on the main island.

Hydrobius fuscipes.

Dytiscus fuscipes, L., Faun. Suec., No. 766.

Horubetsu, in Yezo; one example.

Philydrus haroldi.

? *P. cinctus*, Harold, Deutsche Ent. Zeit., 1877, p. 343 (nec Say).

Major, ovalis, convexus, nitidus, niger, antennis, palpis tarsisque testaceis, palpis articulo pseudo-basali basin versus late infuscato, antennarum clava obscura, prothoracis elytrorumque marginibus brunneo-testaceis, pedibus piceis, supra crebrius punctato; mesosterni processu falcato. Long. $7\frac{1}{2}$ mm.

This species, closely allied to *P. japonicus*, differs by its considerably larger size, and by the broadly infuscate base of the palpi, as well as by the greater prominence

of the apex of the mesosternal process. It is very similar to *Hydrophilus cinctus*, Say, from which it differs by the falcate mesosternal process, as well as other structural characters. It is pretty certainly the species recorded by Harold (*loc. supra cit.*) as being *P. cinctus*, Say, and this latter name must therefore be erased from the list of Japanese Coleoptera.

Sendai, Oct. 20th, 1880, four examples ; Osaka, July 6th, one example.

I have dedicated the species to Baron Edgar von Harold, to whom Science is deeply indebted for his contributions to the knowledge of the coprophagous lamellicorn, and other, Coleoptera.

Philydrus subsignatus.

Philydrus subsignatus, Harold, Deutsche Ent. Zeit., 1877, p. 342.

This insect has not been met with by Mr. Lewis. It was found by Dönitz in the lake at Hakone.

Philydrus uniformis.

Ovalis, sat convexus, nitidus, niger, antennis palpis, thorace, elytris, tibiis, tarsis capitisque macula utrinque testaceis ; crebre fortiter, punctatus ; mesosterni lamina magna. Long. 4 mm.

This little insect, with the upper surface coloured as in *Hydrophilus bicolor*, Payk., is much smaller. The extremities of the maxillary palpi are suffused with fuscous-colour ; the punctuation of the elytra is not dense, and larger serial punctures are not to be observed. The large mesosternal lamina has its lower edge free from serration or inequalities, but has a very minute acumen at its anterior angle.

Yokohama, February, 1880.

Philydrus vilis.

Ovalis, sat convexus, nitidus, niger, antennis, palpis, tibiis tarsisque testaceis, antennarum clava infuscata, capite nigro macula utrinque testacea, thorace elytrisq. fusco-ferrugineis, versus latera dilutioribus ; crebre fortiter punctatus ; mesosterni lamina parva. Long. 4 mm.

The punctuation of the elytra is not dense, and there are no serial punctures to be observed; the mesosternal lamina, though sharply elevated, extends but little forwards in the anterior direction. The darker colour of the upper surface and the smaller mesosternal lamina make the species very easily distinguished from *P. uniformis*.

A single individual in very bad condition was found at Sapporo.

Philydrus ornaticeps.

Minutus, ovalis, sat convexus, nitidus, niger, antennis, palpis, tibiis, tarsis, thorace elytrisque testaceis, capite nigro, macula utrinque testacea; crebre punctatus; mesosterni lamina parva. Long. 2—2½ mm.

This, one of the smallest species of the genus, is in colour very similar to *P. uniformis*, as also in punctuation, and, as in that species, no serial punctures are present; the mesosternal lamina, though sharp and definite, is very small.

Kioto, July 4th, 1881. Also found by Mr. Lewis in 1863 at Kiu Kiang, in China.

Philydrus umbratus.

Ovalis, sat convexus, niger, supra fusco-testaceus, prothorace elytrisque versus latera dilutioribus, capite nigricante utrinque flavo-maculato, antennarum basi, tibiis, tarsis palpisque testaceis, his articulo ultimo extrorsum infuscato; supra crebre æqualiter punctato, elytrisque præterea seriatim punctatis, seriebus punctorum posterius profundioribus. Long. 5½ mm.

This species is well characterised by the distinct lines of close punctures on the wing-cases, which become deeper behind so as there to form evident striæ; besides this the elytra are closely punctured, and on some of the interstices there can be distinguished in addition a few larger punctures; the insect is very similar to *P. simulans*, but is readily distinguished by the absence of deep striæ, and by the greater development of the ordinary diffuse punctuation of the wing-cases, so that the irregular larger punctures on some of the alternate interstices are not very conspicuous as they are in *P. simulans*. The mesosternal lamina is large.

This appears to be one of the commoner species of

the genus in Japan, and has been met with at Nikko, Niigata, Yokohama, and Hakodate.

Laccobius bedeli.

Breviter ovalis, convexus, niger, capitis macula utrinque, prothoracis lateribus, antennis, palpis, pedibus elytrisque testaceis, his confertim fusco-lineatis, pallide subguttatis; prothorace crebre fortiter punctato, inter puncta polito; elytris omnino regulariter seriatim punctatis; mesosterni lamina magna. Long. 3 mm.

This, though very similar to the European *L. bipunctatus*, does not agree sufficiently therewith to justify its being treated as a mere variety thereof. *L. bedeli* is larger, and the elytra are smoother, the very regular punctures being smaller and placed much farther from one another, the two pallid spots near the apex characteristic of *L. bipunctatus* are absent, and the mesosternal lamina is much larger.

This is the insect formerly alluded to in Trans. Ent. Soc. Lond., 1873, p. 61, as possibly a variety of *L. minutus*, L., but, now that the characters of that insect and the allied species in Europe have been ascertained, it is evident that the Japanese insect is also distinct, and I have with much pleasure named it in honour of M. Louis Bedel, whose kind assistance has greatly helped me in making out its characters.

Although only a few examples have been brought back the species is probably very common, as it has occurred at several localities, Yokohama, Oyama, Sendai, Hakodate.

Laccobius oscillans.

Ovalis, sat convexus, niger, capitis macula parva utrinque, prothoracis lateribus, antennis, palpis pedibusque testaceis; elytris ex parte majore nigricantibus, plus minusve pallido-subguttatis, lateribus apiceque pallidioribus, seriatim punctatis interstitiis magis sparsim seriatim punctatis; prothorace inter puncta majora tantum obsolete alutaceo-punctato. Long. 2½ mm.

This is excessively similar to the European *L. alternus*, but under the microscope it is seen that the thorax is only obscurely alutaceous. This character is of too much importance in the genus to allow the union of the Japanese and European insects; the former, indeed, is intermediate between the two groups of European species,

for in the species said to have a polished thorax a good microscope reveals more or less distinct traces of the alutaceous sculpture, so that the *L. oscillans*, where the thorax is undoubtedly, though indefinitely, alutaceous, cannot be satisfactorily placed in either of the two groups.

A fair series of *L. oscillans* has been obtained at Hakodate. It sometimes exhibits a pallid spot near the extremity of each wing-case, like the European *L. bipunctatus*.

Note.—A specimen of what is apparently a third species of *Laccobius* has been obtained by Mr. Lewis at Hakodate, but the surface is obscured by a very fine coating of some mineral substance that cannot be removed, and that renders its accurate observation impossible.

Berosus vestitus.

Niger, capite superne thoraceque late in medio ænescentibus, hoc ad latera testaceo, antennis, palpis, pedibus elytrisque testaceis his crebre fusco-irroratis, subtiliter striatis, crebre punctatis, subtiliterque pubescentibus. Long. 4 mm.

Head and thorax closely punctate, the latter with a longitudinal smooth space on the middle. Elytra rather closely punctate, with blackish punctures, each of which bears a fine depressed hair, and with fine striæ, which are rather more distinct at the apex than at the base. Mesosternal carina reduced to a raised line running along the middle of the mesosternum; carina on basal ventral segment distinct and rather elongate.

Only two individuals have been found of this very distinct little species, one at Bukenji, the other at Niigata in September, 1881.

Octhebius inermis.

Niger, opacus, antennis, palpis pedibusque testaceis; capite thoraceque fere impunctatis, illo vertice trifoveolato, hoc posterius fortiter angustato, et membrana pellucida angustissima marginato, medio canaliculato, disco utrinque longitudinaliter impresso, versus angulos anteriores oblique impresso; elytris seriatim vix regulariter punctatis, nudis, interstitiis haud punctatis. Long. 2 mm.

The labrum is entire; the thorax becomes a little broader from the front for nearly one-half the length, and is then abruptly narrowed, the excised portion being bordered with a very narrow margin of white membrane; viewed in a certain direction the

longitudinal impression on each side of the middle channel is seen to be divided into two impressions; the large impression marking off the portion at the anterior angles is deep and very broad. The under surface is rendered ashy by a very minute dense pubescence, the two terminal segments being left bare.

The species is not closely allied to any other, but may be placed near *O. nanus*, St.

A single example was met with at Miyanoshita in May, 1880.

Hydrochus æqualis.

Supra, metallico-ferrugineus, subtus niger, antennis, palpis pedibusque testaceis; prothorace fortiter punctato, subinæquali, vix foveolato, posterius angustato; elytris seriatim fortiter et profunde punctatis, interstitiis angustis, fere omnino similibus et æqualibus. Long. 3 mm.

This little insect, though very similar to *H. japonicus*, is distinct by the absence of evident areolæ on the thorax.

Only two individuals have been found, one at the Ogura Lake, the other at Osaka, both in the early days of July, 1881.

Helophorus sp.?

The only evidence of the occurrence of any species of this well-known genus in Japan* is a very dirty specimen, found at Kobe, of what may perhaps be our common species, *H. griseus*, though its condition does not allow this to be certainly decided.

Cyclonotum orbiculare.

Hydrophilus orbicularis, Fab., Syst. Ent., 229, 5.

The Japanese individuals are rather less globose, and have a slightly coarser punctuation, than the European individuals.

It is apparently confined to the north in Japan, having been found at Hakodate, Sapporo, and Otaru, in the island of Yezo.

Mr. Lewis failed to take *Sphæridium* in Japan, although continually looking for it. The genus is as common in China as in Britain.

* Since this was written a second species of *Helophorus* has been received, and is described at the end of this paper.

Cercyon setulosus.

Oblongo-ovalis, subdepressus, niger, antennis palpisque testaceis, pedibus sordide testaceis; prothorace ad latera vix subsinuato, angulis posterioribus obtusis haud rotundatis, parce obsoleteque punctato; elytris subopacis, striatis, striis fere impunctatis, postice paulo profundioribus, interstitiis haud punctatis, obscure setosulis. Long. 2 mm.

Allied to *C. algarum* and *C. aptus* by the subopaque, less punctate, upper surface, and by the interstices of the elytra being but little convex behind; from *C. aptus* it is readily distinguished by the more slender legs, which are armed with finer spines, and by the hind tibiæ being undilated at the extremity. The fine setulosity on the interstices of the elytra, though obscure, is diagnostic of this species.

Half a dozen specimens have been found, but the locality has not been preserved; no doubt the insect is of maritime habits.

Cercyon sharpi.

Cercyon Sharpi, Harold, Deutsche Ent. Zeit., 1878, p. 68.

I have not been able to identify Von Harold's description with any insect known to me. The species is a little doubtful, as Harold misunderstood my description of *C. dux* in certain points. I do not think, however, that his description can apply to the species just named.

Found at Tokio by Hilgendorf.

Cercyon aquaticus.

Cercyon aquaticum, Muls., Palp., p. 174.

This European species was found in seven examples at Otaru.

Cercyon ovillum.

Cercyon ovillum, Motsch., Schrenck's Reisen, p. 129.

Two examples of this common Amur-land species were met with at Sapporo.

Cercyon unipunctatus, var.

Coccinella unipunctata, L., Faun. Suec., No. 470.

A single example of a variety with remarkably coarse sculpture was found at Tomakomai, August 18th, 1880, in company with a series of the European *C. quisquilius*.

Cercyon vagus.

Ovalis, convexus, posterius subacuminatus, nitidus, piceus, supra obscurus rufus, hic inde vage piceo-suffusus, antennis palpisque testaceis, pedibus rufis; prothorace crebrius sat subtiliter punctato, elytris profunde striatis, interstitiis parce obsolete punctatis. Long. $2\frac{3}{4}$ mm.

To be placed near *C. ustus*, but readily distinguished by the deeply striate elytra so that the interstices are convex, and by the obsolete punctuation of these latter, the striæ are only obscurely punctured. Only two individuals have been found, and, as the coloration of the surface differs in the two, it is evidently variable, and need not at present be alluded to in detail.

Found at Miyanoshta in May, 1880, and also at Oyama.

Cercyon placidus.

Ovalis, convexus, nitidus, niger, antennis palpisque testaceis, pedibus rufis; prothorace subtiliter minus crebre punctato; elytris anterius seriatim punctatis, posterius profunde striatis, interstitiis parce punctatis. Long. $2\frac{3}{4}$ mm.

Black, with the head and thorax picescent, very shining, with quite fine and scanty punctuation on the thorax; on the elytra there are very distinct series of punctures; those near the suture are quite fine at the base, but become deep striæ behind.

The species may be at a glance distinguished from *C. vagus* by the fine thoracic punctuation, and from *C. ustus* by the elytra being marked with deep striæ behind.

Found at Hitoyoshi and Nikko, but only three examples.

Cercyon æqualis.

Ovalis, convexus, nitidus, ferrugineus, supra niger, anterius picescens, antennis palpisque testaceis, pedibus rufis; prothorace crebre fortiter punctato; elytris seriatim punctatis, posterius substriatis, interstitiis crebre fortiter punctatis. Long. $2\frac{1}{2}$ mm.

Extremely similar to *C. placidus*, but readily distinguished by the coarser punctuation of the thorax and elytra, the latter being also less deeply striate behind. It is distinguished from *C. ustus* by the shorter form, blacker and more unicolorous upper surface, and by the rows of punctures on the elytra being deeper at the extremity.

I have seen only two examples, found at Nikko.

Cercyon rotundulus.

Breviter ovalis, convexior, ferrugineus. antennis palpisque testaceis, supra piceus, nitidus, prothorace sat crebre et sat fortiter punctato, elytris æqualiter crenato-striatis, interstitiis parce punctatis. Long. 2 mm.

Distinguished from *C. ustus* and *C. placidus* by the shorter and more convex form, and from the former by the much less punctate elytra; and from *C. placidus* by the striæ being less deepened behind, and it has moreover the basal joint of the hind tarsus much shorter than either of those species.

Only two examples have been seen by me: Miyano-shita, May, 1880, and Chiuzenji, August 19th, 1881.

Cercyon rubicundus.

Rotundulus, convexus, ferrugineus, nitidus, antennis palpisque testaceis sat crebre subtiliter punctatis, elytris seriatim sat fortiter punctatis, seriebus postice haud magis impressis. Long. 2 mm.

This little insect will be distinguished amongst its allies by the rotund form and the shining, more pallid, upper surface. It has short legs, and the polished space on the middle of the metasternum is less expanded laterally than is usual, and is flat and very definitely punctate.

Miyanoshita and Nagasaki.

Oosternum sorex.

Cercyon sorex, Sharp, Trans. Ent. Soc. Lond., 1874, p. 418.

I indicated when describing it the probability that this insect would have to be generically separated from *Cercyon*, and it now appears that it may be placed in

Oosternum, recently established for a Central American insect. Only another solitary individual of this minute species has been brought back by Mr. Lewis; found at Nagasaki on the 1st of March, so that it appears to be a rarity.

PERATOGONUS, n. g.

Corpus subrotundatum, convexum, supra et infra politum. Labrum exsertum. Mentum planum, obsolete punctatum, opacum, pubescens. Prosternum in medio parvum, utrinque ante coxas nullum. Femora margine anteriore recto, posteriore angulariter dilatato, glabra. Pedes intermedii valde distantes, mesosterni processu latissimo, brevi, in medio antierius angulariter prominulo. Pedes posteriores breves, tarsi perbrevis.

The above characters readily distinguish this curious little insect from all the other genera of *Sphæridiidae* yet known. It may be placed between *Oosternum* and *Deltostethus*. The five joints of the very short tarsi are each almost of one length, and the claws are very minute.

Peratogonus reversus.

Rotundatum, convexum, nigro-piceum, politum; antennis, palpis pedibusque testaceis; elytris profunde striatis, striis internis ad basin subtilioribus, ibidemque discrete punctatis. Long. 2 mm.

The head and thorax are almost impunctate, but the elytra are scored by very coarse striæ, those towards the sides being directed obliquely upwards; the interstices, like the head and thorax, are shining and almost impunctate; there are only eight true striæ, the two outer ones being replaced by a few coarse serial punctures. The metasternum has a few very coarse and deep punctures on each side.

Found in a few examples at Nagasaki in March and April.

Cryptopleurum subtile.

Cryptopleurum atomarium, var. ?, Sharp, Trans. Ent. Soc. Lond., 1874, p. 420.

Breviter ovale, parce pubescens, ferrugineum, thorace in medio plus minusve infuscato, capite, prosterno pectoreque nigricantibus, antennis pedibusque testaceis; prothorace subtiliter crebre punctato, elytris sat profunde striatis, striis antierius evidenter punctatis, interstitiis sat crebre obsolete punctatis. Long. 2 mm.

Very closely allied to the European *C. atomarium*, but smaller and paler, and readily distinguished by the much feebler punctuation of the surface. Like its European congener, it varies considerably in size and in depth of coloration.

Found at Otsu and Otaru.

Pachysternum hæmorrhoum.

Pachysternum hæmorrhoum, Motsch., Bull. Mose., 1866, i., p. 168; Von Harold, Deutsche Ent. Zeit., 1878, p. 69? ?

I still fail to identify this insect, and think it very doubtful whether Harold was correct in his identification of it. Indeed, I should suppose the latter entomologist was speaking of *Megasternum distinctum* were it not for his saying that the thorax is "sehr fein punktirt." For some further remarks on Harold's views as to this species cf. Ent. Mo. Mag., xv., pp. 278—9.

LIST OF JAPANESE WATER-BEETLES.

HALIPLIDÆ.

HALIPLUS.	<i>Haliplus sharpi</i> , Wehneke.
<i>Haliplus ovalis</i> , Shp.	„ <i>japonicus</i> , Shp.

DYTISCIDÆ.

NOTERIDÆ.	BIDESSUS.
NOTERUS.	<i>Bidessus frontalis</i> , Shp.
<i>Noterus japonicus</i> , Shp.	<i>Hydroporus japonicus</i> , Shp.
CANTHYDRUS.	HYPHYDRUS.
<i>Hydrocanthus politus</i> , Shp.	<i>Hyphydrus japonicus</i> , Shp.
LACCOPHILINI.	„ <i>frontalis</i> , Shp.
LACCOPHILUS.	„ <i>leviventris</i> , Shp.
<i>Laccophilus levisius</i> , Shp.	CÆLAMBUS.
„ <i>flexuosus</i> , Aubé.	<i>Cælambus vittatus</i> , Shp.
„ <i>difficilis</i> , Shp.	DERONECTES.
„ <i>Kobensis</i> , Shp.	<i>Deronectes anchoralis</i> , Shp.
HYDROPORIDÆ.	„ <i>simplicipes</i> , Shp.
HYDROVATUS.	„ <i>hostilis</i> , Shp.
<i>Hydrovatus acuminatus</i> , Motsch.	

HYDROPORUS.

Hydroporus natrix, Shp.
Hyphydrus rivalis, Gyll.

COLYMBETIDÆ.

AGABUS.

Agabus japonicus, Shp.
 „ *optatus*, Shp.
 „ *insolitus*, Shp.
 „ *conspicuus*, Shp.

PLATYNECTES.

Agabus dissimilis, Shp.

PLATAMBUS.

Platambus fimbriatus, Shp.
Agabus pictipennis, Shp.

ILYBIUS.

Ilybius apicalis, Shp.

COPELATUS.

Copelatus japonicus, Shp.
 „ ? spec.

RHANTUS.

Colymbetes pulverosus, Steph.
Rhantus erraticus, Shp.

DYTISCINI.

DYTISCUS.

Dytiscus sharpi, Wehncke.
 „ *marginalis*, L.

HYDATICIDÆ.

HYDATICUS.

Dytiscus grammicus, Germ.
Hydaticus thermonectoides, Shp.
 „ *rhantoides*, Shp.
 „ *bowringi*, Clk.
Dytiscus vittatus, Fab.

SANDRACOTTUS.

Sandracottus hunteri, Shp.

GRAPHODERES.

Hydaticus Adansi, Clk.
 „ *japonicus*, Shp.

ERETES.

Dytiscus sticticus, Linn.

CYBISTRINI.

CYBISTER.

Cybister japonicus, Shp.
 „ *lewisianus*, Shp.
Dytiscus tripunctatus, Öl.
Cybister brevis, Aubé.

GYRINIDÆ.

DINEUTES.

Dineutes marginatus, Shp.

GYRINUS.

Gyrinus curtus, Motsch.
 „ *japonicus*, Shp.

Gyrinus gestroi, Regt.

ORETOCHILUS.

Orectochilus regimbarti, Shp.
 „ *agilis*, Shp.
 „ *punctipennis*, Shp.

HYDROPHILIDÆ.

HYDROPHILUS.

Hydrophilus cognatus, Shp.
 „ *japonicus*, Shp.

STERNOLOPHUS.

Hydrophilus rufipes, Fab.

HYDROCHARIS.

Hydrocharis affinis, Shp.
 „ *libera*, Shp.

HYDROBIUS.

Hydrobius fuscipes, L.
 „ *pauper*, Shp.

HYDROCYCLUS.

Hydrocyclus lacustris, Shp.

PHILYDRUS.

Philydrus haroldi, Shp.
 „ *japonicus*, Shp.
 „ *umbratus*, Shp.
 „ *simulans*, Shp.
 „ *subsignatus*, Har.
 „ *uniformis*, Shp.
 „ *vilis*, Shp.
 „ *ornaticeps*, Shp.

HELOCHARES.

Helochares striatus, Shp.
 „ *lewisius*, Shp.

LACCOBIUS.

Laccobius bedeli, Shp.
 „ *oscillans*, Shp.

VOLVULUS.	
<i>Volvulus profundus</i> , Shp.	<i>Cercyon setulosus</i> , Shp.
	„ <i>algarum</i> , Shp.
AMPHIOPS.	
<i>Amphiops mater</i> , Shp.	„ <i>sharpi</i> , Har.
	„ <i>laminatus</i> , Shp.
	„ <i>aquaticus</i> , Muls.
	„ <i>ovillum</i> , Motsch.
BEROSUS.	
<i>Berosus punctipennis</i> , Har.	<i>Sphæridium quisquilius</i> , L.
„ <i>japonicus</i> , Shp.	„ <i>unipunctatum</i> , L.
„ <i>vestitus</i> , Shp.	<i>Cercyon vagus</i> , Shp.
„ <i>lewisius</i> , Shp.	„ <i>placidus</i> , Shp.
	„ <i>æqualis</i> , Shp.
	„ <i>ustus</i> , Shp.
	„ <i>rotundulus</i> , Shp.
	„ <i>otibrus</i> , Shp.
	„ <i>rubicundus</i> , Shp.
HYDROCHUS.	
<i>Hydrochus japonicus</i> , Shp.	
„ <i>æqualis</i> , Shp.	
HELOPHORUS.	
<i>Helophorus</i> sp. ?	OOSTERNUM.
„ <i>auriculatus</i> , Shp.	<i>Cercyon sorex</i> , Shp.
OCTHEBIUS.	
<i>Octhebius inermis</i> , Shp.	MEGASTERNUM.
	<i>Megasternum gibbulum</i> , Motsch.
	„ <i>distinctum</i> , Shp.
CYCLONOTUM.	
<i>Cyclonotum latum</i> , Shp.	PACHYSTERNUM.
„ <i>simplex</i> , Shp.	<i>Pachysternum hæmorrhoum</i> , Motsch.
<i>Hydrophilus orbicularis</i> , F.	CRYPTOPLEURUM.
„ <i>breve</i> , Shp.	<i>Cryptopleurum subtile</i> .
CERCYON.	
<i>Cercyon dux</i> , Shp.	PERATOGONUS.
„ <i>aptus</i> , Shp.	<i>Peratogonus reversus</i> , Shp.

ADDENDUM.

Helophorus auriculatus.

Niger, supra fusco-æneus, palpis pedibusque testaceis; thorace ad latera antè sinuato, angulis anterioribus prominulis; elytris regulariter seriatim punctatis, interstitiis alternis subelevatis et ultra medium subtuberculatis. Long. 6 mm.

This is a very distinct species, with a peculiar formation of the sides of the thorax, the front angles being unusually prominent, and the sides a little behind the front somewhat dilated, so that a slight emargination exists behind the front angles; on the under surface a prominent carina extends longitudinally a little distance from the side; the thorax is covered with fine granulations, those near the side being more distinct; its sulci are fine; there is a short series of punctures on each side of the suture of the elytra at the base.

Miyanoshita.

XXII. *Revision of the Hydrophilidæ of New Zealand.*
By DAVID SHARP.

[Read September 3rd, 1884.]

I HAVE recently submitted the New Zealand specimens of *Hydrophilidæ* in my collection to an examination with a view to determining the species and throwing some light on their classification. As the result I find I have twenty-four species which I am obliged to refer to twelve genera; five of these genera—*Hydrobius*, *Paracymus*, *Tornus*, *Cyclonotum*, and *Cercyon*—are each represented only by a single species, and of these five genera no less than four are found in other countries, the species in New Zealand being the same as that found abroad. *Cercyon* is represented by an introduced European species; *Hydrobius*, *Paracymus*, and *Cyclonotum* each by an Australian species; while *Tornus* at present seems likely to be a peculiar endemic New Zealand form. Of the other seven genera no less than six are peculiar to New Zealand, so far as we at present know, while the cosmopolitan genus *Philydrus* is represented by three species. This result is very remarkable, for the genera of *Hydrophilidæ* are, as a rule, very widely distributed; and, if we consider also that some of the most cosmopolitan genera of the family are quite unrepresented in the fauna, we cannot but admit that the New Zealand fauna of *Hydrophilidæ* is, as a whole, of the most remarkable character. The genera *Hydrophilus*, *Berosus*, *Hydrochus*, and *Octhebius*, all of which are nearly cosmopolitan, and all found in Australia, may be mentioned as examples of forms we should expect to find in New Zealand, but which apparently are absent.

The *Hydrophilidæ* are insects of an unattractive character, and usually of inactive and retiring habits, and it may be taken as certain that there exist in the country numerous species with which I am unacquainted, and which, when known, may modify the opinion I have just

expressed. Indeed in Broun's 'Manual of New Zealand Coleoptera' there are described eight or nine species which I have been unable to identify, and several of which are no doubt valid species. It must not be forgotten also that the study of these insects, except so far as regards those of the temperate regions of the Northern Hemisphere, is very little advanced, so that it is really premature to generalise as to the peculiarities of those in New Zealand.

In order to facilitate the determination of the New Zealand forms I have made an analytical table of the genera; but, as it is drawn up of course only from those forms known to me, little reliance should be placed in it, as such tables are only really trustworthy when the components of a fauna are exhaustively known.

1.	{	Anterior coxæ extending to the front of the prosternum	<i>Phelerosus.</i>
		Anterior coxæ not extending to the front of the prosternum	
2.	{	Basal joint of hind foot shorter than the 2nd joint	3.
		Basal joint of hind foot longer than the 2nd joint	4.
3.	{	Maxillary palpi elongate, as long as or longer than the head	<i>Philydrus.</i>
		Maxillary palpi shorter than the head	
5.	{	Mesosternum armed in the middle with an erect process	6.
		Mesosternum unarmed .. .. .		7.
6.	{	2nd joint of hind foot at least twice as long as the 1st	8.
		2nd joint of hind foot only slightly longer than the 1st .. .. .		9.
8.	{	Joint of antenna preceding club developed transversely in adaptation to the succeeding joint	10.
		Joint of antenna preceding club simple .. .. .		11.
10.	{	Elytra with serial punctures; length of body, 8 mm.	<i>Hydrobius.</i>
		Elytra with only diffuse punctuation; length of body, 2 mm. .. .. .		Paracymus.
11.	{	Hind tarsi compressed, not pilose beneath	<i>Tomus.</i>
		Hind tarsi not compressed, densely pilose beneath		Hydrostygnus.
7.	{	Hind claws short, with very short basal lobe	<i>Saphydrus.</i>
		Hind claws longer, with lobe beneath extending half the length .. .. .		Rygmodus.
9.	{	Antennæ 9-jointed; middle coxæ much separated	<i>Adolopus.</i>
		Antennæ 8-jointed; middle coxæ less separated .. .. .		Cyloma.
4.	{	Basal joint of hind foot only a little longer than following	<i>Cyclonotum.</i>
		Basal joint of hind foot more than twice as long as following .. .. .		Cercyon,

Hydrobius assimilis.

Hydrobius assimilis, Hope, Proc. Ent. Soc. Lond., 1842, p. 48.

H. zealandicus, Broun, Man. N. Z. Col., p. 77.

This is an abundant insect in Australia.

In New Zealand I am acquainted with it only as occurring in the Auckland and Christchurch districts, and I think it may possibly be an introduction.

Paracymus nitidiusculus.

Hydrobius nitidiusculus, Broun, *op. cit.*, p. 78.

This also is one of the commoner Australian insects. Specimens from that country in Castlenau's collection were labelled *Philydrus cæruleus*, Macleay. Although it is probable that Macleay has described one or two species of *Paracymus* or *Anacæna* as *Philydri*, yet there does not appear to be any *P. cæruleus* among them, neither do any of his descriptions agree with this species, so that it is likely the present trivial name will stand.

The only specimens I have seen from New Zealand were sent me by Captain Broun.

SAPHYDRUS, n. g

Ex affinitate generis *Hydrobii*. Palpi maxillares breves, capite breviores, haud crassi, articulis inter se longitudine parum dissimile, articulo ultimo quam præcedente paulo longiore et tenuiore; mentum latum valde transversum, antè emarginatum. Antennæ 9 articulatae, clava laxa elongata; mesosternum muticum; femora subtus pubescentia; tarsi posteriores nullo modo remiformes, breves, subtus pubescentes haud rigide ciliati, articulo basali brevissimo; unguiculi parvi simplices. Pronotum basi obsolete marginato; elytra striata.

This genus consists of insects having the appearance and coloration of convex *Philydri*, but is more nearly allied to *Hydrobius*, from which it differs by the more feeble palpi, broad and emarginate mentum, unarmed mesosternum, and the more laxly articulated tarsal joints, furnished beneath with pubescence instead of rigid cilia. Although very different in size and appearance from the genus *Anacæna*, the systematic characters bring the two

near together; but *Saphydrus* has striate elytra, and the inflexed epipleura is pubescent for all its length, and marked off by a raised line extending four-fifths of the length of the wing-case. It comes equally close to *Rygmodus*, but the claws are small, with indistinct basal lobe.

The genus will probably prove peculiar to New Zealand. The nearest ally I know of to it is a Chilean genus not yet described.

I have at present included in the genus insects having glabrous and others having punctate-pubescent femora; it is probable, however, that it will prove a correct course to ultimately separate the former as a distinct genus, between *Saphydrus* and *Rygmodus*; but, as the few species known to me appear to indicate that the sculpture of the femora may, when more species are known, not prove a sufficiently definite distinction, I do not think it necessary to propose two genera at present.

The four new species known to me may be tabulated thus:—

Femora punctate and pubescent beneath	..	..	1.
Femora glabrous	..	..	2.
1. { Elytra with a pale humeral spot	..	..	<i>S. suffusus.</i>
{ Elytra without..	..	..	<i>S. obesus.</i>
2. { 1st joint of antennal club scarcely so long	..	..
{ as broad	..	..	<i>S. longulus.</i>
{ 1st joint of antennal club longer than broad	..	..	<i>S. antennatus.</i>

Saphydrus suffusus, n. s.

Breviter ovalis, sat convexus, dense punctatus, elytris pubescentia tenuissima ægre observanda vestitis, fuscus, elytris margine externa maculaque humerali pallidioribus, prothoracis lateribus argute testaceis, pedibus rufis, antennis palpisque fusco-testaceis illarum clava fusca; femoribus posterioribus subtus crebre punctato-pubescentibus. Long. 5 mm., lat. 3¼ mm.

The head and thorax are closely and rather coarsely punctate shining, blackish, the anterior part of the clypeus more or less flavescens, and the sides of the thorax yellow. Elytra densely punctate, with a very fine indistinct pubescence, and with eight or nine rows of closely placed punctures, which are not very distinct amongst the general punctuation, while the external are quite indistinct; there is a well-marked pallid humeral spot; the scutellum is sparingly and finely punctate.

Greymouth and Mouri Creek (*Helms*, No. 279).

Saphydrus obesus, n. s.

Breviter ovalis, latus, sat convexus, crebre punctatus, nigricans, elytrorum margine externo piceo, prothoracis lateribus argute testaceis, pedibus piceis tarsis dilutioribus, antennarum basi palpisque sordide testaceis; femoribus posterioribus subtus dense punctato-pubescentibus. Long. $6\frac{1}{2}$ mm., lat. 4 mm.

Very similar to *S. suffusus*, but larger, of darker colour, the elytra almost quite destitute of pubescence, and not quite so densely punctate; the nine or ten series of punctures rather more distinct, and with no pallid humeral spot; the club of the antenna also is more elongate, and the very dense and distinct punctuation of the femora leaves no doubt the species is distinct.

Greymouth (*Helms*); sent to me with *S. suffusus*, and at the time not distinguished from it by me.

Saphydrus antennatus, n. s.

Ovalis, sat convexus, nitidus, piceus, limbo dilutiore, pedibus testaceis, antennarum basi palpisque fusco-testaceis; crebre punctatus et in elytra profunde seriatim punctatus, seriebus postice profundioribus; femora posteriora glabra. Long. 6 mm., lat. $3\frac{1}{2}$ mm.

Extremely similar to *S. longulus*, but with much larger antennal club and longer legs, and also with the palpi and base of the antennæ darker; the elongation of the legs is accompanied by a considerably greater development of the claws and their lobe, so that the species approximates much to the genus *Rygmodus*.

Greymouth (*Helms*); one example sent with *S. longulus*, and not distinguished at the time from it by me.

Saphydrus longulus, n. s.

Ovalis, sat convexus, nitidus, piceus, limbo dilutiore, antennarum basi, palpis pedibusque testaceis; crebre punctatus et in elytra profunde seriatim punctatus, seriebus postice profundioribus, femora posteriora glabra. Long. $6\frac{1}{2}$ mm., lat. $3\frac{1}{2}$ mm.

Head blackish, with the epistome indefinitely broadly pale, rather closely and finely punctate, very shining. Thorax also very shining, moderately closely and coarsely punctate, the punctuation more effaced on the disc than at the sides. Scutellum almost im-

punctate. Elytra coarsely punctate, and with very distinct series of punctures.

Greymouth (*Helms*, No. 46). I have only two examples, both in bad preservation.

RYGMODUS.

RYGMODUS, White, *Voy. Er. and Ter. Ins.*; Broun, *Man. N. Z. Col.*, p. 79.

The important characters of this genus are the 9-jointed antennæ, joints 4 to 6 being moderately large, and the elongate laxly articulated club; the maxillary palpi being rather short, with the three outer joints equal in length; the prominent eyes; unarmed mesosternum, with the middle coxæ almost contiguous; the legs elongate and slender, so that in the natural position the hind femora extend a little beyond the sides of the wing-cases, the knees being thus visible from above; the pilose tarsi, and above all the claws furnished beneath with an elongate lobe; to which may be added that the elytra are of shining blue or metallic-colour. The basal joint of the hind tarsus is short, only one-third or one-fourth of the length of the following, with which, when viewed externally, it is so closely connected that the division between them is not very perceptible, and it was probably this that caused White to place the genus in the *Heteromera*. There is no doubt, however, that it belongs to the *Hydrobiini*; with the ordinary forms of which—such as *Anacæna*—it is closely connected by means of *Saphydrus*, although the long slender legs and the bright metallic colour of the upper surface give these insects an appearance foreign to the tribe to which they belong. These peculiarities are quite accounted for by the fact that the *Rygmodi* are not—in the perfect state, at any rate—aquatic in their habits, but frequent the foliage of plants. Broun has described several supposed new species of the genus, one of which—*R. oblongus*—is probably a *Saphydrus*; and as to the others, his descriptions do not enable me to decide whether they are distinct from *R. modestus* or not.

I shall not tabulate the four species known to me, as the brief diagnoses I have given will enable each to be determined with certainty.

At first sight there seems to be no sexual characters by which externally to distinguish the sexes. I have,

however, succeeded in finding a good test for the sexes in the shape of the claws of the front feet, which in the male are much more abruptly bent than they are in the female, and are furnished with a shorter but more prominent lobe.

Rygmodus modestus.

Rygmodus modestus, White, Voy. Er. and Terr., p. 11.

R. pedinoides, White, *op. cit.*, p. 12.

Ovalis, sat convexus, nitidus, niger, elytris vel metallescentibus vel cyaneis, antennarum articulo basali sordide testaceo; prothorace in medio parce obsoleteque punctato; elytris striatis, interstitiis ad basin planis, apicem versus convexis, sat crebre fortiter (versus suturam subtilius) punctatis. Long. 6 mm.

This is apparently the commonest and most variable species, and the one that has least peculiarities.

Auckland and Greymouth; abundant in both localities, and usually represented in the older collections of New Zealand Coleoptera. The Auckland individuals are smaller and more brilliantly coloured than those from Greymouth, but no important difference exists between them. I also quite fail to find any character of importance by which to distinguish the types of *R. modestus* and *R. pedinoides*, White, from one another, and think it very probable that *R. incertus*, *R. opimus*, and *R. cyaneus*, Broun, may also be the same species.

Rygmodus femoratus, n. s.

Ovalis, nitidus, niger, femoribus læte rufo-testaceis, elytris vel cyaneo-nigris vel viridi-nigris. Long. 8 mm., lat. $4\frac{1}{2}$ mm.

This species is readily distinguished by the bright-coloured femora. In general aspect it is excessively similar to the larger, more obscurely-coloured varieties of *R. modestus*, and differs but little from it in details; it has, however, the punctuation on the disc of the thorax less effaced, that of the interstices of the wing-cases slightly more distinct, and the explanate or flattened-out side of the thorax broader. It varies a good deal in the punctuation, and in the convexity of the interstices; it is not a mere variety of *R. modestus*, as, besides the evident, though slight, distinctions of sculpture and of the colour of the legs, the minute pubescent punctuation

of the under surface is much denser than in *R. modestus*, and the antennal club is a good deal more elongate.

Mr. Helms has sent me several specimens of this insect from Greymouth.

Rygmodes unguicularis.

Late ovalis, parum convexus, nitidus, niger, elytris cyaneis; unguicularum lobo subtus valde curvato apice longius libero. Long. 9 mm., lat. 5 mm.

This is, though very similar to the preceding species, a rather larger and flatter insect, with the punctuation on the disc of the thorax much more developed, the hind angles of the thorax more broadly rounded, and the elytral striæ not deeper behind. It is distinguished by a good and very easily perceived structural character from the other species, viz., the form of the appendage to the claws, as given in the diagnosis.

We are indebted to Professor Hutton for the discovery of this species; he sent me three specimens from Dunedin in 1878.

Rygmodes ovalis, n. s.

Ovalis, angustulus, parum convexus, niger, elytris cyaneis; dense punctatus, prætereaque in elytris seriatim punctatus. Long. 8 mm., lat. 4 mm.

Of narrower and more elongate form than the other species, and readily distinguished by the dense comparatively evenly distributed punctuation of the upper surface, the elytral striæ being on the other hand reduced, so that they are inconspicuous amongst the diffuse punctuation. The antennæ and palpi are quite black; the punctuation of the thorax is the same at the sides and on the middle, and the base of the thorax is more rounded and less bisinuate than in the other species; the striation of the elytra is quite distinct at the apex, but at the base is only to be distinguished as rather larger punctures placed in a serial manner amongst the other punctuation, which is close and rather coarse. The pubescent punctuation of the under surface is very dense and fine. The tarsal claws are rather more feeble than in the other species.

Mr. Wakefield gave me a specimen found on the West Coast by Mr. Slack; and Mr. Helms has recently met

with three examples at Bedley, on the road between Greymouth and Christchurch.

PHILYDRUS.

I have three New Zealand species of this genus, which may be thus distinguished :—

Mesosternal lamina large	1.
Mesosternal lamina small	<i>P. abditus</i> .
1. { Pithy ; head with obscure yellow spot on each side in front	<i>P. tritus</i> .
{ Sordid testaceous ; the black head with large yellow spot on each side in front	<i>P. variolorum</i> .

Philydrus tritus.

Philydrus tritus, Broun, Man. N. Z. Col., p. 78.

Auckland and Tairua (*Broun*) ; Christchurch (*Wakefield*).

Philydrus variolorum.

Philydrus variolorum, Broun, Man. N. Z. Col., p. 79.

Auckland (*Lawson*) ; Tairua (*Broun*) ; Wellington and Christchurch (*Wakefield*).

The character from which the specific name is derived is not a natural one, and will be found only very rarely present ; individuals with the surface pitted occur occasionally in a great number of species of water-beetles, probably from being pressed on sand or something of that sort during the metamorphosis.

Philydrus abditus, n. s.

Oblongo-ovalis, parum convexus, niger, supra fusco-niger lateribus pallidioribus, tibiis, tarsis, antennarum basi palpisque testaceis, his apice summo fusciscentis, capite utrinque macula parum distincta testacea ; corpore supra nitido, crebre sat fortiter punctato ; mesosterni lamina parva. Long. 4 mm.

The colour above is of a dilute black, getting paler at the margins, with the head quite black ; I cannot detect any serial punctuation amongst the diffuse punctuation of the wing-cases, but very vague indications of an obsolete striation can be seen here and there. The maxillary palpi are comparatively short.

This species may readily be distinguished from the

other two by the small stature and the diminished mesosternal lamina, which is hardly one-fourth the size of what it is in the larger species.

A single individual was sent me by Captain Broun, I believe from Tairua, on the same card as a specimen of *P. tritus*.

TORMUS, n. g.

Corpus superne valde convexum. Labrum transversum haud occultum. Oculi indivisi. Antennæ 9-articulatæ, articulis 3—6 simplicibus, clava sat elongata articulis 7o et 8o transversis. Pedes intermedii contigui, mesosternum lamina erecta munitum; femora subtus haud punctato-pubescentia, brevia, tibiæ spinosulæ, tarsi posteriores articulo basali perbrevis, secundo elongato. Abdomen e segmentis quinque, sat dense pubescentibus, compositum.

This genus is allied to the New World *Derallus*, with which, however, it is far from closely agreeing, and is systematically distinguished by the 9-jointed antennæ, and by the joint preceding the club being simple. It may be placed in the New Zealand list near to *Saphydrus*, though it is far from being allied to that genus in most of the peculiarities of its structure.

Tormus helmsi, n. s.

Ovalis, omnium convexissimus, niger, supra æneus, antennis palpisque testaceis, pedibus rufis; nitidus, parce obsoleteque punctatus, elytris ad latera et posterius seriebus abbreviatis punctorum majorum. Long. 3 mm., lat. 1 $\frac{2}{3}$ mm.

The excessively convex form, and the shining brassy upper surface, together with the peculiar sculpture of the wing-cases, readily distinguish this from all the other New Zealand *Hydrophilidæ*. The base of the thorax is extremely rounded near the sides, so that the hind angles are very obtuse, almost quite rounded; on the posterior part of the wing-cases there are series of coarse punctures directed obliquely somewhat upwards, but quite absent from the anterior portions; on the wide interstices between these series are numerous finer punctures, but the basal region is only very finely and sparingly punctate; there is an abbreviated sutural stria, which does not reach half-way to the front.

I am greatly obliged to Mr. Helms for presenting me with the only example yet found of this insect. It was captured near Greymouth.

HYDROSTYGNUS, n. g.

Corpus ovale, convexum; labrum porrectum, emarginatum, palpi maxillares crassiusculi, parum elongati, articulo pseudo-basali sat elongato, sequente longiore, hoc quam ultimo paulo longiore; mentum haud latum, longitudine vix latius; antennæ 9-articulatæ, articulis intermediis omnino discretis; pedes intermediæ plus minusve distantes, metasternum inter eas productum, cum mesosterni processu conjunctum; tibiis crassis, mucronibus elongatis præsertim anteriorum, femoribus posterioribus subtus punctatis, sed vix perspicue pubescentibus, tarsis omnibus subtus densius pubescentibus, posteriorum articulo basali brevi quam secundo triplo brevioribus; corpore subtus omnium densissime subtilissime pubescente.

This is another peculiar genus; it bears a great resemblance in appearance to *Cyclonotum*, but belongs rather to the *Hydrobiini* in the neighbourhood of *Saphydrus* and *Rygmodes*; the large exposed labrum, the thick legs, and the tarsi hairy beneath, are characters which, taken conjointly, distinguish this from all the other New Zealand forms of *Hydrophilidæ*. The two species known to me, though similar in general appearance, differ in some important structural characters, which will be alluded to in the specific descriptions; at present there would be no advantage in treating them as distinct genera.

Hydrostygnum browni, n. s.

Ovalis, haud latus, convexus, nitidus, nigro-piceus, marginibus piceis, antennis palpisque testaceis, pedibus piceis tarsis rufescentibus; corpore supra crebre sat fortiter punctato elytris præterea seriebus decem conspicuis punctorum majorum. Long. $5\frac{1}{2}$ mm., lat. 3 mm.

The epistome is broadly emarginate behind the large labrum; the eyes not prominent, indistinctly faceted. The punctuation of the head and thorax is rather close and distinct, that of the elytra is more scanty, and becomes obsolete towards the apex, the serial punctures are rather large, deep, and approximate, and that next the suture is behind deepened into a definite stria. The basal joint of the antennæ is as long as the three following together, but shorter than the club; the mesosternal portion of the pectoral prominence is very short, and has the form of a crescent attached to the front of the middle of the metasternum, the middle legs being widely separated; the prominent middle of the metasternum is coarsely punctate, the tibiæ are only moderately stout, and the hind tarsus is moderately laxly articulated.

A very mutilated example, deprived of its palpi, some of the legs, and all the tarsi, except a portion of one of the posterior pair, was sent me several years ago by Captain Broun, I believe from Tairua, as No. 10; notwithstanding this I cannot reconcile the insect with any of the descriptions in his 'Manual of New Zealand Coleoptera'; *Cyclonotum flavicorne* would appear to be somewhat allied to it, and may probably belong to *Hydrostygnum*, but the characters "rather short, epistome truncate in front, with rather prominent eyes," are expressions which it would appear almost impossible an entomologist could apply to this species.

Hydrostygnum linsi, n. s.

Ovalis, latus, niger, sat nitidus, antennis palpisque rufis, tarsis piccis; corpore supra dense punctato, clytrisque præterea seriebus decem punctorum majorum, seriebus internis obsolescentibus sed suturali apicem versus in striam continuata; tibiis crassis rude scabrosis. Long. $7\frac{1}{2}$ mm., lat. 5 mm.

This very remarkable Hydrophilid is readily identifiable by the thick, densely scabrous, middle and hind tibiæ; the punctures of the external series of the elytra are remarkably large and definite, but give rise to no appearance of striation; the sutural series is scarcely distinguishable in front, but behind forms a fine well-marked stria. The mesosternal portion of the pectoral prominence is rather large, quite as long as it is broad, and the middle legs are comparatively slightly separated; the hind tarsi are quite laxly articulated, and are furnished with long bushy pubescence beneath.

We are indebted to Mr. Lins, of Mouri Creek, about sixteen miles from Greymouth, for the discovery of this and some other remarkable species of Coleoptera. Mr. Lins is placed in a district which certainly supplies some remarkable insects, and it will be a great benefit to Science if he can devote some time to their research.

Cyloma lawsonus.

Cyloma lawsonus, Sharp, Ent. Mo. Mag. ix., p. 152;
Broun, Man. N. Z. Col., p. 85.

Hitherto found only in the Auckland district. Auckland (*Lawson*); Tairua and Whangarei Heads (*Broun*).

Cyloma thomsonus, n. s.

Ovalis, convexus, parum nitidus, niger, antennarum basi palpisque sordide testaceis, elytrorum apice late maculaque humerali flavis; supra crebre æqualiter punctatus, et in elytris præterea seriebus punctorum majorum. Long. $4\frac{1}{2}$ mm., lat. $2\frac{1}{4}$ mm.

The very large yellow apex of, and the conspicuous humeral spot on, the elytra render this distinguishable at a glance; the apical yellow spot runs forward along the lateral margin near the base, and in some examples reaches the humeral spot. The elytral series of punctures are very distinct, and are of about uniform coarseness throughout, except that the two next the suture are much finer, and that the sutural is deepened into an impressed stria behind.

I have long had a small series of this species from an old collection in my possession, and have recently received an example from G. M. Thomson, Esq., of Dunedin, confirming it as beyond doubt a New Zealand insect.

Cyloma guttulatus, n. s.

Ovalis, convexus, testaceis, capitis thoraceque medio elytrisque fuscis, his sutura margineque externo testaceis, ad basin et ante apicem guttulis albidis numerosis, abdomine nigricante. Long. 3 mm., lat. $1\frac{1}{2}$ mm.

Head very densely punctate, yellow at the sides, broadly fuscous or picceous along the middle. Thorax rather sparingly and finely punctate on the middle, at the sides with numerous coarse punctures mixed with the finer ones. Elytra each with ten series of coarse punctures extending from base to apex, the interstices almost impunctate, except near the suture; they are broadly testaceous at the apex, along the outer margin, and the suture, so that a large patch on each is left dark; and at the base there are numerous spots, some larger, some smaller, of a whitish or ivory colour; and there is another transverse series of similar marks behind the middle. The legs and antennæ are yellow, the club of the latter being a little infusate; the tarsi are short.

Greymouth; a single individual sent by Mr. Helms with a large number of *Adolopus helmsi*, and passed over at the time by me as an immature example of that species.

ADOLOPUS, n. g.

Corpus parvum, rotundato-ovale, superne convexum. Antennæ 9-articulatæ, clava elongata, laxè articulata; palpi maxillares breves, articulis tribus ultimis longitudine subæqualibus, articulo pseudo-basali crassiore, mentum transversim quadratum, anterius late depressum. Prosternum in medio longitudinaliter carinatum. Coxæ intermediæ distantes, metasterno inter eas longius productum, cum processu triangulari mesosterni sutura recta conjunctum, processu hoc ad latera marginato. Femora posteriora subtus glabra; abdomen densissime subtilissime punctato-pubescentis, segmento basali in medio carinato. Tarsi posteriores parum elongati, et parum crassi, articulo basali brevi, secundo parum elongato sed quam præcedente evidenter longiore.

This genus will consist at present of two small New Zealand species of *Hydrophilidæ* having the aspect of *Cyclonotum*, but differing therefrom by the basal joint of the hind feet being shorter than the 2nd joint. Although certain species—found in South America, Oceania, and Australia—of the subgenus *Dactylosternum* show a much greater abbreviation of the basal joint of the hind foot than do the normal *Cyclonota*, yet in them this joint is always longer than the 2nd; and this character, being of great importance in the classification of the *Hydrophilidæ*, the reversal of the relative lengths of these two joints in *Adolopus* necessitates its isolation.

Adolopus helmsi, n. s.

Piceus, limbo dilutiore, elytrorum apice irregulariter pallido, pedibus rufis, tarsis, palpis antennisque testaceis, harum clava fusca; corpore supra crebre punctato, et in elytris seriatim fortiter punctatis, seriebus ad basin desinentibus. Long. 3 mm., lat. fere 2 mm.

The punctuation on the head, thorax, and basal portions of the elytra is close and rather coarse; on the head it becomes finer in front, so that on the epistome it is excessively fine, the surface there being opaque and alutaceous; the series of punctures on the elytra are coarse behind, and at the sides none of them extend to the base, the outer ones stopping short rather abruptly at about one-fifth of the length; those nearer the suture extend very nearly to the base, becoming, however, very fine in front, and the one or two next the suture hardly extend so far forwards as the two or three outside them; the sutural series becomes deepened behind into an impunctate stria.

Greymouth (*Helms*, No. 48).

This is apparently one of the commonest beetles in the Greymouth district, as I have received it several times, and in numerous examples. A variety occurs rarely having the apex of the elytra dark.

Adolopus altulus.

Cyloma altulum, Broun, Man. N. Z. Col., p. 86.

This is extremely similar to *A. helmsi*, but is a trifle smaller, has the serial punctures of the elytra behind much coarser, the series near the suture very much shorter, and the margins explanate behind; the punctuation of the thorax is also finer and more scanty.

Auckland (*Lawson*).

I have also received several examples of this insect from Captain Broun, so that it is no doubt one of the species designated in his 'Manual,' and I think the only one it can be is *Cyloma altulum*.

Cyclonotum marginale.

Cyclonotum marginale, Sharp, Ent. Mo. Mag., 1876, p. 21; Broun, Man. N. Z. Col., p. 83.

This is one of a group of Australian and South American species which, on account of the reduction in length of the basal joint of the hind foot—which is but little longer than the following joint—and of the convex orbicular form, will require to be separated from *Cyclonotum* proper, and from *Dactylosternum*; but to do this at present without indicating all the described species that pertain to it would be premature.

C. marginale is an Australian insect, and has apparently been found in New Zealand only about Auckland.

Cercyon flavipes.

Sphæridium flavipes, Fab., Ent. Syst., i., p. 81.

This well-known European insect has no doubt been introduced into New Zealand in company with cattle or sheep, in whose dung it occurs. It is probably common in the islands at present, as I have seen several examples from Auckland and Greymouth.

PHELEROSUS, n. g.

Antennæ 7-articulatæ; palpi maxillares parum elongati, articulis longitudine subæqualibus; prothorace elytris angustiore basi quam apice haud latiore; prosternum ante coxas omnium brevissimum. Femora posteriora glabra. Generi *Berosus* proximus sed femora posteriora tantum ad summum basin pubescentia discedit.

Although so close to the widely-distributed genus *Berosus*, I think this insect had better be isolated therefrom, the hind femora being pubescent only where they touch the coxæ; the side-pieces of the prosternum are less prolonged inwardly than they are in *Berosus*, and the prothorax is slightly impressed on the middle.

Phelerosus pallidipennis, n. s.

Capite thoraceque æneis, densissime punctatis, hujus margine anteriore et lateribus cumque elytris pallide testaceis; subtus niger; pedibus palpis antennisque testaceis, femoribus basi nigro, palpis apice infuscato; elytris striatis, interstitiis parce obsoleteque punctatis. Long. 4 mm.

Eyes very prominent; thorax sinuate at the sides, with the angles rounded, and a broad, rather indistinct, impression on the disc, and a slight ciliation near the front angles; scutellum metallic, closely punctate; elytra convex, very regularly and distinctly striate, the striæ distinctly punctured, the scanty punctuation of the interstices quite indistinct.

A specimen of this species was first sent to me by G. M. Thomson, Esq., from Dunedin, and shortly afterwards Mr. Helms sent three individuals from Grey-mouth.

XXIII. *Descriptions of new species of Tenthredinidæ and Cynipidæ from Mexico.* By PETER CAMERON.

[Read September 3rd, 1884.]

THE following paper (describing fourteen new species) is supplementary to my work on the Hymenoptera of Central America in Messrs. Godman and Salvin's 'Biologia Centrali-Americana.' The principal fact recorded in it is the occurrence in Mexico of three distinctly northern genera of sawflies, namely, *Nematus*, *Euura*, and *Hemichroa*, genera which have not hitherto been recorded so far south. Among the *Cynipidæ* the genera *Aulax*, *Eucaela*, and *Megapelmus* are also new for the fauna.

I am much indebted to Herr Rogenhofer, of the Vienna Museum, for the opportunity of examining the Mexican Hymenoptera of the Museum under his charge.

TENTHREDINIDÆ.

Nematus mexicanus, n. s.

Livid testaceous; face, sides and apex of abdomen above, and legs, obscure livid yellow; antennæ, metanotum, and back of abdomen, except at apex, apex of hind tibiæ and tarsi, black; anterior tibiæ inclining to fuscous. Wings clear hyaline; costa and stigma whitish yellow. Antennæ shorter than the abdomen, almost glabrous; 3rd joint a little shorter than 4th. Vertex raised in centre; frontal area a deep wide depression; antennal fovea large, longer than wide. Clypeus deeply incised; palpi fuscous. Wings longish; 2nd cubital cellule double the length of 3rd, not angled where the recurrent nervures are received; 3rd cellule a little widened at apex; the 2nd recurrent nervure received a little in front of 3rd transverse cubital. Abdomen longer than the head and thorax together, narrowed towards the apex; its last segment largely developed above; cerci long; ovipositor long, nearly half the length of the abdomen; the sheath at apex pilose. Blotch small; cerci large, white; claws bifid, spurs shortish. The vertex and mesonotum are very finely punctured; on the middle lobe of

the latter is a central furrow; the extreme apex of the scutellum is black, and there is a narrow obscure black line down its centre. Length, 7 mm.

Closely allied to the European *N. hæmorrhoidalis*, Spin., and to the North American *N. chloreus*, Norton. The occurrence of a *Nematus* so far south is of much interest, this being the first record of that northern genus in Central America.

Hab. Northern Sonora, Mexico (*Morrison*).

Euura mexicana, n. s.

Luteous; the vertex broadly, the head entirely behind, the middle lobe of the mesonotum, except at the apex, the lateral, except at the sides, the scutellum, except at the apex, breast, mesopleura behind, metapleura, metanotum, and basal third of abdomen, black, the black passing into brown at its junction with the luteous. Scape of antennæ and the basal joints of flagellum black, the rest fulvous; they are as long as the abdomen, and have the 3rd joint shorter than the 4th, and are covered with a close pubescence. Lateral sutures on vertex deep, and there is a broad transverse one behind the ocelli. Front projecting, a hollow between it and the eyes; at its top in the centre is a fovea, and it is separated from the vertex by a curved depression. Clypeus incised. The legs are paler coloured than the body; the coxæ are black at the base; the apices of the tarsal joints are fuscous; claws bifid. The cerci are nearly as long as the metatarsus, pallid yellow. Wings hyaline; costa pallid; stigma fuscous, whitish at the base. Apical half of sheath of ovipositor black; claws bifid. Length, 5.5 mm.

Hab. Northern Sonora, Mexico (*Morrison*).

This comes very near *E. ovum*, Walsh.

Hemichroa nigricans, n. s.

Black, shining; tegulæ, pronotum at base, apex of femora (anterior broadly), apex of coxæ, trochanters, tibiæ, and tarsi, white; apex of hind tibiæ and tarsi black. Front finely punctured; face covered with a white longish pubescence; frontal area clearly defined; there is a broad transverse furrow behind the ocelli, and a short longitudinal one issues from its centre to the back of the head; lateral sutures indistinct; clypeus broadly incised. Wings hyaline; costa fuscous; stigma livid; the 1st radial cellule much shorter than 2nd; the transverse radial nervure is received a little

past the 2nd transverse cubital; the 2nd cubital cellule has a horny point; 3rd cubital cellule longer than broad, of nearly equal breadth throughout; 2nd recurrent nervure almost interstitial. Abdomen stout, broad at apex, not very much longer than the head and thorax together; its apex above is dull white; cerci short, thick, fuscous. Long. 6.5 mm.

Hab. Mexico, Northern Sonora (*Morrison*).

Blennocampa bicolorata, n. s.

Black; pronotum, mesonotum (except scutellum), and tegulæ, blood-red; clypeus and labrum dull white. Mandibles piceous. Antennæ about as long as the abdomen, thickish, covered with a dense stiff pubescence; 3rd joint nearly one-half longer than 4th; lateral sutures on vertex deep and broad behind, shallow in front of ocelli; frontal area not defined, but there is a shallow fovea down from the front ocellus. Clypeus transverse; first radial cellule the longest; transverse radial nervure straight and received in the apical third of the 3rd cubital cellule, which is long, and receives the recurrent nervure not far from its base; the transverse median nervure is received before the middle of the cellule. The wings are dark fuscous. Claws apparently simple. Length, nearly 5 mm.

This species is most nearly related to *B. inhabilis*, Harris *sec.* Norton, but that has the antennæ shorter; the abdomen is also shorter, it being "short, nearly as wide as long"; while in *B. bicolorata* it is distinctly longer than wide. The mesopleura is red in front, and the transverse radial nervure is bent and received near the 3rd transverse cubital.

Hab. Chapulte and Orizaba, Mexico (*Bilimik*); Mus. Vienna.

Strongylogaster Rogenhoferi, n. s.

Abdomen and legs rufo-testaceous. Head black clypeus, labrum, mandibles, and palpi white. Antennæ black; the basal joint and the apex of 4th to the 7th white. Thorax black; the edges of the middle lobe of mesonotum, scutellum, tegulæ, pronotum, and the pleuræ, except a small black mark below the tegulæ, an oblique one on the mesopleura, and a mark over the middle coxæ, white. The antennæ are nearly as long as the thorax and abdomen together, but slightly thickened beyond the middle; the 3rd joint a little longer than 4th. Sutures on vertex flat and shallow; frontal area not defined; the front ocellus is

situated in a hollow. Clypeus truncated at apex. Wings hyaline; stigma and costa livid testaceous. The transverse radial nervure is received in the apical third of the cellule; the 2nd cubital cellule is a very little longer than 3rd; the transverse median nervure is received near the middle; the 2nd recurrent in basal fourth of the 3rd cubital cellule. The coxæ and trochanters are paler than the rest of the legs. Claws bifid. Male. Length, 9 mm.

A very distinct species. I have named it after Custos Roggenhofer, of the Vienna Museum.

Hab. Orizaba, Mexico (*Bilimik*); Mus. Vienna.

Strongylogaster fumipennis, n. s.

Black; apex of clypeus, labrum, and a thin line on pronotum obscure white; anterior tibiæ and tarsi fuscous in front. Wings smoky; nervures and stigma black. Antennæ longer than the head and thorax together, not much thickened beyond the middle. Frontal area clearly defined, enclosing the lower ocellus; the apex rounded, the base projecting and narrowed between the two hind ocelli; the apex dilated, and from its sides a carina runs to the eyes. Clypeus transverse; 3rd cubital cellule distinctly longer than 2nd, the apex not very much dilated; 1st radial cellule much longer than 2nd; transverse basal nervure received past the middle of the cellule. Male. Length, 10 mm.

Closely allied to *S. nigredo*, Norton, but is larger, and differs otherwise in having the antennæ longer and not so much thickened at the apical half, in the mouth and a line on the pronotum being white, and in the 3rd cubital cellule being much longer than the 3rd; the 1st radial cellule being also longer compared to the 2nd, this not being the case with *nigredo*.

Hab. Mexico.

Ptilia crassula n. s.

Black, shining; labrum and mandibles piceous; pronotum broadly, tegulæ, tibiæ, and tarsi, white; the apex of hind tibiæ broadly, and hind tarsi, except at the base, black. Antennæ piceous, not much longer than the thorax; covered with a microscopic pile. Sutures on vertex broad and deep in front of the ocelli; front ocelli in a deep round pit. Front bluntly keeled between the antennæ. Wings clear hyaline; costa and stigma griseous-testaceous. The first three cubital cellules are together not much longer than the 4th; the 3rd is much broader than long;

the 2nd recurrent nervure is received in the 3rd cellule, but almost touching the 2nd transverse cubital nervure. Female. Length, nearly 6 mm.

Hab. Northern Sonora, Mexico (*Morrison*).

Ptilia nigerrima, n. s.

Black; the anterior tibiæ dirty white in front. Wings hyaline; nervures and stigma black. Antennæ a little longer than the abdomen, covered with long hair. Sutures on vertex broad and deep, and converging in front of the ocelli, shallow at the side of the ocelli, deep and broad behind them. The 1st recurrent nervure is received a little in front of the middle of the cellule; the 2nd is interstitial; 3rd cubital cellule a little broader than long. The body is broad and thick; the legs are covered with pale microscopic down, and the knees incline to piceous. Male. Length, 5 mm.

Hab. Northern Sonora, Mexico (*Morrison*).

Ptilia luteiventris, n. s.

Black; abdomen luteous; knees piceous; anterior tibiæ dirty white in front. Wings hyaline; nervures and stigma fusco-piceous. Antennæ not much longer than the thorax; covered with a microscopic pile. The three cubital cellules are together shorter than the 4th; the 1st recurrent nervure is received in the middle; the 2nd is interstitial; 3rd transverse cubital nervure bent outwardly; the 3rd cubital cellule broader than long. Female. Length, 5.5 mm.

Hab. Northern Sonora, Mexico (*Morrison*).

Obs. I have placed the above-described three species in *Ptilia*, as I have defined it in *Biol. Cent. Amer.*, *Hymen.*, p. 42, as the 2nd recurrent is received rather in the 3rd than in the 2nd cubital cellule; but these species illustrate the difficulty of using the neuriation in generic definitions, for actually they are intermediate between *Ptilia* and *Diolocera*.

CYNIPIDÆ.

Aulax rufipes, n. s.

Black; the antennæ and legs (including the coxæ) red; scape somewhat infuscated; the abdomen at the base, the sides, and ventral surface, of a more obscure red than the legs; oral region and mandibles (except at the apex) piceous-red. Head with the vertex shining, finely punctured; the face opaque, more strongly

and closely punctured; the lower part at the base of the mandibles striated. The thorax opaque, closely rugose-punctate, except a smooth, shining, impunctate space on the mesopleura. The lateral furrows on mesonotum distinct; scutellar foveæ smooth and shining, longer than broad. Antennæ 13-jointed; 1st joint nearly double the length of the 2nd; 3rd distinctly longer than 4th; the last double the length of 12th, and a little thicker than it. Head and thorax closely covered with a pale pubescence; abdomen smooth and shining; 3rd segment (or 2nd after the petiole) long, almost concealing the others. Wings hyaline; nervures pallid fuscous; radial nervure rather broad; cubitus reaching to the apex of the wing, but rather faint. The male has the 3rd joint of the antennæ bent laterally and dilated at the apex, and the other joints are longer; the reddish colour extends laterally down from the eyes, and, if anything, the pubescence on the thorax is denser. Length, 2.5 mm.

Hab. Mexico (*Bilimik*); Mus. Vienna.

Cothonaspis rufiventris, n. s.

Black; abdomen at the base, at the sides, and on ventral surface, piceous-red. Antennæ longer than the body; scape smooth and shining; flagellum opaque, covered with a microscopic pile, and very faintly striated; 3rd joint longer than 4th; the last two subequal. Head and thorax smooth and shining, the latter very obscurely aciculated above; scutellar cup shallow, longer than broad, the base more sharply pointed than apex; the foveæ at base of scutellum obsolete. Wings hyaline, ciliated at apex; radial nervure closed, about one-half longer than broad; cubitus obsolete. Length, scarcely $1\frac{1}{2}$ mm.

This is a *Cothonaspis* as defined by Foerster. There is a slight trace of pilosity on the base of abdomen, but it certainly does not form a dense tuft like what we have in *Eucæla*.

Hab. Mexico (*Bilimik*); Mus. Vienna.

Eucæla incisa, n. s.

Black, opaque; the flagellum of antennæ to the 7th joint and legs piceous-red; the coxæ, except at apex, the middle of the femora broadly, and the apex of hind tibiæ and hind tarsi, black; the legs sparsely covered with white glistening hairs. Wings hyaline; nervures white; radial cellule closed at base, longer than broad; cubital nervure obsolete. Antennæ as long as the entire body and hind legs, when stretched out behind; 1st joint of scape

double the length of 2nd; 1st joint of flagellum a little longer than the 2nd; the joints taper a little in thickness towards the apex. Cup of scutellum oval, shallow, the edge piceous; foveæ at its base large, deep. Hair-fringe on abdomen griseous, of moderate size; the metanotum covered with longish white hair. The front of the pronotum is produced in the middle into a plate, which projects a little above the base of the mesonotum, is depressed in the centre, and is broader at the bottom than at the top. The sides are clearly margined and distinctly separated from the rest of the pronotum. The latter is, at the sides close to the head, covered with a dense tuft of griseous hair, and it has there a distinct margin. Clypeus rounded; mandibles piceous. Length 4 mm.

Hab. Mexico (*Bilimik*).

If Foerster's ideas of the limits of genera are to be carried out the above species should form the type of a new genus, owing to the peculiar structure of the prothorax. It comes, I think, nearest *Psilodora*. The peculiar form of the pronotum is only an extreme accentuation of what we have indications of in other species of *Eucælidæ*.

Megapelmus mexicanus, n. s.

Black; legs rufous; the coxæ at basal half, basal three-fourths of hind trochanters, and the four hind femora above and beneath, black. Wings hyaline; nervures blackish; radial cellule longer than broad. Antennæ longer than the body; the flagellum faintly fuscous on lower side at base; the 3rd joint a little longer than the 4th. Sutures on mesonotum shining, microscopically aciculate. Scutellum rather flat, but still raised in the centre; at the apex it has rather an abrupt slope, as has also the metathorax; the apex of the scutellum has a distinct border above, and this border goes also along the sides, but it is much more distinct at the apex, where it is elevated above the rest of the scutellum, which, in front of it, is depressed. The transverse carina in front of the scutellum is distinct. Petiole nearly one-half the length of the abdomen. The sides of the head and of the thorax covered with a longish white pubescence. Length, 4 mm.

Closely allied to the European *M. eucharoides*, Dalm., but differing in having the radial cellule narrower; the sutures on mesonotum not crenulated; scutellum longer and flatter and much more distinctly margined behind.

Hab. Mexico (*Bilimik*); Vienna Museum.

Ibalia ruficollis, n. s.

Black; the greater part of the pronotum, tegulæ, and abdomen red. Wings fuscous. Antennæ thin; the basal joint four times as long as the 2nd; the 3rd a little shorter than the 4th. Head rugose, the sides strongly striated; a carina runs from the outer ocelli to the base of the antennæ, forming a somewhat square area, having a keel in the centre, and from this central keel strong striations run obliquely to the sides. Mesonotum very strongly transversely striated, the sides and pronotum more finely and obliquely; at its junction with the mesothorax the pronotum is strongly margined, the margin projecting over the mesonotum, especially at the middle, which is indented; mesopleura hollowed, finely punctured. Scutellum transversely striated, like the mesonotum, its sides margined, the margin at the apex indented like the pronotum. In the centre of the metanotum is a shield-shaped area, longer than broad, smooth and shining, and with a straight keel in its centre; from this area some keels run obliquely down the sides. Over the hind coxæ is a broad tubercle, which ends in a moderately sharp point. Below the hind wings is a reddish mark, touching the suture of the mesopleura, which is smooth and shining opposite it. Petiole short, broader than long, smooth, shining. The 2nd segment of abdomen longer than 3rd, which is of the same length as 4th; the 5th a little longer; 6th on the upper side a little longer than the three preceding together. The head and thorax covered with a pale pubescence; legs with a longer and stiffer pile of the same colour. Length, nearly 12 mm.

The striations on the mesonotum are wide apart, and have the space between them smooth and shining. The lateral sutures of the mesonotum are deep, wide, smooth, and shining; the central becomes indistinct beyond the middle.

Hab. Pinos Altos, Chihuahua, Mexico (*Buchan-Hepburn*).

XXIV.—*Facts concerning the importation or non-importation of Diptera into distant countries.* By C. R. OSTEN-SACKEN.

[Read October 1st, 1884.]

THE conditions attending the importation of Diptera across the ocean to distant parts of the world are not so simple and so uniform as one might suppose. Importation will not occur for centuries in cases where it might be expected from day to day; and again, it will sometimes take place under circumstances most improbable, and *à priori* impossible to foresee. My purpose, in publishing a few cases of importation and non-importation which I have been able to investigate, is to invite the attention to such occurrences, principally in the colonies of Great-Britain, where they must be continually going on, and, unless noted down by contemporaries, must be easily forgotten and lost to science. The close investigation of phenomena of that class may even have a bearing on some questions connected with the distribution of insects in geological time.

The substance of this paper has been published by me in German, in the 'Stettiner entomologische Zeitung' (No. 4 case in 1861; the other cases in 1880).

1.—ERISTALIS TENAX.

"*Eristalis tenax* is in its way a remarkable phenomenon, for which there does not seem to exist any other boundaries in time or space (vertically or horizontally) than those which put an end to insect-life in general. It flies round the top of our Schneeberg, and it is equally common in the sewers of the city of Vienna. And when the frosty November fogs have swept out all insect-life, recently hatched, but torpid, specimens of *E. tenax* may still be frequently seen on walls and fences" (Frauenfeld, Beitr. z. Fauna v. Dalmatien, in the Verh. Zool.-Bot. Verein, 1856).

Eristalis tenax occurs throughout Europe; in Lapland, where it is common, as well as in Southern Italy,

Corsica, and Malta; in Algiers (Loew, Sudafr. Dipt., p. 318); in Gibraltar and Madeira (Schiner, Novara, 360); in Cairo and round Mount Sinai (Walker, Entom., v., 274); in the Canary Islands, Madagascar, and Bourbon (Macq., Dipt. Exot., ii., 2, p. 30); in China (Schiner, Dipt. Austriaca, Syrphidæ, p. 114); in Siberia and Japan (Loew., Wien. Ent. Monatschr., ii., p. 101); in Northern Persia (Rondani, Ann. Mus. Civ. Gen., iv., p. 295); it is also common in Syria (Schiner, *l. c.*). For the occurrence at the Cape I do not find any authority, except the passage in Schiner, *l. c.*, p. 10, where it seems to be a *lapsus calami*, as the statement is not repeated under the head of *E. tenax* on p. 114.

During my twenty years' collecting in North America I had never met with this species, until November 5th, 1875, when I found a specimen, to my great astonishment, on a window in Dr. Hagen's house in Cambridge, Mass. A year later, October and November, 1876, I observed several specimens on fences in Newport, Rhode Island. In June, 1877, I left America, but, as I ascertained afterwards, during that year the fly had become so common that, according to Dr. Hagen's statement, "hundreds were caught" (see his Lecture before the Soc. of Nat. History in Boston, Dec. 18, 1877). Between 1876 and 1878 many specimens were taken in the vicinity of Boston, in Galena, Illinois (compare Psyche, ii., p. 260), and even in Georgia (Psyche, ii., p. 188). Mr. Williston (Can. Ent., 1881, p. 176) says that it had become very common in New Haven, Conn.; he also had received specimens from beyond the Rocky Mountains (Washington Territory). Von Roeder's collection in Hoym (Anhalt) contains specimens taken about 1876—77, in Georgia and Missouri, by the well-known collector Mr. Morrison.

This sudden appearance of *E. tenax* in all parts of the United States, in localities thousands of miles apart, and within a short period of three or four years, is a very extraordinary phenomenon, and requires an explanation. Two hypotheses as to its mode of introduction are possible.

E. tenax may have been imported from Europe in ships to one of the harbours on the Atlantic. But if this importation happened long ago it would have been noticed earlier; if it has taken place recently it leaves unexplained the almost simultaneous appearance of the

fly in Georgia, Missouri, Illinois, and even on the Pacific coast.

The other possible hypothesis is that *Eristalis tenax*, like some other European species (for instance, *Syrphus pyrastris*), was indigenous on the western side of the American Continent only, and not on the eastern; and that it began to spread eastward since civilization in its westward progress came in contact with the area of its occurrence. The Colorado-beetle reached the Atlantic in that way, and *A. Fulleri* is another remarkable instance. Dr. Horn says (Bull. Brooklyn Ent. Soc., No. 6, 1884):—"In 1874, when working with Dr. Leconte on the Rhynchophora, among all his material only a single specimen of *Aramiges Fulleri* was contained, and that came from Montana. A year or two later it was received from all parts of the country, and was dreaded as one of the worst hot-house pests. How did this species spread so suddenly over so large a territory? Prof. Lintner had first found the insect in 1876. Mr. Dimmock finds it very troublesome in hot-houses, particularly on roses." *E. tenax* may have reached Missouri and Illinois years ago without being noticed; it attracted attention as soon as it appeared on the Atlantic coast, where dipterologists could recognise it. This supposition is supported by the fact that *E. tenax* exists in Siberia and Japan; but it is somewhat weakened by the circumstance that, as far as I know, it has never been found in California. I have been collecting seven months in California, in 1876, and have carefully examined the collection of Henry Edwards, Esq., in San Francisco, without seeing a single specimen of that species. However that may be, the suddenness of the appearance of *E. tenax* on the Atlantic coast of North America is a very extraordinary fact; and if imported from Europe, this fly is a noteworthy instance of an importation after nearly four centuries of intercourse.

2.—SARCOPHAGA CARNARIA.

Importation, after all, is not such a very easy matter as it would seem. It took four centuries to import *Eristalis tenax* into America (if it was imported at all), a very common species spread all over the Old World, and which owes its very name to the remarkable powers of endurance of its larvæ. I will give now an instance of an equally common and equally enduring European

species which has not yet made its appearance in America.

Sarcophaga carnaria, like its congeners, shows, in the larva stage, most remarkable powers of endurance and adaptation. Putrid vegetable matter and dung (Bouché, *Naturg. d. Ins.*, p. 60); meat, fresh or rotten; ulcers on men and animals suit it well (Portchinski, 'Trudy' of the Russian Ent. Soc., ix., p. 106—109). It will undergo its transformation even when starving and not full-grown (Portchinski, *l. c.*). When Claude Bernard introduced the larva artificially into the stomach of a dog, it came out undigested and alive with the dejections. Portchinski tried the same experiment with a frog and a bird (*Sylvia hortensis*); with the former the larva remained alive; with the latter it came out dead, but undigested.

Under such circumstances it was natural to expect that, of all flies which swarm around human dwellings, *S. carnaria* would be among the first introduced into North America; and yet such is not the case. After the publication of Mr. R. H. Meade's Monograph of European *Sarcophagæ* (*Ent. Mo. Mag.*, xii., p. 216 *sqq.*, 1876), I sent him for comparison a collection of North American *Sarcophagæ*, in the expectation that European species would be found among them. Mr. Meade found in that collection twenty-four true *Sarcophagæ* and four *Sarcophagidæ* belonging to other genera; but among those species there was not a single one that could be absolutely identified with any European species. A single species from the Far West (Colorado and Lake Superior) comes very near the European *S. similis*, Meade.

Now it is well known that *Musca domestica*, *Cyrtoneura stabulans*, *Calliphora vomitoria* and *C. erythrocephala*, *Anthomyia canicularis* and *Stomoxys calcitrans*, all of them common European house-flies, are equally common in the Atlantic States of North America; and also that they have been imported into the most distant colonies, like Chili, Australia, and New Zealand, where they were not indigenous. *Rhyphus fenestralis*, *Scenopinus fenestralis*, and the handsome green-eyed *Scyphella flava* occur on windows in North America, just as much as in Europe. *Sarcophaga carnaria*, as far as I know, has never been mentioned as occurring in any of those countries. (All the above-named flies are, for instance, mentioned by Dr. Schiner in the Novara work as brought home from

distant regions, except *S. carnaria*. The single instance in Macq., Dipt. Exot., ii., 3, p. 95, that this species had been received from Haiti requires further confirmation).

It would seem, therefore, that there are some obstacles to the introduction of this species by means of shipping into distant countries. It may be that the chances of transportation are diminished in this case owing to the circumstance that *S. carnaria*, although living about human dwellings, does not often appear *within* them; and for this reason, even if it made its appearance on board ship, would be less apt to remain within it than the other house-flies. But as this reasoning is not applicable to the larvæ, the case remains doubtful.

Similar remarkable cases of *non-importation* may be quoted in the vegetable kingdom. A great many of the common European weeds have been imported into the United States, and have to a considerable extent, especially in the environs of towns and villages, almost crowded out the native flora. One might naturally have expected that the poppy and the blue-bottle (*Centaurea cyanus*) would be, with the cereals, among the first arrivals. Nevertheless these two weeds have never spread in America.

3.—PSILOPUS PALLENS.

This is an instance of importation under the most improbable circumstances. The dolichopodid *Psilopus pallens*, Wied., although it occurs along the Atlantic coast of North America, has the general appearance (colouring, &c.) of a European *Psilopus*, quite different from the numerous American representatives of that genus, which have the more brilliant colouring of tropical species. Wiedemann received it from North America more than half a century ago. When I sent Dr. Loew the first specimens which I found, he wrote me that they were absolutely identical with a species which he had found on the island of Rhodes (*Psilopus albonotatus*, Loew). This was remarkable, but I have gathered some facts since which bridge over the distance between Rhodes and New York. In the collection of Mr. Bergenstamm, in Vienna, I have seen specimens of the same species from Barcelona; and Mr. Van der Wulp informed me that it has been found in Amsterdam and in Haarlem (*cf.* Tijdschr. voor Ent., xi., p. 20).

New York was originally a Dutch colony, and *Psilopus pallens* may have been imported from Holland to New York very early. The peculiar mode of life of this species, quite different from its congeners, helps to explain the otherwise improbable fact of the importation by ship of a *Psilopus*.

Ordinary *Psilopus* run on leaves of plants, usually far from human dwellings. On the contrary, *P. pallens* I have always found in and about houses; I even took specimens on the walls of a foreign Consulate in one of the busiest quarters of the city of New York (Bowling Green). Other specimens were found by me on the outside walls of houses in Newport, Rhode Island and Sag Harbour, Long Island—that is, always not far from the sea-shore. Thus we are justified in supposing that *P. pallens*, in frequenting ships'-cabins, has been able to withstand the long voyage across the Atlantic. Still the wanderings of this species and its partiality for sea-ports are very remarkable, and it would be worth while to investigate the perhaps peculiar conditions of its metamorphosis.

4.—THE IMPORTATION OF GNATS (*Culex*) INTO THE SANDWICH ISLANDS.

The following case may be typical of the mode of importation of gnats across the ocean:—About 1828—30 an old ship from Mazatlan, Mexico, was abandoned on the coast of one of the Sandwich Islands. Larvæ of *Culex* were probably imported in the water-tanks upon it. The natives soon became aware of the appearance round that spot of a—to them unknown—blood-sucking insect; it so far excited their curiosity that they used to congregate in the evening in order to enjoy the novelty. Since then the species spread in different localities, and in some cases became a nuisance.

This was related to me by Mr. T. R. Peale, the well-known American entomologist and artist, who visited the Sandwich Islands a few years later with the United States Exploring Expedition, under command of Capt. C. Wilkes (1838—40). A distinguished American, who spent many years on the islands and whose acquaintance I made in Washington, confirmed the story to me, and told me that he remembered positively that there were no mosquitoes on the islands about 1823.

This version is at any rate more probable than another which I read in the German periodical, 'Die Natur' (1857, p. 232), that gnats were intentionally imported into those islands by a mischievous sea-captain, in vengeance against the inhabitants!

However, as the genus *Culex* seems to be cosmopolitan, it is very probable that native species existed on some of the islands of the Pacific Ocean. I read in F. D. Bennett's 'Narrative of a Whaling Voyage round the Globe from the Years 1833 to 1836' (London, 1840) that on Raiatea, one of the Society Islands, he met with a grey *Culex*, handsomely spotted with black, which was very common and annoying in the jungle, but seldom appeared in the villages. On Pitcairn Island the same traveller was told that the mosquito (*Culex*) had been but recently introduced.

5.—SYRPHUS PYRASTRIS.

The geographical distribution of this common species offers some peculiarities which deserve to be noticed. It is common throughout Europe, but not as far north as Lapland; it occurs in Egypt, Algiers, on the Canary Islands, and Madeira (Schiner, *l. c.*, and Macquart); eastwards it has been found in Moscow (Fedtchenko), Kharkow (Jaroscheffski), and in the Volga-Ural region (Eversmann). Its occurrence farther east is very probable, but data are wanting. The *S. lunatus*, Wiedemann, from China, which this author calls "the representative of the European *S. pyrastris*, only a little smaller," may perhaps be the same species.

A species which I cannot distinguish from *S. pyrastris* is quite common in the region between the State of Colorado and the Pacific Ocean, including California. Say discovered it as early as 1820 on the Arkansas River, near the Rocky Mountains—at a time, therefore, when that region was as distant from the centres of civilisation as some places in the interior of Africa are at present. He was aware of its resemblance to the European species, and for this reason called it *S. affinis*; the difference which he notices, "a somewhat darker colour," is unimportant.

We thus have in the occurrence of *S. pyrastris* on the western side of the American Continent a clear case of a *disconnected area* of distribution. Remarkable as this is, it is still more remarkable that the occurrence of *S.*

pyrastri is confined to the western side of the American Continent. As far as I know, it has never been found in the Atlantic States. As Say discovered it east of the Rocky Mountains more than sixty years ago, it is difficult to understand what prevented it from spreading farther east and reaching the Atlantic Ocean. It remains to be seen whether the increase of the intercourse between east and west in North America, which has taken place lately, will not in the end bring about that result. But it is difficult to conceive why it has not happened earlier. A species which occurs in St. Petersburg, in Egypt, and on the Canary Islands must possess, as to climate, considerable powers of adaptation.

S. pyrastri also occurs in Chili (see Macq., D. E., ii., pp. 83 and 88); for I have myself seen specimens from there, and this is a new instance of the relationship of the Chilian with the Californian fauna; but this same fact renders very improbable the hypothesis of the importation of that species on ships. If it had been imported from Europe to California and Chili, it would in all probability have been introduced to New York, Charleston, and other Atlantic ports much earlier.

S. pyrastri is not a circumpolar insect. I mean to say that the other Syrphi common to Europe and North America (*ribesii*, *topiarius*, Zett., *abbreviatus*, *lapponicus*, *umbellatarum*, L. (?), *cinctellus*, Zett. (?)) all occur in Lapland, and therefore may have reached America by way of Greenland, in an earlier geological period. *S. pyrastri* does not occur in Lapland, and is not an insect of the extreme north; therefore its occurrence in Western America can be explained only (barring the hypothesis of importation) by a migration across the more temperate regions of Asia, and then over the islands, connecting both continents. Still its non-occurrence in the Atlantic States remains unexplained.

XXV. *An Essay of Comparative Chætotaxy, or the arrangement of characteristic bristles of Diptera.* By C. R. OSTEN-SACKEN.*

[Read November 5th, 1884.]

I PROPOSE the term Chætotaxy for the arrangement of bristles on the different parts of the body of the Diptera, the composition of this term being analogous to phyllo-taxý, the order or arrangement of the leaves of plants. The characters derived from the number and position of bristles (macrochætæ) have been gradually gaining ground in dipterology, but it has not been attempted to introduce a uniform nomenclature for them. The study of the Diptera of South-Eastern Asia, on which I have been recently engaged, excited for the first time my more immediate interest in the bristle-bearing families of Diptera (Diptera chætophora) they may be called), whilst my attention had hitherto been confined to the *Tipulidæ*, *Tabanidæ*, *Syrphidæ*, &c., which are all bristleless (I propose to call them Diptera eremochætata). I soon perceived that I could not proceed much further with the study of the Diptera chætophora without an attempt at a comparative chætotaxy; and this gave occasion to the present essay.

In the choice of terms my principal aim was to prefer such that are more or less obvious, that is, to derive the names bestowed upon the macrochætæ from the places of their insertion. The bristles on the vertex, for instance, I call vertical bristles; those on the sides of the front, fronto-orbital, &c. Such terms offer the double

* The present paper appeared originally in the Mitth. d. Münchener Entom. Vereins, vol. v., pp. 121—138, 1881. In distributing my extra copies to correspondents I added a postscript, consisting of two pages printed on a separate sheet. (The contents of this postscript are reproduced in an article of mine in the Wien. Ent. Zeit., 1882, p. 91). In the present edition the substance of the postscript is incorporated in the body of the paper; a woodcut is added (borrowed from Prof. Mik's paper, 'Zu Osten-Sacken's Chætotaxie,' &c., in the Verh. z.-b. Ges. Wien, 1882); some useful remarks by Prof. Mik in the same paper are adverted to, and some additions are made on the last two pages. Otherwise the edition is unchanged, except a few emendations of little moment.—O. S.

advantage of being easily remembered, and not easily disputed; many of them have been anticipated by earlier writers. In following this plan, however, I met with a difficulty in the incomplete or uncertain terminology* of certain parts of the body of the Diptera, especially of the thorax, and this afforded me an opportunity for developing it. In doing this I purposely preferred a purely conventional to a homological or anatomical nomenclature. The latter is much easier to praise than to carry out, being often subject to uncertainty and dispute. Thus, what dipterologists hitherto called *metanotum* has been recently proved to belong to the mesothorax (see the paper of Mr. Hammond in the *Journal Linn. Soc.*, vol. xv.), and if the arrangement is sustained we shall have either to change the term for another or to continue to use it as a merely conventional term. The difficulties of descriptive Entomology are great enough without such uncertainty of terms, and it is evident that a conventional terminology offers more chances of fixity; it may very well exist alongside of a homological and anatomical terminology. It was principally the pleura which required some development of the nomenclature of its different regions, and of the sutures which divide them. The term pleura itself, being conventional, and not anatomical, I have formed the new names of the combinations of this word with other words indicative of the position of the parts which I intended to name (*mesopleura*, *metapleura*, &c.).

Bristles easily fall off, and the scars which they leave are not always recognisable; in such cases we may sometimes be in doubt whether we have a defective specimen or an individual aberration before us. Statements about chaetotaxy must therefore be made, as well as received, with some caution.

It is hardly necessary to add that in this, as in all my previous publications, I adopt Loew's terminology (explained in the *Monogr. N. Am. Dipt.*, vol. i.) as my rule and the basis to start from, only I prefer the Latin terms to their equivalents in English. Although somewhat incomplete and too hastily written, that chapter was composed by Loew at a late period of his career, and

* I deliberately prefer *terminology*, which is consecrated by usage and by the best writers, to *horismology*, which is not to be found in Webster's Dictionary, except in the incorrect form of *orismology*.

with the full benefit of a long experience. It was a deliberate attempt (as Loew says in the introduction to it) to act as an arbiter between the conflicting terminologies of previous writers, and for this reason it deserves the highest consideration. In the nomenclature of bristles I have taken into account the terms introduced by earlier writers, as far as consistency permitted it.

Sufficient attention has not yet been paid to the functions of the macrochætæ in Diptera, and to the remarkable circumstance that, while they occur with great regularity through a long series of families, they are wanting in others.

Among the *Orthorhapha* the Diptera eremochætæ (bristleless) form the rule, the chætophora the exception; but this exception comprises the large and important families of *Asilidæ* and *Dolichopodidæ*. (The bristles on the legs of the *Mycetophilidæ* and *Culicidæ* are not properly macrochætæ).

Among the *Cyclorhapha* the Diptera chætophora are the rule; the eremochætæ form the exception, but a very important one—the large family of *Syrphidæ*.

Macquart thought that the macrochætæ serve as a protection to the parts of the body upon which they are inserted; that they act as buffers in cases of sudden contact. In the Introduction to his 'Nouvelles Observations sur les Tachinaires' (Ann. Soc. Entom. Fr., 1845, pp. 239—240) he says:—"En examinant la situation et la direction de ces soies, qui sont d'ailleurs les mêmes dans la plupart des Muscides, il est impossible d'en méconnaître la destination. Elles protègent toutes les parties supérieures de la tête contre les chocs, et l'on ne peut guère douter que ces moyens de préservation n'aient été accordés à cette famille immense, à l'exclusion de la généralité des autres Diptères, pour compenser la faiblesse des tégumens. Les quatre soies occipitales, en se dirigeant en arrière, défendent le cou; les deux stemmatiques, tournées en avant, préviennent les dangers auxquelles les ocelles sont exposés, surtout pendant le vol; les latérales du rang intérieur, dirigées en dedans, forment une voute pour abriter le crâne qui recouvre le cerveau; enfin, celles du rang inférieur dans les femelles, tournées en avant, défendent les côtés du front, élargis dans ce sexe." Macquart might have continued in the same strain about the bristles of the thorax; the supra-alar bristles protect the root of the wings from above; the

mesopleural perform the same office in front; the meta-pleural fan of bristles (in certain families) acts as a screen in front of the halteres, &c. Hence the persistency of the certain bristles in the same places, not only through the immense divisions of the *Calyptrata* and *Acalyptrata*, but even among more distant families, like *Asilidæ* and *Dolichopididæ*; hence also the possibility of a uniform terminology.

Still, this hypothesis of Macquart's does not explain how certain families can exist without any macrochætæ at all. The integuments of a *Tabanid* are apparently not harder than those of a *Tachina*, and yet they are unprotected by bristles. We may perhaps get over this difficulty by observing the different mode of locomotion of different groups of Diptera. There is a well-marked contrast in this respect between the aerial Diptera, which are most of the time on the wing and use their legs merely for alighting (*Tabanidæ*, *Bombylidæ*, *Syrphidæ*), and the pedestrian Diptera, which use their legs for running or seizing their prey, and fly only at intervals (most of the *Cyclorhapha*, except the *Syrphidæ*; among the *Orthorhapha*, the *Asilidæ* and *Dolichopodidæ*). The pedestrian Diptera are those principally provided with macrochætæ, probably because in their mode of life—running upon leaves, struggling with their prey, or ovipositing on caterpillars—they are more exposed to contacts and collisions than the aerial Diptera. The latter are not only in this respect less exposed, but most of them possess the power of regulating the momentum of their flight, which involves the faculty of poisoning themselves in the air. Observe the flight of a *Syrphus*, the cautious way in which he turns round a solid object and repeatedly touches it with the tip of his tarsi, without alighting, and compare it to the headlong flight of a *Calliphora*. The most bristly of all the Diptera and the least cautious in their flight are the *Calyptrata*, those very flies which C. C. Sprengel, in his 'Das entdeckte Geheimniss der Natur, 1793,' called the "stupid flies" (die dumme Fliegen), for their clumsiness, their inability to discover honey in flowers, and the ease with which they are deceived by odours and appearances. *Stratiomyidæ*, *Tabanidæ*, *Bombylidæ*, *Syrphidæ*, all have the power of poisoning, and all are absolutely or nearly eremochæta. *Therevidæ* and *Empidæ*, which also have that power, are provided with only very few macrochætæ. I assume,

therefore, that macrochætæ are organs of orientation, connected with the nervous system, being in their useful action not unlike the whiskers of a cat.

We may go further, and connect this generalisation with another one which I recommend to the attention of observers. That faculty of poisoning seems, for some as yet unknown reason, to be connected with contiguous eyes in the male sex. Most of the above-named families of Diptera eremochæta which possess that faculty (*Tabanidæ*, *Bombylidæ*, *Syrphidæ*, &c.) have holoptic males (as I will call them for brevity's sake). The Diptera chætophora hardly ever have holoptic males (even among the *Orthorhapha*, as the *Asilidæ* and *Dolichopodidæ*), the only exceptions, as far as I remember, occur among certain *Calyptrata* (for instance, *Hydrotæa*, *Ophyra*, *Homalomyia*), and it is very remarkable that just these possess, more than their relatives, the faculty of regulating their momentum. *Diaphorus* (*Dolichopodidæ*) is, by exception, also holoptic. Thus we have on one side an opposition between macrochætæ and eyes; on the other side a coincidence between macrochætæ and legs.

The Diptera eremochæta, as I have shown, are for the most part holoptic in the male sex; at the same time they are principally aërial insects; they use their wings for locomotion, their legs for alighting only (*Stratiomyidæ*, *Bombylidæ*, *Tabanidæ*, most *Syrphidæ*,* &c.).

On the contrary, the Diptera chætophora use their legs as much as, sometimes more than, their wings; they run, climb, snatch their prey, &c. (most of the *Muscidæ*, *Phoridæ*, *Dolichopodidæ*, *Asilidæ*); in consequence, their legs are much more developed and differentiated than the legs of the eremochæta, but the males are very seldom holoptic. What a contrast, for instance, between the soaring, bristleless, holoptic *Bombylius*, and the bristly, pedestrian *Phora*!

These two groups do not, however, embrace all the Diptera. The *Tipulidæ*, for instance, cannot be called

* Among the *Syrphidæ*, *Chilosia*, *Chrysochlamys*, *Volucella*, *Rhingia*, and *Brachyopa* have some macrochætæ on the sides of the thorax and on the scutellum, but none on the head. Some *Syrphidæ*, like *Xylota*, are occasionally seen running upon leaves; Grischner (Wien. Ent. Zeit., 1884, p. 200) makes the same observation on *Calliprobola speciosa*; but these are exceptions to the usual aërial habits of *Syrphidæ*. Certain *Bombylidæ*, like *Toxophora* and *Mulio*, have conspicuous macrochætæ, and the males are nevertheless holoptic.

either aërial or pedestrian; at the same time they are neither holoptic nor chætophorous.

“Insects organised for an exclusively aërial life,” says Dr. A. Forel (*Libellula, Tabanus, Bombylius, &c.*), “depend on their eyes; they generally have very little developed antennæ, and are absolutely helpless in the dark; they hardly dare to walk. . . . In other insects (for instance, ants) the eyes play a subordinate part; these may be called antennal insects; they can work by night or underground, as well as by day” (A. Forel, *Beitrag z. Kenntniss der Sinnesempfindungen der Insecten; Mitth. d. Münchener Entom. Vereins, ii., 1878*). *Tipulidæ* and some of the *Nemocera* in general, *Chironomidæ, Mycetophilidæ,* and *Cecidomyjidæ* may probably be ranked among the antennal insects. *Culex*, for instance, attacks us in the dark, following the scent by means of its antennæ. In the male *Culex*, according to the observations of A. M. Mayer, the antennæ are organs of hearing, and serve to discover at a distance the piping of the female (see *Amer. Journ. of Sci., vol. 108, pp. 89—103*). Thus the secondary sexual character of *Culex*, consisting in the different structure of the antennæ, would find its natural explanation in a functional difference.

It is by no means impossible that the macrochætæ are useful in more than one way; it will belong to the observer and the anatomist to determine whether, for instance, they may not serve for the transmission of sound (mere perception of the sound-waves of the air, and not specific hearing), like the long antennæ of certain Orthoptera or moths.

The further discussion of this subject would draw me beyond my present aim, which is a merely practical one, the settlement of the terminology of the macrochætæ, and, by that means, the utilisation of a set of characters which, it seems to me, have not yet been sufficiently appreciated in descriptive Entomology.

I.—TERMINOLOGY OF THE PARTS OF THE THORAX.

This terminology refers especially to the *Diptera Cyclorhapha*; but the same sutures and regions of the pleuræ can be recognised more or less distinctly in the *Orthorhapha*. Some of the sutures sometimes become less distinct or obsolete—for instance, in the *Tipulidæ*.

separated by a suture. It answers to the side of the metasternum of Lowne, and the epimeron of the mesothorax of Hammond. (*d* of the figure).

Metapleura, immediately above the hypopleura, and behind the pteropleura; a more or less convex, tubercular piece between the root of the wing and the haltere: in the *Asilidae* it bears a characteristic fan-like row of bristles; between it and the metanotum the *callus metanoti lateralis* of Loew (Mon. N. A. Dipt., i., p. xiv.) is placed. (*e* of the figure).

C. OTHER TERMS FOR PARTS OF THE THORAX.

Scutellar bridges, the small ligaments which on each side of the scutellum connect it with the mesonotum, crossing the intervening suture. (Prof. Mik proposes to call them in Latin, *jugum scutellare*).

Præsutural depression; a triangular depression usually existing in the angle formed by the transverse mesothoracic suture and the dorso-pleural suture; a slight swelling at its bottom is the *præalar callus*.

Præalar and postalar callus; more or less distinct tubercles which often exist, the former in front of the wing, the latter between its root and the scutellum; they often bear characteristic bristles. (In my former writings I have occasionally used the term *præscutellar callus* for post-alar, but the latter is preferable). The word *callus*, here as elsewhere, is taken for the German *Schwiele*, in the sense of tubercle, swelling, and not merely of a hardness of the skin (which is the sense of *callus* in Webster's Dictionary). In this, as in other cases, I have preserved the terminology adopted by Loew in the Monogr. N. A. Dipt., vol. i. (1862).

Supra-alar cavity, an excavation of the mesothorax above the root of the wing, along the edge of which the supra-alar bristles are inserted. It is divided into an anterior and a posterior portion by a small ligament, which runs towards the root of the wing (*alar frenum*).

II.—THE TERMINOLOGY OF THE BRISTLES.

1.—In studying the chaetotaxy of the Diptera it was natural for me to begin with those families in which the arrangement of the bristles is the most simple, that is, with the *Diptera Acalyptata*. After having adopted a terminology for these, the next step was to ascertain

how far it was applicable to the other great divisions of Diptera. I found that the homologies were so striking that there was no great difficulty in applying the same nomenclature of bristles to all the large divisions of the order. The terminology given below refers, therefore, first of all to the *Acalyprata* (especially the *Ortalidæ* and *Trypetidæ*); but at the end of this paper a brief sketch of its application to the principal other divisions is given. This sketch is necessarily approximative, and not exhaustive; many other characteristic hairs and bristles remain in each family to be observed, described, and perhaps named; this is left to the specialist; my aim was, by indicating the homologies, to insure the uniformity of the nomenclature.

2.—It must be borne in mind that, in enumerating the lateral bristles of the head or thorax, one side only is always considered. Thus, two fronto-orbital bristles means that there are two on each side of the head. On the contrary, the bristles on the central portions of the head or thorax are enumerated in pairs. Thus, vertical bristles, one inner and one outer pair, means that there are two vertical bristles on each side, one of which belongs to the inner, the other to the outer pair.

3.—The abdominal bristles do not require any special terminology; their position is easily defined by naming the abdominal segment on which they are inserted. Only the marginal bristles may be distinguished from the discal, as Rondani has done it (*Prodr.*, iii., p. 244). In describing the bristles on the legs, the rule enunciated by Prof. Mik (in his ‘*Dipterologische Untersuchungen*,’ Vienna, 1878, p. 3, note) should be followed:—“On the legs I distinguish a front and hind side, and upper and under side. When a leg is stretched out horizontally, and perpendicularly to the longitudinal axis of the body, the front side is that which is turned towards the head; the hind side that which looks towards the anus; the meaning of upper and under side follows as a matter of course. I call præapical bristles those which occur principally on the front side of the hind femora of many *Dolichopodidæ*, single, elongated, erect bristles.” The same term of præapical bristle was used by Dr. Schiner for a characteristic bristle at the end of the tibiæ in some *Acalyprata* (especially *Sciomyzidæ*). Thus the former would be the femoral, the latter the tibial præapical bristle.

A. CEPHALIC BRISTLES.*

Vertical bristles, so called from their position on the vertex; there are two pairs of them, the inner and the outer one; both are inserted more or less behind the upper and inner corner of the eye. They are either erect or the bristles of the inner pair are converging, those of the outer diverging. These two pairs of bristles are the most persistent of all, among the *Acalyprata*, although even they disappear in some genera. (For the identification of these bristles I recommend the head of *Tetanocera*).

Post-vertical pair of bristles, in the middle of the upper part of the occiput, behind an ideal straight line, connecting the vertical bristles of the inner pair. They are generally small or absent; large and conspicuous in *Tetanocera*.

Ocellar pair of bristles, on the ocellar triangle; they are always diverging and pointing forward; often wanting.

Fronto-orbital bristles, placed on each side of the front, near the orbit, immediately below the vertical bristles, on the little stripes which generally run down from the vertex on each side of the front of the *Ortalidæ*. There is only one pair of them (on each side), or two, one below the other; often none. In the *Ortalidæ* they are generally placed high on the front; in other families (*Tetanocera*, *Sapromyza*, &c.) they reach lower.

* The terminology of the parts of the head is confused and contradictory in different writers, and for this reason an explanation is necessary. Frontal orbit I call the whole interval between the frontal stripe and the eye. The term is not always appropriate, especially for the *Tachinidæ*, where that interval occupies the greater part of the front; but I prefer to retain it rather than to change the terminology adopted by Loew in the Monogr. N. Am. Dipt., vol. i. These parts are the *Wangenscheitelplatten* of Prof. Brauer (Die Zweiflügler des Kais. Mus. in Wien), and the *optica frontis* of Rob. Desvoidy. When there is no distinct frontal stripe, as in some *Acalyprata* (for instance, the *Ephydridæ*), the dividing line of the orbits is merely an ideal one. There is no separate term in Loew for the portion of the face, very distinct in many *Cyclorhapha*, between the lower part of the frontal fissure and the antennal foveæ; a stripe which generally contains, in the *Calyptrata*, a vertical ridge bearing a row of bristles. We have no other choice but to use Robineau Desvoidy's term *facialium* (plural, *facialia*), also adopted by Walker. This piece is very distinct in the *Ephydridæ*, and, although level here, it is bounded by sutures and often bears a row of hairs. Stenhammar calls it *epistomatis partes laterales*, which is too cumbrous for use.

Lower fronto-orbital bristles occupy the lower part of the front, above the antenna, along the orbit. They are differentiated from the ordinary fronto-orbital bristles in not being quite in a line with them—that is, in being inserted either a little nearer to the orbit (*Trypetidæ*) or a little farther (*Scatophagidæ*); they also differ from the upper fronto-orbital bristles in being smaller or inserted closer together. They are not of frequent occurrence.

Vibrissa (Meigen, vol. i., xxix.), a stout bristle on the lower end of the facialia, immediately above the peristomium and below the antennal foveæ on each side, often accompanied by some smaller bristles. *Vibrissæ* are characteristic of some families; they are wanting in the *Trypetidæ* and *Ortalidæ*.

Facial bristles,* inserted in a series on each side of the middle portion of the face, above the vibrissæ, along the facialia; they are especially conspicuous in the *Tachinidæ*. They are rare among the *Acalyptrata*; the *Ephydridæ*, for instance, have some weak ones on each side of the face.

In some genera other characteristic bristles occur, less persistent than those enumerated above, that is, appearing sometimes in one species and disappearing in another in the same genus. Such is an *occipito-orbital bristle* in some *Ortalidæ*, inserted on the posterior orbit of the eye; one or several *genal bristles* on the cheek, near the lower corner of the eye, &c. A row of bristles along the posterior orbit of the eye in the *Dolichopodidæ* have been aptly called by Loew *cilia of the posterior orbit*; similar bristles exist in the *Diptera Calyptrata*, in the *Asilidæ*, &c. They are often plumose.

B. THORACIC DORSAL BRISTLES.

I divide the thoracic dorsum into regions, as they are indicated by the existing structural features: the dorsal stripes indicative of the position of the longitudinal thoracic muscles, and the thoracic transverse suture (or rather furrow) separating the anterior from the posterior bundles of the vertical muscles. Thus we obtain the

* Rondani (Prodr., iii., p. 244) calls the facial bristles *setæ orales*, a term which is misleading, because *oralis* means belonging to the mouth, as well as belonging to the face. (We have the oral organs and oral margin, both referring to the mouth). Rondani's other terms, *setæ verticales*, *ocellares*, and *frontales*, are the same as mine.

dorso-central region in the middle (III.), and the dorso-humeral (I.) and dorso-alar (II.) regions on each side. This division will be found very convenient for localising any bristle we may have to describe. These Roman numerals will be sometimes used by me to represent the corresponding regions. Thus *supra-alar* bristles (II.) will mean supra-alar bristles (dorso-alar region).

I. *Dorso-humeral region*.—It is bounded by the anterior end of the thorax and the thoracic transverse suture on two sides, and by the dorso-plural suture and dorso-central region on the two others (No. I. of the figure). I distinguish here:—

1. The *humeral bristle* (Loew, Europ. Helomyziden), inserted on the humeral callus; in the *Acalyptrata* either one or none at all; in the *Calyptrata* often several.

2. The *post-humeral bristles*, as far as I know, with rare exceptions, two inserted immediately above the dorso-pleural suture, between the humeral callus and the root of the wing; both are inserted at the bottom of the præsutural depression, a triangular depression which usually exists here in the *Cyclorhapha*.

3. A *præsutural bristle*, immediately in front of the thoracic suture, above the præsutural depression. It is not found in the *Ortalidæ*, but occurs in most *Trypetidæ*, *Sciomyzidæ*, and *Sapromyzidæ*. It may be homologous with a bristle in the same place in the *Diptera Calyptrata*, but which is less conspicuous among the other bristles which they have in the same region, and which I call *intra-humeral*. The *Asilidæ* possess very characteristic and persistent præsutural bristles (two or more).

The *Acalyptrata*, as far as I am aware, have no other bristles in the dorso-humeral region. The *Diptera Calyptrata* have several bristles besides, which may be called the *intra-humeral bristles*. There are often two, sometimes three or more of them, and they are inserted between the outer dorso-central row on one side, and the humeral callus and the præsutural depression on the other (compare below the notice on the *Diptera Calyptrata*).

II. *Dorso-alar region*.—Between the transverse suture and the scutellum on one side, and the root of the wings and the dorso-central region on the other (No. II. of the figure). In the *Acalyptrata* this region only contains the group of—

Supra-alar bristles, usually three; one is inserted on the post-alar callus (which is often indistinct in the *Ortalidæ*), very near the scutellar bridge and almost in a line with the præscutellar bristles; the second is in front of the first, just at the top of a small ridge or ligament (*alar frenum*), which descends to the root of the wing and crosses the supra-alar cavity; the third is in front of the second, on the edge of the anterior portion of that cavity. These bristles are not placed in a straight row; their bases form a triangle. A fourth supra-alar bristle sometimes exists in the *Ortalidæ*, behind the mesothoracic transverse suture and above the posterior post-humeral bristle. As far as I can ascertain, this last bristle is distinctive of the section *Ortalina*; I do not find it in the other sections of the *Ortalidæ*. The *Diptera Calyprata* often have a series of more than three supra-alar bristles along the edge of the anterior supra-alar cavity. Even among the *Asilidæ*, the supra-alar bristles form a distinct group.

The *Diptera Calyprata* show other bristles in the same region; they often form a longitudinal row of two or three, placed between the supra-alar group and the outer dorso-central row. They may be called *intra-alar bristles*.

III. *Dorso-central region*.—Bounded by two imaginary lines drawn from the scutellar bridges forward, and coinciding with a space free of bristles that exists on the outer side of the dorsal rows, and that is often occupied by a dorsal thoracic stripe (No. III. of the figure). This region contains the *dorso-central bristles*, arranged in two or four longitudinal rows. They are often wanting in the *Ortalidæ*. In the *Dolichopodidæ* the intermediate pair of rows is represented by two, sometimes only one (*Liancalus*) row of peculiar, minute bristles, which Prof. Mik (*Dipterol. Unters.*, Wien, 1878, and also *Verh. z.-b. Ges. Wien*, 1880, p. 600) calls the *acrostichal bristles*. In the absence of dorsal rows of bristles (for instance, in the *Ortalidæ*, *Tetanocera*, &c.) there is often a transverse row of four (or two) bristles in front of the scutellum; they represent the terminal bristles of the (here non-existing) dorsal rows. I call them *præscutellar bristles*. Sometimes (in *Trypeta*) there is only a single pair of præscutellar bristles, while a second pair, more in front and farther apart, represent the (absent) outer dorsal row. The præscutellar bristles are always inserted

between the scutellar bridges. A bristle usually existing immediately outside of the scutellar bridge, almost in a line with the præscutellar bristles, belongs to the dorso-alar region, and has been already mentioned above as the hindmost bristle of the supra-alar group. In the *Asilidæ* there are often two longitudinal short rows of small bristles in front of the scutellum; they may be called *præscutellar rows*.

C. THORACIC PLEURAL BRISTLES.

Prothoracic bristle (Loew, Monogr. N. Am. Dipt., iii., p. 33).—A strong bristle immediately above the front coxæ, which exists in Loew's division *Ortalina*. The bristle called *Borste über der Vorderhüfte* in Loew's paper on *Helomyzidæ*, p. 16, is homologous to this. It also exists in *Cordylura*, but not in *Scatophaga*; in the *Calyptrata* several bristles are generally found here.

Mesopleural bristles.—Inserted on the mesopleura, in the angle formed by the horizontal dorsopleural suture and the vertical mesopleural suture. There are often (for instance, in the section *Ortalina*) several bristles here, arranged in a row along the vertical mesopleural suture; there are two such bristles in *Scatophaga*, none in *Dryomyza* nor in *Helomyza*. In the *Diptera Calyptrata* these bristles form a conspicuous row.

Sternopleural bristles.—One or several on the sternopleura, below the longitudinal sternopleural suture. In Loew's divisions *Ortalina* and *Cephalina* there is one such bristle above the middle coxæ. Loew calls it the *mesothoracic bristle*, which name I cannot adopt, however, as it is too indefinite. There is one such bristle in *Scatophaga*, one or two in *Helomyza* and *Blepharoptera*, two in *Sapromyza*, and three in *Dryomyza*; none in Loew's *Platystomina*. In some *Anthomyiæ* I perceive three (one anterior, two posterior); in some *Dexiæ* and *Tachinæ* also three (two anterior, one posterior); in *Sarcophaga* three (one anterior, one posterior, and one between them).

Pteropleural bristles.—Inserted on the pteropleura; are of rare occurrence, and generally difficult to perceive; *Trypeta*, for instance, has a weak bristle inserted on the pteropleura, under the root of the wing.

Metapleural bristles.—On the metapleura; they are especially conspicuous in the *Asilidæ*, where they form a fan-like row.

Hypopleural bristles.—On the hypopleura; as far as I have observed, occur only in some of the *Diptera Calyptrata*, which have a row or a tuft of them.

III.—APPLICATION OF THE TERMINOLOGY OF THE BRISTLES TO THE PRINCIPAL LARGE DIVISIONS OF DIPTERA.*

Diptera Acalyptrata.—To illustrate the chætotaxy of this division I select the genus *Trypeta*, as being provided with the most complete set of bristles among the *Acalyptrata*. The chætotaxy of the Trypetid *Platyparea pœciloptera* may be expressed thus:—

Head: Vertical bristles, outer pair but little shorter than the inner; post-vertical pair small; ocellar pair of moderate size; fronto-orbital (2); lower fronto-orbital (3).

Thoracic dorsum: I. Humeral (1), post-humeral (2), præsutural (1). II. Supra-alar (3). III. A præscutellar pair; a second pair more in front, but farther apart.

Pleura: Mesopleural (2), sternopleural (1), pteropleural (1, very small).

Scutellum (4).

This is the usual type of chætotaxy in the genus *Trypeta* in the wider sense; in describing, therefore, that of any given species it will suffice to say *chætotaxy normal*, and to indicate the differences. Instead of two fronto-orbital bristles, there is sometimes only one; instead of three lower fronto-orbital bristles, there are often only two: in some cases there are three dorso-central pairs of bristles, the third being in front of the suture (Loew, *Die Europ. Bohrfliegen*, p. 5); the scutellum has sometimes only two bristles, sometimes as many as six.

If we compare the above formula with the chætotaxy of the Asiatic Trypetid *Ptilona*, v. d. W., we perceive at once important differences, which lead us to the conclusion that the genus, although a Trypetid, cannot be

* An Arabic numeral, placed in brackets after the name of a bristle or bristles, indicates the number of them; the Roman numerals, whether placed before or in brackets behind, indicate the region of the thoracic dorsum where the bristle is inserted:—I., Dorso-humeral region; II., dorso-alar; III., dorso-central. Thus, one intra-alar bristle (II.) means one intra-alar bristle (dorso-alar region). This addition may seem superfluous, because the term intra-alar bristle already implies that the bristle belongs to the dorso-alar region; still, I have occasionally used it because I thought that, owing to the novelty of the subject, it would be easier thus to recall the position of the different bristles.

referred to *Trypeta* in the wider sense of Meigen and Loew. *Ptilona* (at least a species from the Philippine Islands, which I have before me, and which seems closely allied to *P. brevicornis*, v. d. W.) has no ocellar bristles; only one fronto-orbital, inserted very low down, a little above a single fronto-orbital of the lower row. On the thorax: I., no præsutural; III., only one pair of præscutellar bristles. The rest is normal. I hold the absence of the præsutural bristle (I.) as the more important and decisive character.

Some African species of *Dacus*, according to Loew, have no dorso-central bristles at all. (the Asiatic *Dacus*, which I can compare, have one præscutellar pair).

Loew (*l. c.*) describes the lateral bristles of the thoracic dorsum as forming two rows on each side; I believe that we gain a much clearer view of them when we consider separately those of the dorso-humeral and of the dorso-alar region. As soon as I adopted this mode of grouping I became aware of the importance of the præsutural bristle (I.), as characteristic of a true *Trypeta*, and of a bristle behind the suture (II.), which occurs in the section *Ortalina*, but is wanting in the other sections of the *Ortalidæ*.

In contrast to the complete chætotaxy of *Trypeta*, I will give an instance of an incomplete one, in *Psila fimetaria*.

Head: Vertical bristles, two pairs of medium size; ocellar pair very small; no post-vertical; no fronto-orbital.

Thoracic dorsum: I. One præsutural. II. Only two supra-alar, the posterior one is wanting. III. A præscutellar pair. (All the other dorsal bristles are wanting).

Pleura: No bristles. Scutellum: Two.

Diptera Calyptrata. — *Cephalic bristles*. — The vertical (improperly called *soies occipitales* by Macquart, Ann. Soc. Ent. Fr., 1845, p. 239), post-vertical, and ocellar (*soies stemmatiques* of Macquart) are easy to distinguish among the other hairs and bristles; the fronto-orbital bristles (*soies laterales* of Macquart) afford important characters in this family, and are sometimes very numerous, forming one or several rows. Among the *Tachinidæ* they afford secondary sexual characters. The facial bristles are also of importance here.

Pleural bristles. — They are represented by one or several prothoracic bristles above the front coxæ; by a number of mesopleural, and two, three, or four sterno-

pleural, the position of which may afford valuable generic characters. Most of the *Calyptrata*, except the *Anthomyiidae*, have a tuft or row of bristles on the hypopleura, a region which is destitute of them in the other families of Diptera.

The dorso-central region contains the usual four rows of bristles, more or less complete*; the dorso-humeral region one or several bristles on the humeral callus, two posthumeral, on the præsutural triangular depression, and a few other bristles, inserted in the interval between the humeral callus, the præsutural depression, and the outer row of the dorso-central region; these bristles I have called the *intra-humeral bristles*. In the *Anthomyiina* there are usually only two such bristles; one of them seems to be the homologue of the præsutural bristle of the *Acalyptrata*, and is inserted immediately above the præsutural depression; the other is in front of the former, near the humeral callus. In *Calliphora erythrocephala*, *Lucilia Cæsar*, &c., I perceive four such bristles that are more conspicuous than the others; three along the præsutural depression, the fourth near the humeral callus.

The dorso-alar region contains (usually) two posterior supra-alar bristles, inserted on the post-alar callus; the second of them, as usual among the *Acalyptrata* also, is placed immediately above the *alar frenum*; and a row of anterior supra-alar bristles, three or more, along the edge of the anterior supra-alar cavity. The other bristles of this region may be called the *intra-alar bristles*, and form a longitudinal series of two or three, between the supra-alar bristles and the outer row of the

* The outer row is called by Kowarz, "die inneren Dorsalborsten" (Die Dipterengatt. *Lasiops*. in den Mitth. d. Münchener Vereins, 1880, p. 125, note), because he applies to the *Muscidae* the terminology adopted by Mik for the *Dolichopodidae*. But I believe that, in a terminology generally applicable, it will be found much more convenient, even unavoidable, to distinguish the inner and outer pairs of rows of dorso-central bristles. When the inner rows are very much differentiated, as is the case in the *Dolichopodidae*, they may be called by the name proposed by Prof. Mik for them—acrostichal bristles. But it must be borne in mind that these bristles represent the inner rows of the dorso-central bristles in a great many Diptera; and that it is for this reason inconvenient to call "innere dorsal Borsten" that pair of rows which in reality is the outer. This is one of those cases where it seems to me a change in the nomenclature adopted by former authors becomes unavoidable.

dorso-central. They sometimes form a spurious, irregular row or series with the intra-humeral bristles of the dorso-humeral region.

The passage from hairs to bristles is so gradual among the *Calyptrata* that the number of bristles of a given kind is sometimes difficult to state, and sometimes variable in the same species, adventitious hairs assuming the proportion of bristles. The more hairy a species is, the more it seems liable to such variations.

In the *Æstridæ*, as an exception, the differentiation between the macrochætæ and ordinary hairs is feebly developed in some genera, and not at all in others.

Syrphidæ are aerial, and generally destitute of macrochætæ; the exceptions have been noticed on p. 501.

Myopidæ.—Macrochætæ almost undeveloped, hardly distinguishable from hairs or minor bristles; undistinguishable in *Conops*; in *Stylogaster* a pair of conspicuous vertical bristles, and distinct fronto-orbital ones.

Dolichopodidæ. — Only one (outer) pair of vertical bristles; a post-vertical is so placed that it may be interpreted as the inner vertical pair. Ocellar pair very high on the vertex, between the vertical bristles, and very conspicuous. Cilia of the posterior orbit (Loew); humeral (1), post-humeral (2), some intra-humeral (I.), distinct supra-alar and intra-alar bristles (II.). In the dorso-central region two dorso-central outer rows; two (sometimes only one—*Liancalus*) rows of small bristles representing the inner dorso-central rows, and which Prof. Mik has called the *acrostichal bristles* (Dipterol. Untersuch., Wien, 1878). On the pleura, in *Dolichopus*, a characteristic prothoracic bristle. (Prof. Mik observes “*Medeterus* has from two to six bristles here, one above the other”).

Asilidæ. — The cephalic bristles are indistinct among numerous hairs. A pair of ocellar bristles, and another pair (immediately behind) are sometimes discernible. A series of occipito-orbital (often plumose) bristles are homologous to the cilia of the posterior orbit (Loew) of the *Dolichopodidæ*. On the thorax, one (*Leptogaster*) or more præsutural bristles (I.) are characteristic; several supra-alar bristles on the post-alar callus (II.); and a number of intra-alar bristles (*Asilus*); in *Leptogaster*, a very characteristic single intra-alar bristle (II.). Often two longitudinal præscutellar rows of a few short bristles. On the pleuræ, sometimes a few mesopleural

bristles (*Laphria*), often hardly distinguishable from hairs, and a characteristic fan-like row of metapleural bristles. (Mik says that Loew called it *Haarschirm* in the *Empidæ*).

There is a mine of systematic characters yet to be explored in the study of the chætotaxy of the *Asilidæ*. As an instance I will cite *Dasygogon diadema* and *D. teutonius*, placed by Loew in the same ultimate subdivision of *Dasygogon* (*sensu stricto*). A glance at the chætotaxy of these species shows that *D. teutonius* has no bristles on the scutellum, while in *D. diadema* the scutellum is beset with 4—6 strong macrochætæ. A further examination reveals other abundant differences in the arrangement of the bristles on the thorax and the legs; it discloses at the same time other characters peculiar to each of the species,—in the shape of the abdomen, in the structure of the forceps of the male, &c.,—all of which tend to prove that these species belong to two very distinct genera. And yet when we read the descriptions (not excepting even those of Loew) we find almost nothing but colours mentioned. When Rondani (*Prodr.*, i., p. 157, and *Corrigenda*, iv., p. 7) introduced a new genus for *D. diadema* (*Cheilopogon*, afterwards called *Seilopogon*), he did so merely because this species has the 4th posterior cell closed; in consequence of which other writers have placed in that genus all the *Dasygogoninæ* with a hook on the anterior tibiæ, which have the 4th posterior cell closed, without any regard to other characters or to other genera which may have been previously established for such species.

Midaidæ.—They are entirely destitute of macrochætæ, and I have shown (*Berl. Ent. Z.*, 1883, p. 292) that, for this as well as for other reasons, the relationship between them and the *Asilidæ* is not as close as is generally supposed.

Empidæ.—The characteristic bristles are often, as in the *Asilidæ*, indistinct among other hairs; but whenever these are less dense, some of the bristles become easily recognizable; one larger humeral, and several smaller ones; post-humeral bristles; a fan-like metapleural row, similar to that of the *Asilidæ*, &c.

Bombylidæ.—It is only in a very few genera of this extensive family that the macrochætæ are differentiated in a more or less striking manner from ordinary hairs. Thus in *Toxophora* there is a number of conspicuous

macrochætæ on the thorax; but as their bases are hidden by other, shorter hairs, their homologies can only be guessed at; on the head there is an ocellar pair, but no other macrochætæ. In accordance with this, *Toxophora* is among the least aërial among *Bombyliidæ*; it has short wings, and remains most of the time on flowers. *Mulio obscurus* has many macrochætæ about the thorax, the nomenclature of which is as uncertain as that of the macrochætæ of *Toxophora*; the abdomen of *Mulio* also shows conspicuous rows of large bristles. The North American *Systropus*, although so little hairy that the macrochætæ would be easily perceptible, has none whatever. The same may be said of *Phthiria*. In the genera of *Anthraxina* and *Bombylina*, which form the bulk of the family, the dense hairiness or fur prevents us seeing any macrochætæ; still, traces of them may be occasionally seen; for instance, among the yellowish fur of some *Bombylii* a pair of black hairs are often visible above the root of the wing, which may represent supra-alar bristles; in *Anthrax flava* and congeners a tuft of macrochætæ exists on the post-alar callus.

Therevidæ.—With the species of *Thereva*, which are covered with a dense fur, we experience the same difficulty as with the *Bombyliidæ*; but that difficulty vanishes with the glabrous or subglabrous species, and here we at once observe much more marked homologies with the normal chætotaxy of the other families. There are none of the normal cephalic pairs of bristles; even the ocellar pair, elsewhere so persistent, is wanting. No humeral bristles; a row of three or four bristles, which must be considered as post-humeral, as they are inserted on the triangular præsutural depression (which is distinctly visible here, although it cannot exactly be called a depression). Two anterior supra-alar bristles (on the edge of the anterior supra-alar cavity), and one posterior (on the post-alar callus). Two pairs (sometimes only one) of præscutellar bristles, one exactly in front of the other. Four scutellar bristles.

Stratiomyidæ, *Tabanidæ*, *Leptidæ*, *Acanthomeridæ*, and *Xylophagidæ* (if such a family exists, of which I am by no means certain) are entirely destitute of macrochætæ, and form a natural group, the Diptera eremochæta *par excellence*. I have never met with a single instance of the presence of any macrochætæ in those families. This

character is important, and of easy application in some doubtful cases. Thus several forms described as *Xylophagi* may at once be recognised as not belonging there by the presence of macrochætæ (for instance, *X. brunneus*, Wied., which is a Therevid). On the contrary, *Lampromyia*, which has no macrochætæ whatever, is a Leptid, and not an Empid, as has been sometimes contended.

Nemocera. — All the families forming this artificial group are destitute of macrochætæ. The stouter hairs on the thorax and scutellum of *Culex*, and the bristles on the legs of the *Mycetophilidæ* can hardly be considered as such.

The *Culicidæ*, *Chironomidæ*, and *Tipulidæ* are distinguished by the development and the sexual differentiation of the antennæ, which are in this case very probably the principal organs of orientation (as I have shown above, on p. 500). The same conclusion may perhaps be arrived at with regard to the *Cecidomyidæ* and *Mycetophilidæ*.

It is worthy of notice that *Simulidæ* and *Bibionidæ*, remarkable for the great sexual differentiation in the structure of head and eyes (holoptic males; differentiation between upper and lower facets), execute aerial dances, implying a power of regulating their flight.

The *Blepharoceridæ* may be placed in the same group. I have observed *Rhyphus* (holoptic male) performing a similar dance, which consists in a slow flight up and down with outstretched legs. In all these cases we see a confirmation of the connection I have adverted to above between holoptic eyes, the power of regulating the flight, and aerial life and dances.



PROCEEDINGS
OF THE
ENTOMOLOGICAL SOCIETY OF LONDON
FOR THE YEAR 1884.

February 6, 1884.

J. W. DUNNING, Esq., M.A., F.L.S., &c., President, in the chair.

The President appointed Sir Sidney S. Saunders, Mr. F. P. Pascoe, and Mr. R. Meldola as Vice-Presidents for the year.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Members.

Edward B. Poulton, Esq., M.A. (Wykeham House, Banbury Road, Oxford), and S. Prout Newcombe, Esq. (Northcote, East Croydon), were balloted for and elected Members of the Society.

Exhibitions, &c.

Mr. P. Crowley exhibited eggs, larval galleries, pupæ and imagos of *Castnia eudesmia*, Gray. The specimens had been lately received from Valparaiso by Mr. Watkins. The eggs greatly resembled grains of white wheat in size and colour; the larval galleries (so-called cocoons) appeared to consist of silk and sawdust, and were exceedingly tough and hard; they were from one foot to sixteen inches long and about four inches in circumference; in some instances they were very closely adherent to the spiny leaf of the food-plant (*Pourretia coarctata*); the empty pupa-case protruded from the side of these galleries, after the manner of a *Cossus* pupa, which it much resembled.*

* The metamorphoses of this species have been described and figured by Philippi, Stett. Ent. Zeit., xxiv. (1863), pp. 337—341, pl. iii.; cf. Westw., Trans. Linn. Soc. (2), i., 164; pl. xxviii., figs. 1—4.—[W. F. K.]

Mr. G. C. Champion said the *Pourretia* was very common in Central America, being largely used as a hedge plant, and locally known as "pinuela."

Mr. W. F. Kirby exhibited a beautiful coloured photograph of the abnormal *Samia*, which was bred by M. Alfred Wailly (*cf.* Proc. Ent. Soc. Lond., 1883, p. xxvii).

Mr. H. T. Stainton called attention to the life-history of *Aglossa pingualis*, Linn., as lately worked out by the late Mr. Buckler (Ent. Mo. Mag., xx., 193), showing that the lard- and butter-eating capabilities of the larva, with its special adaptation for such a mode of life, were merely a fable, which had been fully accepted as a fact from the days of De Geer and Réaumur to the present time. In answer to a question from Mr. Fitch, Mr. Stainton said that Mr. Buckler was likewise acquainted with the larva of *Aglossa cuprealis*, Hübn., but how far its history had been written he did not know.

The Secretary exhibited photographs of the upper- and under-side of the female *Hypocephalus armatus*, Desm., on behalf of Dr. D. Sharp, and read the following note:—

"The accompanying photographs have been sent to me recently by M. Antoine de Lacerda, of Bahia, and appear to represent the female sex, hitherto unknown, of the interesting beetle *Hypocephalus armatus*. So far as can be gathered from these photographs of a mutilated example, it appears that the female greatly resembles the other sex, but that the prothorax is proportionally only about half as long, and that the enormous hind legs of the male are replaced by limbs of a considerably less exaggerated, though similar, type. The supposition has been entertained that the female of this insect might prove to be very different to the male, and offer further evidence as to the position in classification of this much-discussed insect. As regards the latter point, I may remark that the sexual differences are quite such as we might expect to find in an aberrant Prionid, and that they are therefore some additional evidence that Lacordaire was correct in his views as to the position of *Hypocephalus*. M. de Lacerda informs me that this species occurs in the interior of Bahia, and that specimens have to be obtained through the aid of ignorant and unobservant people, and therefore little information can be given as to its habits; but it is said to be found crossing roads and paths after showers in summer. The female from which the photographs have been taken was probably picked up dead."

The Secretary referred to Bull. Soc. Ent. France, 1883, p. cxlvi; Bull. Soc. Ent. Belgique, 1884, p. liii; and to M. Fairmaire's note, with figures, in 'Le Naturaliste,' p. 397.

Mr. F. P. Pascoe exhibited selections from a collection of *Curculionida* from New Guinea, consisting of specimens collected by D'Albertis and

others, comprising upwards of three hundred species, of which probably one half were undescribed.

The President observed that, with a view to the fertilization of clover, the agriculturists of New Zealand have for some time been anxious to import humble-bees into their colony; previous experiments having failed, Mr. Nottidge, of Ashford, had been endeavouring to supply the want. Impregnated humble-bees are often found in a state of torpor, hiding in holes in banks and hedgerows when the process of hedging and ditching was carried on in November and December. Mr. Nottidge advertised for specimens, offering a small sum for every living queen; and the result was that he was able to dispatch to Christchurch, N. Z., a parcel of twenty impregnated queens on the 13th December, 1883, and a lot of sixty on the 10th January, 1884. Each queen was packed in dry moss, and placed in a separate box, with a cake of candy in case of the temperature on the voyage rising to such a height as to revivify them, but with instructions to keep them at about 40°. The humble-bees were sent in ships fitted with refrigerators for the carriage of meat, and it was hoped that by maintaining a temperature not exceeding 40° they would remain in a semi-torpid state until their arrival in the colony. The success of the experiment remains to be seen; but it will be tried on a larger scale at the end of the present year.

The President said that he had just received the first part of the Transactions of the Huddersfield Naturalists' Society, which contains "A Catalogue of the Lepidoptera found in the Huddersfield District," by Messrs. Mosley and Porritt. The list includes 666 species. In his introductory remarks on the Macro-Lepidoptera, after mentioning that those marked as having been taken by Mr. Inchbald were captured from about 1855 to 1870, Mr. Mosley adds:—

"Many of the latter gentleman's captures were in the district about Storthes Hall, and Mr. Alfred Beaumont and Mr. J. W. Dunning can corroborate many of the records. Since that time great changes have taken place, and the young collector must not now expect to go straight to certain localities and take certain species, for many are now no more. It is very strange to reflect upon a great number of species which, during the period referred to, were common or even abundant in the pastures between Castle Hill and Farnley Tyas, such as several of the Ringlets, Skippers, Blues, and at other places Burnets and Foresters absolutely swarmed, all of which are now entirely gone."

The President added that he could certainly corroborate most of Mr. Inchbald's records, but the last year in which he (Mr. Dunning) collected in the Huddersfield district was 1850; and the extinction of so many common species since that time was certainly remarkable. Thus *Anthocharis cardamines*, "used to be common behind Castle Hill about

twenty years ago, but now entirely disappeared"; *Vanessa urticæ*, "was abundant throughout the district twenty years ago, but now only occasional stragglers are seen"; *Vanessa Io*, "common formerly, but now rare"; *Satyrus Aegeria*, "formerly on Castle Hill side, now entirely disappeared"; *S. Megæra*, the same; *S. Janira*, "very common at Almondbury and Castle Hill up to within the last ten or fifteen years, but now disappeared"; *S. Hyperanthus*, and *Chortobius Pamphilus*, "formerly at Farnley"; *Lycæna Alexis*, "Mollicar pastures, formerly"; *L. Argiolus*, "used to be taken freely among the holly-bushes about Storthes Hall and Carr Wood, but now extinct there"; *Hesperia Tages*, "formerly in Storthes Hall fields"; *Procris statice*, "used to occur commonly in a field near Lepton Great Wood, but not seen for last twenty-five years" (it was common at Storthes Hall about 1848); *Zygæna loniceræ*, "along with last, but now gone"; *Euchelia jacobææ*, "used to be found in fields at the bottom of Kirklees Wood, and at Lumb; now gone"; *Chelonia plantaginis*, "formerly abundant on Crosland and Norland Moors; a few still exist on Norland Moor"; *Liparis salicis*, "formerly in King's Mill Lane; now entirely gone"; *Orgyia pudibunda*, "formerly, Storthes Hall"; *Bombyx rubi*, "formerly common on Crosland and Norland Moors; now extinct"; *B. quercus* = *callunæ*, "extremely abundant on Crosland Moor up to about 1873, but not seen recently"; *Saturnia carpinii*, "used to be common on Crosland Moor"; *Trachea piniperda*, "used to be common in fir woods at Storthes Hall"; *Agriopsis aprilina*, "used to occur, not unfrequently, at Storthes Hall; not seen of late years"; *Heliodes arbuti*, "Castle Hill side; not seen there recently"; *Euclidia mi* and *glyphica*, "formerly"; *Phytometra ænea*, "formerly on Castle Hill side"; *Nyssia hispidaria*, "used to be taken in wood at top of Storthes Hall Lane, also in Mollicar and Honley Woods, but not seen of late years"; *Asthena candidata*, "not seen recently"; *Acidalia incanaria*, "not seen of recent years"; *Abraxas ulmata*, "used to swarm in Birks Wood, Woodsome, about twenty years ago, but now not found there; since then single specimens have been taken in the town, and at Clare Hill"; *Hybernia leucophearia*, "Storthes Hall and Woodsome, formerly"; *Eubolia mensuraria*, "used to be in profusion in old pastures behind Castle Hill"; *Emmychia octomaculalis*, "Mr. J. Varley used to take this pretty species in plenty in Dungeon Wood and Spring Wood, but it had been quite lost for many years until 1882, when it was reported as having been seen in Dungeon Wood." Could it be that all these thirty prominent species have really disappeared from the district in so short a time? if so, what is the cause of this disappearance? and have other species taken their place?

Mr. Alfred Beaumont said that the disappearance of many species from the Huddersfield district during the last twenty or thirty years was an indubitable fact; and he attributed it principally to the smoke consequent

upon the growth of the town and the increase in the number of mills outside it. Moreover, the district included in the list was of small extent, say five or six miles round the town; if a radius of ten or twelve miles were taken, probably most of the missing species would still be found within those limits.

Mr. J. Jenner Weir expressed his belief that butterflies were everywhere in Britain considerably scarcer than was the case thirty years ago, and this quite irrespective of the influence of bad seasons. He especially instanced *Aporia cratagi*, which used to occur in numbers in Sussex, but he had only met with a single specimen since 1840; twenty years ago this butterfly was exceedingly common in the New Forest, but now it was almost entirely confined to a very few localities in the western part of the forest; he had no doubt Mr. H. Goss, who was present this evening, could fully confirm this.

Mr. A. E. Hudd said that certainly in the West of England butterflies generally were much rarer than they used to be; he drove from Bristol to Llangollen last July in beautiful weather, and did not see a single butterfly during the journey.

Mr. C. O. Waterhouse said these opinions quite expressed his own views as to the rapid decrease in our British butterflies, and he hoped that the publication of these opinions would have some weight in deterring enthusiastic collectors from capturing every possible specimen of any butterfly they might meet with.

The Secretary read the following report:—

To the Council of the Entomological Society of London.

“GENTLEMEN,—We the undersigned, re-appointed a Committee to further examine into and report upon the supposed presence of *Phylloxera vastatrix* on vines in the Colony of Victoria, have the honour to present the following Report:—

“In a former Report, submitted to the Council on June 1st, 1881, we, and our colleague, Mr. Roland Trimen (who is no longer in England), stated that the evidence then before us did not appear conclusive as to the existence of *Phylloxera* in the Colony, and we urged that the Colonial authorities should forward to the Society specimens of the creatures (believed in the colony to be *Phylloxera*), mounted as microscopic slides; and also vine-roots, supposed to be attacked, preserved in alcohol. The latter has lately been done, and two bottles, containing such roots, have been received through Sir Joseph D. Hooker, K.C.S.I., C.B., F.R.S., &c., accompanied by a copy of a letter dated ‘Melbourne, 24th September, 1883,’ from the Hon. James Service, Premier of Victoria.

“We have carefully examined these roots, and regret to be obliged to report that the *Phylloxera* is undoubtedly present upon them, and in some numbers.

“In the Premier’s letter it is stated that all the vines supposed to be infested have been dug up and destroyed, and that the roots sent are some of those that remained in the ground from vines so destroyed. Furthermore it is stated that the insects on the roots are in the first stage of development, and that others, more advanced, will be forwarded at a later date.

“We find that the insects now examined are mostly very small; but there are a few considerably more advanced, and more than half grown.

“The roots left in the ground after the destruction of the vines no doubt retain their vitality for a considerable period, and so long as any vitality exists the insects will no doubt continue to live and breed upon them. This is a very serious matter, and we strongly advise that all ground upon which vines believed to be infested have been grown, should be dug out to a depth sufficient to eradicate all the roots, and that the soil be carted away and thoroughly burnt; or, if possible, the ground may be submerged for a considerable time (though we doubt the efficacy of this); or, failing the practicability of either of these suggestions, that the ground be copiously saturated with some one of the chemical preparations (such as bisulphide of carbon) used in France in such cases. In addition to this we should strongly recommend that plots of land upon which vines believed to have been infested have grown, should not again be used as vineyards until after the lapse of several years.

“We ask you to cause a copy of this Report to be sent to Sir Joseph Hooker, and have the honour to remain,

Your obedient Servants,

ROBERT McLACHLAN, F.R.S.

EDWARD A. FITCH, F.L.S.

London, 7th January, 1884.”

The Secretary read a communication from Prof. Thistleton Dyer, of the Royal Gardens, Kew, acknowledging the receipt of the report, with an expression of Sir Joseph Hooker’s thanks for the same. A copy of the report had been sent to the Agent General of Victoria.

Papers read.

Mr. J. W. Douglas communicated a paper “On a new species of the genus *Orthezia*” (*O. manariensis*), received from M. J. Lichtenstein, who obtained it from Montecristo, where it was found on *Erica arborea*. Drawings of the insects were exhibited.

Sir Sidney S. Saunders communicated some “Further notes on the Capricification of domestic Figs, with reference to Dr. Paul Mayer’s comments thereon.”

New Part of ‘Transactions.’

Part V. of the ‘Transactions’ for 1883 (Index, &c.) was on the table.

March 5, 1884.

SPECIAL GENERAL MEETING.

J. W. DUNNING, Esq., M.A., F.L.S., &c., President, in the chair.

Pursuant to a requisition presented to the President and Council, and in accordance with chapter xix. of the Bye-Laws, a Special Meeting was convened for this day, to consider the desirability of obtaining a charter incorporating the Society.

Prof. Westwood, Hon. Life-President, proposed :—

“That it is desirable to obtain for the Society a Royal Charter of Incorporation.”

Mr. Stainton seconded the proposition.

The meeting was addressed by Mr. Verrall, Mr. M'Lachlan, Mr. Slater, and the President.

On being put to the vote, the proposition was carried *nem. con.*

ORDINARY MEETING.

Prof. J. O. WESTWOOD, M.A., F.L.S., &c., Hon. Life-President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Members.

The Rev. Alfred Fuller, M.A. (East Pallant, Chichester), and Hamilton' C. J. Druce, Esq. (43, Circus Road, St. John's Wood, N.W.), were balloted for and elected Members of the Society.

Exhibitions, &c.

Mr. E. A. Fitch exhibited a large geodephagous larva (probably belonging to a *Leistus* or a *Nebria*), which had recently been raised by a young man at Maldou who was suffering from bronchitis.

Mr. J. W. Dunning called attention to a paper entitled “Description of a *Pieris* new to science—*Pieris Spilleri*, mihi,” by A. J. Spiller, published in ‘The Entomologist,’ vol. xvii., p. 62. The species was taken in Natal in 1881 by Mr. Spiller, and he seems to have taken some pains to ascertain that it was nondescript :—“I beg therefore to name it after myself.” The practice of naming a new species after its captor, simply because he first captured it, was to be discouraged : “names taken from persons should not be lightly applied ; this distinction should be reserved for those whose works and scientific labours give them a claim to the admiration of posterity.” The story, at once ludicrous and melancholy, of *Æcophora Woodiella*, as narrated by Mr. Sidebotham (Entom., xvii., 52), should be a warning to nomenclators against the hasty imposition of personal names. If the

attempt of one entomologist by this means to confer honour (often undeserved) upon another may be excused, what can be said for the man who is not content to wait till the compliment is paid him by another, but insists upon crowning himself? The President believed the case to be without precedent, and, as it was certainly a departure from good taste, he trusted Mr. Spiller would not find an imitator.

Whilst on the subject of paronymic nomenclature, the President desired to enter a protest against such grotesque barbarisms as *Huxellhydrus*, *Tyndallhydrus*, *Darwinhydrus*, and *Spencerhydrus*, which met his eye on perusing the pages of the 'Zoological Record' for 1882. Those monstrosities are due to Dr. David Sharp, and are published in the Scientific Transactions of the Royal Dublin Society. It might be doubtful which was the most to be pitied, the poor water-beetles, or the eminent men whose names Dr. Sharp had thus profaned. If done in ignorance it might have been passed over in silence; but in Dr. Sharp's case it could only be that he has sinned from eccentricity prepense. Such hideous and unmeaning forms only tend to bring scientific nomenclature into contempt. It was puzzling to imagine how any educated man (*vel doctus, vel doctor*) could deliberately write, much less print, such names; and still more, how any scientific Society could allow them to appear in their Transactions.

Mr. R. M'Lachlan said that the Dublin Society had no choice in the matter, as the names in question were published in the 'Comptes rendus de la Soc. Ent. de Belgique' for 1880. See also Ent. Mo. Mag., xvii., 187, where it is suggested that "the most egregious of the horrors" were brought forward merely to show Dr. Sharp's contempt for nomenclators.

Mr. H. J. Elwes protested against the custom adopted by Mr. Moore and others of using Hindoo mythological names; they were more difficult to remember than any other names he had met with.

Mr. F. P. Pascoe remarked that there was the difficulty of spelling as well as of remembering any barbarous names; we were accustomed to names with a Greek or Latin derivation, and he thought that no others should be used.

Mr. R. M'Lachlan thought that we should not argue too much from our own insular predilections; what we should often consider a barbarous name would be quite familiar to a Russian, and *vice versâ*.

Prof. Westwood recommended a study of the principles laid down in Linné's 'Philosophia Botanica' and in Fabricius' 'Philosophia Entomologica' to all nomenclators. He thought a Hindoo god as worthy of having an insect named after it as any of the Greek or Roman gods or goddesses.

Papers read.

Mr. E. Saunders read the concluding part of his "Synopsis of the British Hymenoptera Aculeata—Part III. *Apidae*." Also "Further Notes on the terminal segments of Aculeate Hymenoptera."

April 2, 1884.

J. W. DUNNING, Esq., M.A., F.L.S., &c., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Members.

Edward Pyemont Collet, Esq. (76, Islip Road, Kentish Town, N.W.), Stanley Edwards, Esq. (Kidbrook Lodge, Blackheath, S.E.), F. Lovell Keays, Esq., F.L.S. (Fairmile Court, Cobham, Surrey), Edmund Shuttleworth, Esq. (8, Winckley Square, Preston), and John A. Finzi, Esq., formerly a Subscriber, were balloted for and elected Members of the Society.

Exhibitions, &c.

The President read a letter received from Mr. A. J. Spiller.

Mr. T. R. Billups exhibited specimens of *Sigalphus obscurellus*, Ns., and *Diospilus oleraceus*, Hal., bred from the cabbage-stem galls of *Ceuthorrhynchus sulcicollis*. Mr. Billups believed that the former species emerged from the galls, whilst the latter species emerged from the earth-cocoons made by the weevil larvæ. Specimens of *C. sulcicollis*, Gyll., its cocoons, and gall were also exhibited.

Mr. J. Jenner Weir remarked that he had found it impossible to grow any of the cabbage-tribe in his garden, owing to the amount of "club" resulting from the attacks of this weevil; the only remedy he had found to be at all efficient was the free use of gas-lime.

Mr. Billups also exhibited three specimens of *Dimeris mira*, Ruthe, captured at Headley Lane last January; and two specimens of *Ceroptres arator*, Hart., bred from the galls of *Cynips Kollari*. Also a long series of the very local *Philonthus thermarum*, Aubé, taken from a cucumber-frame on the West Ham marshes.

Mr. H. Bedford Pim remarked that he had captured twenty specimens of *P. thermarum* in a hotbed at Dulwich last year.

The Rev. Alfred Fuller exhibited an interleaved copy of the first volume of Stainton's 'Manual,' containing several early figures of larvæ made by the late William Buckler. He also made some remarks on the thoroughness of the work done by his late friend, stating that not a figure would be admitted into his work until he was satisfied of its likeness (many specimens being repeatedly sketched before a figure was thought satisfactory), and not until the complete life-history had been worked out.

The President alluded to the pleasure it gave him to hear that the Ray Society had procured Mr. Buckler's drawings. Mr. Fuller's remarks, from a twenty-five years' knowledge of his work, were but another testimony to its

great value. He trusted the publication of the volumes—whether three or four—would not be delayed.

Papers read.

Sir Sidney S. Saunders read a paper, "On the *Pediculus melittæ* of Kirby, and its affinities with reference to the larva of *Meloë*." This was illustrated by the exhibition of many microscopic preparations of the specimens referred to in the memoir, and by an exhibition of many thousand specimens of the yellow larvæ of *Meloë*.

Mr. H. J. Elwes read a paper, "On the Genus *Parnassius*," especially referring to the remarkable form and development of the anal pouch in the females as a specific character, to the geographical distribution of the species of the genus; and made some remarks on their life-history. Edwards' and Burmeister's writings on the genus were referred to, and Mr. Elwes commented on the remarkable fact that almost every systematic writer except Boisduval had entirely overlooked the presence of the anal pouch. Mr. Elwes illustrated his remarks by numerous diagrams, and by the exhibition of specimens of every known species and form occurring in the genus. A discussion followed, in which Messrs. Dunning, Fitch, Weir, Kirby, Pascoe, and Slater took part.

Mr. E. Meyrick read a further paper on the classification of the Australian Pyralidina, treating of the families *Musotimidæ*, *Botydidæ*, and *Scopariidæ*. He remarked that only forty per cent. of the *Botydidæ* were endemic, whereas the general average in all other groups, except the butterflies, was about ninety per cent.

Lord Walsingham communicated a paper on "North American Tortricidæ."

May 7, 1884.

J. W. DUNNING, Esq., M.A., F.L.S., &c., President, in the chair.

The President feelingly alluded to the loss the Society had sustained since their last meeting through the death of their Vice-President, Sir Sidney Saunders, who was then present and read a paper to the Society. He made some remarks on Sir Sidney's life and works, and said it was the second time it had fallen to his lot to announce the death of a Vice-President in harness; now it was "one of the oldest and worthiest of our colleagues, and one who with a genuine love of Science combined the courtesy and kindness of a gentleman."

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Members.

W. H. Patton, Esq. (Waterbury, Connecticut, U.S.A.), and William White, Esq. (Morden House, 55, Highbury Hill, N.) were balloted for and elected Members of the Society.

Exhibitions, &c.

Mr. W. F. Kirby exhibited a remarkably small and dark variety of *Samia Cecropia*, Linn., bred by M. Alfred Wailly.

Mr. C. O. Waterhouse exhibited an Aphis from apple, and a large *Aphidius* bred therefrom, the cocoon of the parasite being formed underneath the body of the Aphis. Also, on behalf of the Rev. F. A. Walker, three dragonflies, captured in the island of Rhoda, opposite Cairo. Mr. M'Lachlan identified these as a male *Crocothemis erythræa*, Brullé, and a pair of *Trithemis rubrinervis*, Selys.

Mr. T. R. Billups exhibited upwards of sixty specimens of Hemiptera, captured at Headley Lane on January 14th last. The collection included the following species:—*Metacanthus punctipes*, Germ., *Tropistethus holosericeus*, Hahn, *Peritrochus puncticeps*, Thoms., *Drymus sylvaticus*, Fabr., *Stygnocoris sabulosus*, Schill., *Cymus clavicornis*, Fall., *C. glandicolor*, Hahn, *Monanthia costata*, Fabr., *M. cardui*, Linn., *Acalypta parvula*, Fall., *Piezostethus cursitans*, Fall., and *Anthocoris sarothamni*, D. & S.

The Secretary, on behalf of Mr. Samuel Stevens, exhibited specimens of *Andrena fulva*, Schr., and read a note referring to their destructive habits to a garden-lawn at Upper Norwood, "by burrowing in the grass and throwing up small mounds of mould all over the lawn." Mr. M'Lachlan and Mr. Waterhouse said they had been consulted as to means of remedying similar evils caused by this bee, and Mr. Waterhouse further remarked that it was particularly abundant this spring in his own garden at Wandsworth.

Mr. A. S. Olliff exhibited a new species of *Helota*, an Eastern Asian genus, collected in Angola by Dr. Welwitsch; he proposed to describe it under the name *Helota africana*. Mr. Olliff said that Lord Walsingham had pointed out to him a similar and equally unexpected case of geographical distribution in the genus *Deuterocopus* of Zeller, belonging to the *Pterophoridaæ*, which up to this time had only been known from Java, and of which he has lately received an undescribed species from Bathurst, West Africa.

Mr. E. A. Fitch exhibited specimens of *Isosoma orchidearum*, Westw., bred from insect-affected shoots of *Cattleya Trianae*, sent to him by Mr. R. P. Percival, of Southport. The affected shoots were exhibited, also specimens of swollen rootlets which bore evidence of insect attack, but from which at present nothing had been bred. Mr. Fitch remarked that he still believed the *Isosoma* to be parasitic on some other insect, which was the

destructive species—probably some dipteran, because the seven specimens of the *Isosoma* bred had emerged from one small hole in a shoot (exhibited). Mr. Percival also noticed a difference in the larvæ, remarking “that those in the roots are of a yellow colour, and those in the growth whitish-looking; they also vary in size.” Mr. Fitch had not examined the larvæ, being anxious to determine the resulting imagos; he attributed his failure in breeding the *Isosoma* host to the fact that he had great difficulty in keeping the shoots fresh, as Mr. Percival, being an orchid-grower, had of course cut off the affected parts directly they were noticed.

Mr. M'Lachlan expressed his belief in the parasitic habits of the *Eurytomidæ*. He also called attention to the volume recently issued by the Ray Society, now on the table, “British Oribatidæ, by Albert D. Michael,” noticing its chief points of excellence, and remarking that such a work did honour both to the Society and to the author. Mr. Pascoe (who said Mr. Michael always drew his figures from two specimens, one living, and one dead and mounted), Mr. Waterhouse (who said Mr. Michael had presented a beautiful series of his types to the Trustees of the British Museum), and Mr. Dunning (who could not believe that the volume only represented five years' work), all bore testimony to the great value of the work, and to the remarkable figures of the internal anatomy of such minute mites.

Mr. A. G. Butler communicated the following note:—

Note on the North American Genus Hemileuca. By A. R. GROTE.

“The genus *Hemileuca*, established by Walker in the British Museum Lists, has for its type the Bombycid moth *Maia* of Drury, a black and white Spinner with curious dark red tuftings of hair at the end of the body, most noticeable in the male. The moth is distributed over the eastern portion of North America, and is in certain localities, such as New Jersey, and again in Illinois and Missouri, tolerably abundant; being easily roused to flight in the daytime. The normal colour of the wings or the ground colour may be considered to be black, with a white median band more or less irregular, and enclosing the discal marks drawn across both pairs. The specimens vary in the density of wing-vestiture, some being very crape-like in appearance and thinly scaled. A number of subspecies have been erected, some of which, like *Nevadensis*, may still intergrade with the typical form; others, like *Yava-pai* and *Grotei*, seem more stable in their characters. But the probability is that they are all more or less nearly related to the typical form, the insect being in reality plastic and readily accommodating itself to variation. An examination of a number of the subspecies has shown me that the antennæ retain the colour of those of *Maia*, and thus give a hint of the parentage of these apparently differing forms. And this is true of the curious form called *Euleucophaeus tricolor* by Dr. Packard, who makes it the type of a different

nus. But this moth, in all and every structural particular, agrees with *Maia*. In the similarly-coloured antennæ we have the permanent character of *Hemileuca* still persistent. But the wings have become dusty grey or whitish, an undefined colour borrowed perhaps from the arid plains of Utah, where the moth lives. Dr. Packard suggests this reason for its peculiar colour, but, having compared the mouth-parts, feet and head, and neuration, I can find no reason for separating the moth under a new genus. It must be called *Hemileuca tricolor*. The red tuftings are persistent on the body also, as well as the antennal peculiarity. In another form from Arizona there is a wider divergence from the *Maia* type. The red tuftings still appear in this species, which is called *Argyrauges Neumægeni*. But the antennæ are different in colour, and the head is no longer so sunken as in *Maia*. The ornamentation is modified, and departs more widely from the type of *Maia* than any of the other forms here mentioned. While there is every probability that in *H. tricolor* we have to do with a bleached form, belonging structurally to the type of *Maia*, we may consider *Neumægeni* to be distinct enough to form a different genus. In classifying it as a species of *Euleucophaus*, its describer was evidently led by its white colour to associate it with *tricolor*."

Mr. W. L. Distant said that this once rare moth was now common since its larva had been discovered; a correspondent of his had bred it commonly, and he hoped that it would become acclimatized in this country; the eggs which had been sent to him had hatched before the oak-leaves appeared, but he hoped to retard their development so as to obviate this difficulty next year.

Paper read.

Mr. A. G. Butler communicated a paper, "On the Lepidopterous genus *Cocytia*," remarking on the two already known species (*C. Durvillii*, Boisd., and *C. chlorosoma*, Butl.), and describing a new species (*C. Veitchii*) somewhat intermediate in character between them.

New Part of 'Transactions.'

Part I. of the 'Transactions' for 1884 was on the table.

June 14, 1884.

J. W. DUNNING, Esq., M.A., F.L.S., &c., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Members.

Capt. Richard Holt (Heathfield Lodge, Granville Road, Wandsworth, S.W.) and W. F. de Vismes Kane, Esq., M.A., M.R.I.A. (Sloperton Lodge, Kingstown, Ireland) were balloted for and elected Members of the Society.

Exhibitions, &c.

Mr. G. Coverdale exhibited a box containing many Micro-Lepidoptera and several Macros set, on pith with gum, without pinning, according to his new process, described in the 'Entomologist' for June (xvii. 131). Messrs. Dunning, M'Lachlan, and Fitch made some remarks thereon.

Mr. R. M'Lachlan exhibited galls on the roots of various species of *Cattleya*, similar to those exhibited at the last meeting which produced *Isosoma orchidearum*, Westw., which had been received from the Hon. and Rev. J. T. Boscawen. He also exhibited the extraordinary heliciform lepidopterous larva-cases from East Africa—about 200 miles inland from Zanzibar—which he had described and figured in Ent. Mo. Mag., vol. xxi., p. 1; also, from the same locality, several other cases of *Psychidæ*, one species bearing a remarkable resemblance to a *Dentalium*; and an egg-case, probably of a Mantis, very similar to those exhibited at the last December meeting but not identical, these being neither so large nor so delicate and transparent.

Mr. M'Lachlan also exhibited nearly 100 microscopic slides of British Aphides, prepared by the late Francis Walker in 1847, which had been presented to him by Mr. P. Hubert Desvignes, son of the late Mr. Peter Desvignes, who was one of the original members of the Society; these slides evinced great care and skill in microscopic mounting, considering that nearly forty years had elapsed since they were prepared.

Mr. T. R. Billups exhibited several specimens of *Cremastogaster scutellaris*, Oliv., captured while running about on the pavement of Church Street, Greenwich. As there was a cork importers in the immediate neighbourhood of the capture, and as the ants commonly nested in bark, their presence was not difficult to account for.

Mr. W. C. Boyd exhibited some remarkably fasciated strawberry plants from his garden at Cheshunt; it was thought that the attacks of a *Phytoptus* had caused the abnormal growth.

Mr. W. H. Patton communicated the following—

Some Notes on the Classification and Synonymy of Fig-Insects.

Being unable to accept the views as to the position of the *Agaonidæ* expressed by Sir S. S. Saunders in the valuable memoir published in our 'Transactions' for 1883, I present to the Society the reasons, as briefly as possible.

Sir S. S. Saunders' arguments (Trans. Ent. Soc. Lond., 1883, pp. 10—20) for placing the *Agaonidæ* in the *Cynipidæ*, aside from showing the relationship of these groups in the ovipositor and ventral valve (characters which are not distinctive of the family) prove nothing, for he shows no unity in the antennæ and wings, the fig-insects agreeing with the *Chalcididæ* in these organs. In the slight curve of the ovipositor the fig-insects clearly resemble the Chalcids more than the Cynipids; but it is useless to argue this point, for there is no essential difference in the ovipositor of the two families, the structure and general form of the ovipositor being alike in both, as a comparison of *Cynips* and *Eurytoma* will readily show.

Regarding Sir S. S. Saunders' observation that the ovipositor of the *Agaonidæ* differs from that of *Callinome* in having the fifth ventral segment serve as the ventral valve, it may be said that he has himself ably shown that the ovipositor arises in this position in *Halticella* and *Idarnella*, which go with *Callinome* in the *Chalcididæ*. His new genera show an important character in having the fifth ventral segment form the tip of the abdomen, but it should be noted that in *Cynips* itself, however it may be in *Rhodites* and the Figitides, this segment is not prolonged, but is like that of *Halticella*.

The *Cynipidæ* have straight, slender antennæ, with never less than thirteen distinct joints. The *Agaonidæ* have elbowed, more or less clavate antennæ, with never more than twelve joints. In the Sycocolacides, as in some other *Chalcididæ*, there are, it is true, thirteen joints in the elbowed antennæ of the female; but to count this number we must enumerate the annulations of the club, as in *Sycophaga*, and also the annulations between the second and third joints proper, as in *Idarnodes*. In the *Cynipidæ* the wings have the radial and cubital cells complete, except in a few genera, like *Onychia*, in which these cells are still distinctly outlined and the basal transverse vein present. In the fig-insects no wing-cells are formed. The peculiar dentate claspers of male *Agaonidæ* are like those of *Chalcididæ*, but the *Cynipidæ*, as far as known, have claspers of the form usual in other families of Hymenoptera.

The elbowed antennæ and absence of closed wing-cells are the characters distinctive of the *Chalcididæ* with respect to the *Cynipidæ*, and these characters exclude the fig-insects from the *Cynipidæ*. The venation of *Eupristina*, which Sir S. S. Saunders cites as an exception, is as distinctly Chalcidian as that of *Chalcis* itself, and bears not the slightest resemblance to that of any Cynipid. A wingless male is unknown among the gall-flies, while in the *Chalcididæ* we already had *Anthophorabia*.

The following characters define the *Agaonidæ* :—

Female. Head with two longitudinal grooves and with recurved occipital spine. Mandible with a serrate appendage. Mentum with leaf-like appendage. Antennæ 10—12 jointed; 3rd joint produced externally into a spine

(in *Eupristina* and *Blastophaga* a joint appears between the 2nd and 3rd of the other genera, making the produced joint count as the 4th). Abdomen oval and cylindric, or tapering and compressed; 5th ventral segment elongate, cultriform; ovipositor exerted. Wings developed; venation Chalcidian.

Male. Mandibles short, bidentate; palpi obsolete. Antennæ short, 3—7 jointed. Abdomen with the four basal joints swollen; the following joints slender and tubiform; claspers represented by two divergent dentate appendages. Wings wanting.

These characters exclude the *Haplostomata* of Saunders, a group which may prove to be parasitic. They have not the peculiar characters of the veritable seed-feeders. Should they prove to be sycophagous the term *Sycophagides* should be retained for them, as the genus *Sycophaga* is included; otherwise Saunders' term *Sycocolacides* may be employed.

Francis Walker's descriptions of fig-insects in the 'Entomologist' of January, 1875, which have appeared so unsatisfactory to recent students, admit of ready explanation if we bear in mind that they were not communicated for publication by Mr. Walker himself, but were found among his papers and published after his death. They bear internal evidence of having been written before Part IV. of his 'Notes on Chalcidiæ' was published (1871), and a comparison of the descriptions in the two publications shows that he had not intended to publish these 'Entomologist' descriptions at all, as they are mere duplicate or synonymous descriptions of those published in the 'Notes,' and are based on the same specimens. The synonymy is as follows:—

SYCOPHILA, Walk., 1871 (= *Pseudisa* and *Isanisa*, Walk., 1875).

SYCOPHILA MEGASTIGMOIDES, Notes, p. 64 = *Pseudisa smicroides*, Entom. viii. 15.

SYCOPHILA DECATOMOIDES, Notes, p. 64 = *Isanisa decatomoides*, Entom. viii. 16.

SYCOBIA, Walk., 1871 (= *Agrianisa*, Walk., 1875).

SYCOBIA BETHYLOIDES "♀", Notes, p. 60 = *Agrianisa myrmecoides*, Entom. viii. 17.

Walker's description of the petiole in *Agrianisa* as "extremely developed, longer than the metathorax" might appear to invalidate this synonymy, but the specific name, *myrmecoides*, shows that by "petiole" he meant the whole first abdominal segment.

POLANISA, Walk., 1875 (= *Idarnella*, Westw., 1883).

POLANISA TRANSIENS (Walk.).

Idarnes transiens, Notes, p. 62 = *Polanisa lutea*, Entom. viii. 18.

Idarnella transiens, Westw., Trans. Ent. Soc. Lond., 1883, p. 37.

MICRANISA, Walk., 1875.

MICRANISA PTEROMALOIDES (Walk.).

Idarnes pteromaloides, Notes, p. 63 = *Micranisa* (sp. innom.), Entom. viii. 18.

IDARNES, Walk., Ann. Nat. Hist. xii. p. 47.

IDARNES STABILIS, Notes, p. 62 = *I. orientalis*, Entom. viii. 17.

This differs from typical *Idarnes* in its more slender legs and scape of antennæ.

Paper read.

Mr. F. Moore communicated "Descriptions of new species of Indian Lepidoptera Heterocera.

New Part of 'Transactions.'

Part II. of the 'Transactions' for 1884 was on the table.

July 2, 1884.

J. W. DUNNING, Esq., M.A., F.L.S., &c., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Members.

Dr. Fritz Müller (Blumenau, Santa Catharina, Brazil) and Dr. A. S. Packard (Providence, Rhode Island, U.S.A.) were balloted for and elected Honorary Members of the Society; and Charles Golding Barrett, Esq., was elected an Ordinary Member.

Exhibitions, &c.

Mr. C. O. Waterhouse remarked on the great changes which occurred in the colours of insects from exposure to light, changes so startling that they would certainly mislead anybody not cognisant of the fact; as a rule, brilliant fiery red became changed to bright green, blue to black, green to purple or purplish brown, and pale yellow to light brown. In illustration, Mr. Waterhouse exhibited certain specimens of the following Coleoptera before and after exposure in the show-cases of the British Museum:—*Eurhinus cupratus*, Illig., *Poropleura bacca*, Kirby, *Eumolpus ignitus*, Fabr., *Doryphora cincta*, Germ., and *Omoplata aulica*, Boh.

Mr. W. L. Distant remarked that from this cause quite recently old and exposed specimens of Lepidoptera had been described as new species.

Mr. E. P. Collett exhibited a specimen of *Calosoma sycophanta*, Fabr., captured on the cliff near Foreness Point, Kent, by Mr. Cockerill, in 1879; also thirteen females of *Athous difformis*, Lac., captured last June by sweeping at night at Guestling, near Hastings, by the Rev. E. N. Bloomfield.

Dr. Sharp exhibited two nests or cocoons he had received from Mr. James Inglis, of Dilkhoosha, India, each containing a large stag-beetle, *Odontolabis carinatus*, Reitter. These nests were constructed in the thatch of a house, which was mixed with much earthy matter, and were lined with some fine earthy substance making the interior smooth. Mr. Inglis sent them under the impression they were the hybernacula or "winter-nests" of the stag-beetle; but they were more probably the cocoons in which the insect had undergone its transformation to the imago state, although it was improbable that the larva of so large an insect should live in and feed on the thatch.

Dr. Sharp also exhibited a small insect recently received, together with its larva and peculiar nests constructed by the latter, from Senor Antonio de Lacerda, of Bahia. The beetle is a small *Cassida* identified by Mr. Waterhouse as *Porphyraspis tristis*, Dej. Senor Lacerda states that they are found on the "young leaves of the cotto-nut tree." The larva constructs a nest, similar in form to a bird's nest, and composed of coarse vegetable fibres, which are apparently attached to the insect by a membranous process extending from the hind part of the dorsal region of the insect; the latter is thus completely concealed by these fibres, so that no one would suspect there was an insect beneath them.

Mr. W. F. Kirby exhibited drawings of a new species (and probably genus) of *Mymaridæ*, which had been bred by Mr. J. M. Gooch from the Coccus affecting St. Michael oranges, and which appeared to be near the genus *Limacis*, Först., but had some of the characters of the *Tetrastichidæ*; also an extensive series of drawings of the saws of sawflies drawn by Mr. Gooch under the camera from fresh specimens.

Mr. T. R. Billups exhibited specimens of *Trichopteryx brevicornis*, Mots., a species hitherto only found in Madeira, which were shaken out of a stack of radish seed at Canning Town, West Ham, in November, 1883.

Mr. Billups also exhibited specimens (some living) of *Pelopceus architectus*, St. Farg., and its nest, which was found attached to a leaf of tobacco from Owensboro, Kentucky, and taken from a hog'shead weighing over 12 cwt. recently opened at Whitechapel.

Mr. Kirby remarked that he had seen a similar nest to the one now exhibited attached to a pod of maize.

Mr. A. Sidney Olliff exhibited a small coleopterous larva, said to be one of the *Staphylinidæ*, and possibly that of a species of *Philonthus* or *Quedius*, which was found by the Rev. Robert Dunn, of Cricklade, engaged in a vigorous encounter with a large earthworm. The specimen was the one to

which Mr. W. E. Darwin called attention in a letter published in a recent number of 'Nature' (vol. xxx., p. 146). Mr. Olliff said that although he did not think there was anything particularly remarkable in finding a larva of this kind attacking a worm, except as showing the great courage and voracity of the creature, he brought it for exhibition this evening as members of the Society might feel interested in seeing the specimen to which Mr. Darwin had referred.

Mr. Billups thought this no uncommon occurrence, as he had frequently witnessed encounters between the larva of *Ocyppus olens* and earthworms, and had kept *Carabus auratus* alive on nothing but earthworms for more than five months.

Dr. Sharp remarked that *Cybister Ræseli* had been kept alive from five to seven years by being fed on earthworms once or twice a day; he thought that the larva exhibited was carabideous, and that earthworms were the favourite food of carnivorous Coleoptera.

Mr. W. Cole thought it very probable that the later stages of many entozoa which were known to exist in earthworms, and had been sought for in vain in birds, would very probably be found in coleopterous insects.

Mr. H. T. Stainton communicated a newspaper cutting taken from the 'Dundee Advertiser' of June 27th, 1884, in which it was recorded from Dunning, near Perth, that the gooseberry sawfly (*Nematus ribesii*) larva was making sad havoc with the black currant bushes; he had never known this larva to attack black currants in his own experience.

Mr. Waterhouse and Mr. Fitch thought it extremely improbable that the larva of *N. ribesii* would eat the black currant.

Paper read.

Mr. J. B. Bridgman contributed "Further Additions to Mr. Marshall's Catalogue of British Ichneumonidæ."

August 6, 1884.

J. W. DUNNING, Esq., M.A., F.L.S., &c., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Exhibitions, &c.

Mr. F. P. Pascoe exhibited some curious white puffy balls he had found on a vine growing in a greenhouse when staying at St. Helier's, Jersey, doubtless the work of *Coccidæ*, and probably belonging to *Lecanium (Pulvinaria) vitis*.

Prof. C. V. Riley confirmed the determination.

Mr. J. H. Durrant exhibited specimens of the three British species of *Blaps* (*B. mortisuga*, L., *B. mucronata*, Latr., *B. similis*, Latr.), all lately captured in the neighbourhood of Hitchin.

Mr. W. L. Distant exhibited an ordinary specimen of *Cilix spinula*, Schiff, and remarked that though its peculiar position when at rest had been described, it had not been noticed that it thus perfectly resembled a species of the homopterous genus *Flata*. Its anterior wings, vertically raised, with the upper surface exposed, are only visible, the antennæ being hidden and the head depressed, so that it appears truncate in front. Familiar with the Homoptera, Mr. Distant concluded that he had discovered a species of *Flata* new at least to Britain, until he came to set out the specimen. He further remarked that the recently loosely-used term "mimicry" could not be applied here, as the moth could hardly be considered to mimic a *Flata* which did not occur in our fauna.

Mr. A. G. Butler remarked on the great similarity sometimes existing between lepidopterous and homopterous insects; he had lately described a Lithosiid allied to *Nudaria* from New Holland, which he certainly thought at first was an Homopteron; the resemblance was so striking that he had named the genus *Homopsyche*; the hairs along the costa were very striking, and he quite believed this was a case of mimicry. Quite lately he had found a second specimen in the Museum collection which had been put away in the supplementary cabinet as not a lepidopterous insect.

Mr. E. A. Fitch called attention to the great resemblance that *Cilix spinula* bore to the excrement of a bird, when at rest on the upper side of a leaf, as was its common practice.

Mr. G. C. Champion said when collecting in Central America he was frequently deceived as to the orders to which certain insects belonged, and was often surprised at their great resemblance to other natural objects.

Mr. F. P. Pascoe, in connection with the above, exhibited a large and pretty Chalcid (which Mr. Fitch determined as one of the *Cleonymidæ*), which he had lately captured at St. Helier's, quite thinking it was an Hemipteron; when running it had its wings overlapping in true bug fashion.

Mr. T. R. Billups exhibited specimens of the two following *Tenthredinidæ*, new to Britain, which had been determined by Mr. Cameron:—*Bleuoncampia alternipes*, Kl., captured at Loughton last May, and *Camponiscus apicalis*, Brischke, captured at Weybridge last May. The latter species was only described last year, and is probably exceedingly rare. Also specimens of a hymenopterous insect taken from the burrows of *Halictus morio* at Chertsey on July 21st last.

Mr. Fitch said this latter insect was a *Chelogyne* (probably *C. lapponicus*, Thoms.), one of the *Dryinidæ*; he could not account for its presence in the bee burrows, but he called attention to the remarkable anterior raptorial claws, and exhibited Curtis's figure (Brit. Ent. fol. 206).

Miss E. A. Ormerod exhibited a piece of leather perforated by *Æstridæ*, the punctures being more than one to the square inch. Miss Ormerod called attention to what is known of the life-history of our bot-flies, and especially of the warble-fly (*Hypoderma bovis*, DeG.), and made considerable allusions to the practical necessity of attempting to lessen the amount of injury occurring both to the cattle themselves and to the great loss from warbled hides. Apparently what was required was to know the exact time when the egg is laid in or on the cattle, and how early in life is the maggot come-at-able under the bullock's hide, then probably methods of precaution or remedy might be recommended that would be tolerably effective. Miss Ormerod thought that the injury occasioned by the *Æstrus* larva could be prevented with slight trouble and expense, and hoped that the necessary observations to ensure successful treatment would be made.

Mr. W. L. Distant agreed as to the great injury occasioned to the hides by these pests, and recommended Miss Ormerod to address a letter to the 'Leather Trades Journal' upon the subject; he believed many people engaged in the leather trade would be willing to lend their assistance towards the object of lessening the number of warbled hides.

Mr. E. A. Fitch said that the amount of damage occasioned by the *Æstrus* larvæ was very uncertain; he had always found short-horn beasts (and especially yearling and two-year olds) most affected, and three and four year old Welsh or Scotch beasts—commonly known as 'runts'—quite free from attack; he believed that the warble opened in May or June, but there appeared to be some special difficulty in breeding the perfect *Æstrus*, as he had tried it from many scores of larvæ, but had never yet succeeded.

Prof. C. V. Riley expressed the interest he felt in the remarks of Miss Ormerod. In reference to the time of year when the cavity opened, it would differ somewhat in different countries and with individual larvæ. In the State of Illinois, where he had much experience with the species, the larva left the cattle in May and June; oviposition extended over a period of several weeks, and there would be a corresponding difference in the period of opening of the cavity. For this reason it was best to defer destruction of the "warble" till late in the autumn, when the rubbing of kerosene along the backs, or the use of a little mercurial ointment would destroy the larvæ. The insect was rarely injurious to grown cattle, but when abundant affected the health of yearlings. The interests of the cattle raiser and of the leather dealer had little in common, and it was for this reason that it was so difficult to get concert of action on the part of stock-raisers in freeing their animals from the insect.

Miss Ormerod thanked Prof. Riley for his information, and said she could give some confirmation of his remarks, as in some Northumbrian districts the application of a mixture of oil with a small amount of turpentine or of strong pickling brine had effected a perfect cure.

M. Wailly exhibited a large box of bred Lepidoptera, especially of silk-producing Bombyces. Amongst them was the hybrid between *Attacus Roylei* and *A. Pernyi* which was believed to be extinct, but it had been preserved by one of his correspondents in Landes; two full-fed larvæ and some cocoons were exhibited: the preservation of this hybrid had proved that they were not mules, neither had they degenerated. Also hybrid larvæ between *Samia Cecropia* and *S. ceanothi (californica)*; the parents had paired without forcing in any way, but no pairing between the sexes of *S. ceanothi* could be obtained; he believed these would produce *S. Gloveri*. Also hybrids between the Himalayan *Attacus Roylei* and the North China *A. Pernyi*. M. Wailly remarked that in the first year the cocoon of the hybrid had a thick outer envelope, but in the third year this had been thrown off, and the cocoon almost exactly resembled the typical cocoon of *A. Pernyi*. Also specimens of *Cricula trifenestrata* from the mountains of Madras—a species which had never previously been bred in Europe; the elongate perforated cocoons, of a golden yellow colour, were found in masses of two to three hundred; the silk was of little commercial value. There was also an interesting series of *Attacus Atlas*, comprising the large form from the Himalayas, the dull and obscurely-marked one from Ceylon, and the almost uniformly red-brown one from Sarawak, but these specimens were much brighter than those from Ceylon; the Bornean specimens had been obtained for M. Wailly by Rajah Sir James Brooke.

The Secretary exhibited a specimen of *Chrysopa perla*, L., and a photograph of the same taken by Mr. G. C. Bignell, of Stonehouse, who had lately paid much attention to Micro-photography as a means of illustrating the neuration of certain insects.

The Secretary exhibited, on behalf of Mr. M'Lachlan, four specimens of *Cecidomyidæ* which had emerged last month from the *Cattleya* galls exhibited at the June meeting, and read some remarks on the same from Mr. M'Lachlan and from Prof. Westwood.

Prof. C. V. Riley took exception to Mr. Fitch's concluding remarks, that the gnats were certainly *Cecidomyidæ*, if not belonging to the restricted genus *Cecidomyia*, and were probably the true gall makers. The rearing of these few *Cecidomyids* from the galls did not necessarily warrant the conclusion that they were the architects of the gall. While the flies had not been critically examined, they did not have the appearance of true gall-making species, and he was of opinion that they were merely inquilines, breeding probably in the gall substance. Such inquilines were often mistaken for gall-makers, and he cited instances. The galls from which the specimens came should be carefully examined. In reference to the phytophagic nature of *Isosoma* in America, as illustrated by *Isosoma hordei*, *I. vitis*, and *I. tritici*, there could be no question whatever. The matter has been definitely settled. The *Isosoma* larva is always

easily distinguished from any Cecidomyid larvæ, and has been watched in the newly-forming galls on wheat, and its feeding and development observed.

The Secretary read the following extract from a letter from Dr. Fritz Müller to Mr. R. Meldola:—

“ My brother, Dr. Wilhelm Müller, a young man of twenty-seven years of age, has been with me for nearly a year, and is at present diligently studying the larvæ of our *Nymphalina*. He is likely to make some very interesting observations, and has already reared a considerable number from the egg to the pupa. We now know the larvæ of the following genera of *Nymphalina*:—*Protogonius*, *Paphia*, *Siderone*, *Prepona*, *Apatura* (?; imago not yet bred), *Ageronia* (five species), *Myscelia*, *Epicalia*, *Didonis*, *Callicore* (?; imago not yet bred), *Gynæcia*, *Heterochroa* (ten species), *Smyrna*, *Victorina*, *Junonia*, *Phyciodes*, *Hypanartia*, and *Pyrameis*. We also know the larvæ of *Dione* and *Colanis*; but these genera do not belong to the *Nymphalina*, but are allied to *Eueides* and *Heliconius*.

“ The larvæ of several genera or even groups of genera of Brazilian Lepidoptera are confined to allied plants. Thus all our species of *Heliconius* (two), *Eueides* (two), *Colanis* (two), and *Dione* (two), feed upon *Passifloræ*; *Phyciodes*, *Anartia*, *Junonia*, and *Victorina* on *Acanthaceæ*; our five species of *Ageronia* and *Myscelia Orsis* feed upon one and the same species of *Dalechampia*; our species of *Epicalia* and *Didonis* feed upon *Atchornea* and *Tragia* respectively, plants belonging to the same family (*Euphorbiaceæ*), and our two species of *Siderone* feed upon the same *Casearia*. On the other hand, larvæ belonging to other genera feed on plants belonging to very different families. Thus some of the species of *Paphia* feed on *Piperaceæ* (like *Protogonius*), and others on *Laurineæ*; those of *Prepona* feed on *Leguminosæ* (*Juga*, *Monimia*, &c.); the larvæ of *Heterochroa* feed on *Rubiaceæ* (five species), *Cecropia* (two species), *Melastomeæ* (one species), *Rubus* (one species), and *Malpighiaceæ* (one species on *Tetrapterys*).

“ Many young larvæ of the genera *Protogonius*, *Paphia*, *Siderone*, *Prepona*, *Ageronia* (except the gregarious larvæ of *A. Amphinome* and *A. Fornax*), *Myscelia*, *Epicalia*, *Gynæcia*, and *Heterochroa* have the remarkable habit of eating the space next to a vein of the leaf bare. My brother first called my attention to this. All these larvæ have the still more remarkable habit of lengthening the stalk by attaching particles of dirt to it. The small brown larvæ are often difficult to distinguish from the withered brown leafstalk, and must be admirably concealed from many enemies in this manner. But the collector who has once discovered this habit can easily detect the whereabouts of such larvæ by the leafstalks, when he would otherwise only be able to detect them by the closest observation.

“ My brother has made some very interesting observations, which I believe to be quite new, on various pupæ, which when in the dark are

suspended (as is invariably the case in other *Nymphalinae*), but in the light raise themselves more or less. There are some which actually execute lateral movements if a light is thrown upon them from the side.

“*Pantherodes pardalaria* was noticed in ‘Nature’ as drinking and voiding large quantities of water. Herr Heczko, a good observer of living insects, who has been residing here for the last year, has noticed the same habit in *Papilio Polydamas*. He counted from twenty to twenty-six (usually between twenty-three and twenty-six) evacuations in a minute, and the sand behind the animals was completely soaked. *Pantherodes pardalaria* was very scarce here last summer, although it is very common in many seasons. I once saw a whole swarm of these moths sitting on stones grown over with *Podostomeæ* in a rapidly-flowing rocky brook. They were looking down just above the water, and were probably engaged in drenching themselves with it.”

Mr. A. G. Butler did not know whether Dr. Fritz Müller had proved that *Dione* and *Colænis* were not *Nymphalinae*, as they were always classed with them.

The Secretary read the following:—

Note on the Habitat of Platychile pallida, Fabr.

By ROLAND TRIMEN, F.R.S., &c.

“This curious Cicindelide, so long a rarity in collections, was two years ago discovered close to Cape Town by Mr. L. Péringuey, who kindly pointed out the locality to me, and went with me to examine it and search for specimens of the beetle. So singular did the station prove to be that I no longer felt any surprise at the insect being so very seldom met with previously.

“The haunt of *Platychile* turns out to be the sandy sea-beach about three miles and a half north of Cape Town. On the day of our visit to the spot we examined two low sand hummocks without success; but in a third very low one, just above high-water mark at the highest tides, I at length unearthed a *Platychile*, and, almost immediately afterwards, two others. This little hummock and its immediate vicinity proved very rich in the precious insect, yielding between forty and fifty examples. To obtain them was a simple process; we merely lay down on the beach, and slowly turned over the loose drift-sand. The beetles were completely covered by the sand, but were only from one to two inches below the surface; when uncovered they lay perfectly still, as if dazzled by the light, but with limbs and (usually) jaws extended. When seized they bit energetically, and usually exuded a dark liquid from the mouth. When thoroughly roused, or dropped after being seized, they ran with great rapidity in a true *Cicindela*-like fashion, and also for a little time displayed much activity in the cyanide bottle.

"There can, I think, be little doubt that *Platychile* is nocturnally active, retiring under the sand during the day. Its pale unvaried tint is well adapted to concealment among the sand. We could not discover any burrows attributable to this beetle or its larva, the holes here and there examined not yielding any specimens of the species.

"South-Africa Museum, Cape Town,
24th June, 1884."

Paper read.

Mr. Butler communicated a paper by Surgeon-Major R. W. Forsayeth, "On the life-history of sixty species of Lepidoptera observed in Mhow, Central India." Mr. Butler referred to the more remarkable species, and Mr. Forsayeth's three books of drawings were exhibited.

September 3, 1884.

R. M'LACHLAN, Esq., F.R.S., &c., Vice-President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of a Member.

Lieut.-Col. Charles Swinhoe (12, The Close, Winchester) was balloted for and elected a Member of the Society.

Exhibitions, &c.

Mr. G. Coverdale exhibited a box of British Micro- and other Lepidoptera, all of which were set in his new method, without pinning, which he had greatly improved upon since the last exhibition.

Mr. H. T. Stainton called attention to the rarity and interest of many of the specimens exhibited. He especially referred to some specimens of a *Goniodoma* captured on the Shoebury saltings, which appeared to be almost intermediate between *G. auroguttella* and *G. limoniella*, being of the colour of the former and having the pale costa of the latter species.

Mr. T. R. Billups exhibited two large and very hard woody excrescences on birch twigs from the New Forest; there was a difference of opinion whether they were a form of the familiar "witch-knot" supposed to be produced by a *Phytoptus*, or whether they were only hardened sap caused by some injury the twig had received, and having no connection with insect-attack.

Mr. Billups also exhibited a specimen of *Ocypus cyaneus*, Pk., captured in North Devon by Mr. W. South this summer, and a series of *Loxops coccineus*, Meyer, taken at Chobham last August. Also a box containing

many specimens of *Odynerus reniformis*, Gmel., and its parasite, *Elampus Panzeri*, Fabr., together with many portions of the burrows of the wasp, showing the beautifully-curved entrance to the same: these nests were collected at Chertsey last June.

Mr. W. F. Kirby, on behalf of M. Wailly, who was present as a visitor, exhibited cocoons of *Cricula trifenestrata*, from Yercaud, Madras: also cocoons of *Ceratocampa imperialis*, and M. Wailly said that his suspicions that this larva was a cannibal had been fully verified by Mr. E. F. Hitchings, of Warren, Mass., who thus writes respecting this species:—

“I was much pleased to see the account of *Ceratocampa imperialis*. I had had some small experience with the larva, which I will relate. In the fall of 1881 I obtained several almost full-grown larvæ and put them in a box with plenty of pine and button-wood leaves; in a few days I noticed that several had disappeared, and upon examination found the skins with the juice all extracted. They were all of large size, and I found one or two of these skins held in the manner described by you. I then put in several full-grown larvæ of *T. Polyphemus*, and they were disposed of in the same way. This led me to conclude they were carnivorous. In 1882 I noticed the same thing.”

Papers read.

Mr. E. B. Poulton read a paper entitled “Further notes upon the markings and attitudes of Lepidopterous larvæ, together with a complete account of the life-history of *Sphinx ligustri* and *Selenia illunaria* (larva).” Mr. Poulton illustrated his remarks by the exhibition of numerous coloured drawings, also by many enlarged diagrams. An interesting discussion followed, in which Messrs. Stainton, Jenner Weir, White, M'Lachlan, and others joined.

Mr. A. S. Olliff read “Notes on the life-history of *Porphyraspis tristis*, Boh., a palm-infesting *Cassida* from Brazil.”

Dr. David Sharp communicated a paper “On the water-beetles of Japan” and a “Revision of the *Hydrophilidæ* of New Zealand.”

Mr. P. Cameron communicated “Descriptions of new species of *Tenthredinidæ* and *Cynipidæ* from Mexico.”

October 1, 1884.

J. W. DUNNING, Esq., M.A., F.L.S., &c., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of a Member.

Haygarth Addison, Esq. (145, Seven Sisters Road, Finsbury Park, N.), was balloted for and elected a Member of the Society.

Exhibitions, &c.

Mr. J. Jenner Weir exhibited an imago of *Pyrameis cardui*, taken by him in September last in the New Forest. Three of the five black spots in the disk of the upper side of the lower wings had blue pupils; the specimen thus approached the Australian form of the insect (*P. Kershawii*), the blue pupils in the black spots being one of the chief characteristics of the latter species.

Mr. Weir also exhibited a specimen of a large locust from the Kalahari Desert, South Africa, which he had received from Mr. Farini. It had been brought to England with the Earthmen now exhibiting in London, and was stated to be used by that race as an ordinary article of food.

Mr. A. C. Horner exhibited the following British Coleoptera:—One specimen of *Myrmedonia Haworthi*, Steph., from a miscellaneous collection made by Rev. O. Pickard Cambridge at Bloxworth, Dorset. Three specimens of *Philonthus astutus*, Er., captured near Folkestone—a species only lately introduced as doubtfully British by Rev. W. W. Fowler (see Ent. Mo. Mag. xx. 168). Several specimens of *Dyschirius extensus*, Putz., also from near Folkestone; two specimens were caught in the act of devouring ants. Five *Homalota languida*, Er., one *H. planifrons*, Wat., and five *H. eximia*, Sharp (hitherto only recorded from Scotland), captured at Tonbridge. Several *H. luteipes*, Er., from Tonbridge and Winchester. Several specimens of *Ocalea latipennis*, Sharp, from Tonbridge; this is usually considered a northern insect; *O. castanea*, Er., was exhibited for comparison. Two specimens of *Stenus morio*, Gr., from Tonbridge. A specimen of *Trichonyx Märkelli*, Aubé, found in a run of *Formica flava* under a stone at Lulworth, Dorset. A long series of *Lathridius testaceus*, Steph., from fir-bark at Tonbridge. Several specimens of *Cryphalus fagi* from beech-bark at Tonbridge. The two sexes of *Phleotrya Stephensi*, Duv., showing the extremes of size from about eighty specimens captured by night on the trunk of a half-decayed horse chestnut at Tonbridge.

Mr. J. J. Walker exhibited a series of forms of Chilian *Colias*, comprising *C. Cunninghamsi*, Butl. (both sexes), from Punta Arenas, Straits of Magellan; a long series of *C. minuscula*, Butl., showing great variation in the width of the black border in the male, taken at Coquimbo in August and September, 1883; *C. Vautieri*, Guér., a series chiefly from Coquimbo, Talcahuano, and Valparaiso; also *C. Lesbica*, Fabr., from Monte Video, and a specimen of an unnamed species from Matucana, Peru (near Lima and 7788 feet above the sea), closely resembling superficially *Scalidoneura Hermina*, Butl., but without the distinctive character in the venation of the fore wings.

Mr. Walker also exhibited a collection of Lepidoptera made in the South Sea Islands in March, April, and May, 1883. It included ten species

of Diurni, viz., *Danais Archippus* from the Marquesas, Tahiti, Eimeo, and Rarotonga; a long series of *Diadema Bolina*, Linn., showing great variations in the size of both sexes, and in the colour and marking of the females from the different islands. Those from the Marquesas Islands (Faton-hiva and Nuka-hiva) are small, the females very dark; in Tahiti and Eimeo both sexes are very much larger than in the Marquesas, some of the females exceeding four inches in expanse, and are usually very dark coloured; while those from Rarotonga and Aitutáki vary greatly in size, and the females are usually very handsomely suffused with red, in this respect approaching the East Indian form. Nearly the whole of the specimens were bred from larvæ feeding on a species of *Commersonia* (*Malvaceæ*). *Diadema unicolor*, Salv. & Godm., a few from Rarotonga. *Euplæa Eleutho*, Quoy & Gaimard, a long series from Tahiti and Eimeo. *Euplæa sp.* (as yet unnamed), a series from the island of Aitutáki, varying in colour from entirely black to a handsome white-spotted form approaching *Eleutho*. *Melanitis Leda*, Linn. a long series from Tahiti, Eimeo, and Rarotonga. *Atella Gaberti*, Guér., a series from Tahiti, where it is one of the commonest butterflies. *Lycana Batica*, Linn., from Tahiti and Eimeo; *L. Plato* from Rarotonga and Aitutáki; and *L. communis*, Bdv., from Tahiti and Aitutáki. The collection included four species of *Sphingidæ*, viz., *Sphinx convolvuli* (or a very nearly related species), bred from larvæ found in Tahiti and Eimeo feeding on various species of *Convolvulus*, and from pupæ dug up in sweet-potato patches in Pitcairn Island; also a very abnormal specimen of perhaps a distinct species captured at Nuka-hiva, Marquesas; *Chærocampa Erotus*, Cram., from Nuka-hiva and Tahiti; a beautiful series of *C. celerio*, Linn., bred from larvæ found in Tahiti and Eimeo, feeding indifferently on "taro" (*Calocasia esculenta*), "apé" (*C. costata*), and "nono" (*Morinda citrifolia*); *Macroglossa sp.*, taken numerously at flowers in Tahiti and Eimeo, and a few bred from larvæ found on *Morinda citrifolia*. It also included various Noctuæ, Geometræ, and Pyrales, particularly a species of *Ophideres* from Râp-â or Oparo Island (also seen in Aitutáki and Tahiti), and *Achæa melicerta*, which was observed in the Marquesas, Tahiti, Eimeo, Râp-â, Rarotonga, Aitutáki, and Atiú, but not seen in Pitcairn Island; most of the specimens were bred from larvæ feeding on *Mimosa*, *Ricinus*, &c., in Nukahiva, Râp-â, and Tahiti, it being most abundant in the first-mentioned island.

Mr. R. M'Lachlan exhibited a specimen of *Nemopteridæ*, which was captured by Mr. J. J. Walker at Coquimbo. This was remarkable as hitherto no species of this family had been known to occur in America. This new species appeared to come nearest to *Brachystoma*, Rambur; unfortunately the tips of its hind wings had been nibbled off by cock-roaches.

Mr. M'Lachlan also exhibited the photograph of the wings of a dragon-

fly sent to him by Dr. Puton; he remarked how beautifully, and of course correctly, the neuration was shown, and suggested that if possible this method should be used for entomological illustrations generally if it were possible to reproduce the figures in any number, about which he should like to hear some practical opinion. The process by which the photograph was produced is described in 'La Nature' for August 23rd, 1884.

Mr. R. Meldola said that previous to the meeting he had inspected the photograph exhibited, and was much impressed with the sharpness with which the neuration had been reproduced upon the sensitised paper. He was of opinion that this method might be made of general practical use for the multiplication of any number of copies if instead of printing upon albumenised paper, as had been done in this case, the wing had been exposed in the usual way over a bichromatised gelatine film. By this means a printing-block could be obtained by the well-known methods which would give the neuration white upon a black ground. If, on the other hand, it was found advisable to have the neuration black upon a white ground a glass negative might first be taken by exposing the wing pressed over a gelatine plate, and then this negative, when used to print, over a bichromatised gelatine film would give upon the latter a positive impression, which could, as before, be used as a printing-block. Any transparent wings might be adapted to the process; in the case of Lepidoptera it would, of course, be necessary to first remove the scales.

Mr. T. R. Billups exhibited a species of *Homalomyia* which had proved destructive to a field of collard, or colewort; six or eight of the yellowish larvæ being found in almost every stalk. One specimen exhibited had seven legs, there being four on the left side; the posterior leg being doubled from the coxa, the femur was entirely split, and both legs were thence quite perfect and distinct.

Papers read.

Baron Osten-Sacken communicated "Facts concerning the importation or non-importation of Diptera into distant countries."

Lieut.-Col. Swinhoe communicated a "List of Lepidoptera collected in Southern Afghanistan by himself."

Mr. Rudolph Rosenstock communicated "Notes on Australian Lepidoptera, with descriptions of new species."

November 5, 1884.

J. W. DUNNING, Esq., M.A., F.L.S., &c., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of a Member.

A. W. Kappel, Esq. (2, Burlington Gardens, Chiswick, W.), was balloted for and elected a Member of the Society.

Exhibitions, &c.

Mr. J. J. Weir exhibited, on behalf of Mr. J. W. Douglas, *Idiocerus cognatus*, Fieb. (*I. distinguendus*, Kbm.), a species new to the British list of Homoptera, taken in September and October last from a white poplar tree at Lewisham. It is distinguished conspicuously from *I. tremulæ* by its constant paler coloration, by the broad central fascia on the elytra never continued to the costa, and by structural differences. Specimens of *Idiocerus tremulæ* were exhibited for comparison.

Also the following *Coccidæ*, taken at Lewisham :—

Lecanium ribis, A. Fitch : a quantity of the "scales" fixed to a shoot of red currant. These scales abound on the currant bushes in sheltered situations, but no harm accrues ; they are rarely found on the wood of the present year.

Lecanium æsculi, Koll. : male imago, and male and female shell-scales, from horse-chestnut.

Lecanium aceris, auct. : male and female shell-scales, from sycamore.

Lecanium coryli, Linn. : female shell-scales, from hazel-nut tree.

Lecanium genevense ?, Targ. : male and female shell-scales, from hawthorn.

And hymenopterous parasites which emerged from the female scales of the last four species, probably belonging to the genera *Coccophagus* and *Encyrtus*.

The "scales" of many of the species of *Lecanium* are very much alike, as may be seen in those of *L. æsculi* and *aceris*, which may really be those of only one species on different trees ; but others, such as *L. ribis*, are very distinct in formation. In most cases satisfactory determinations of the species are only to be obtained by prolonged observation of the sexes in all the stages of life.

Mr. A. S. Felton, who was present as a visitor, exhibited a large collection of Lepidoptera and Hemiptera, containing many interesting species, collected from 1875 to 1883 in the province of Espirito Santo, Brazil, by Bazilio Carvalho Daemon.

Mr. R. Meldola exhibited a specimen of *Nonagria sparganii*, Esp., captured at Deal early in last September.

Mr. T. Wood exhibited *Cis bilamellatus*, a new species recently described by him, captured at West Wickham on September 15th last.

Mr. W. F. Kirby exhibited specimens of *Ephestia elutella*, Hübn., and *E. parasitella*, Staud., which were doing much damage to cocoa-beans from the West Indies and South America in the Metropolitan Wharf of Messrs. Anderson, Weber, and Smith; also *Bracon brevicornis*, Wesm., a parasite of the *Ephestia*. Mr. M'Lachlan suggested heat as the only remedy for getting rid of the pests, but Mr. Jenner Weir and Mr. Fitch pointed out the impracticability of application in the large bonded and other warehouses; in the present case the stock affected exceeded 20,000 bags.

Mr. J. J. Walker instanced an attack of *Ephestia elutella* on ship's biscuits; when the biscuits were removed the moths came out in thousands.

Mr. A. S. Olliff exhibited a specimen of *Passandra 6-striata*, Dalm., captured on the Zambesi in 1878 by Dr. Bradshaw, lent to him by Mr. Swierstra, of the Museum at Amsterdam. He remarked there was but one example in Britain—a small specimen in Mr. Pascoe's collection, from Angola.

Paper read.

Baron Osten-Sacken communicated a revised edition of his "Essay on comparative Chætotaxy, or the arrangement of characteristic bristles of Diptera."

New Part of 'Transactions.'

Part III. of the 'Transactions' for 1884 was on the table.

December 3, 1884.

J. W. DUNNING, Esq., M.A., F.L.S., &c., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Members.

Baron C. R. Osten-Sacken (Haus Mai, Heidelberg) was balloted for and elected an Honorary Member of the Society; and James J. Walker, Esq., R.N., a Subscriber, was elected an Ordinary Member.

Exhibitions, &c.

Mr. H. T. Stainton exhibited specimens of *Goniodoma Millierella*, bred from *Statice virgata* in the South of France, recently received from M. Constant, and British specimens of *G. auroguttella*, Fisch.-Rössl., bred from *Atriplex laciniata*, for comparison. Although Mr. Stainton quite believed

they were distinct species, he had as yet failed to find an appreciable character to separate them. Specimens of *G. limoniella*, bred from *Statice Limonium*, were also exhibited.

Mr. H. Goss exhibited specimens of *Bankia argentula*, Hübn., from a new locality on the borders of Cambridgeshire and Suffolk; also a drawing of the larva of this species, received from Mr. Brown, of Cambridge. The drawing represented the larva as feeding on some species of grass apparently belonging to the genus *Festuca*, though, according to Mr. Buckler, the larva feeds on some species of *Poa*.

Mr. R. M'Lachlan said it would be interesting to British entomologists to know that *Tapinostola Bondii*, Knaggs, had occurred on the island of Rügen in the Baltic (Stett. Ent. Zeit. xlv. 432); it was only known previously from Central Greece and Britain.

Mr. W. F. Kirby alluded to *Noctua subrosea*, Steph., as another British moth with very limited distribution (Britain, Livonia, Finland).

Mr. J. Jenner Weir, on behalf of Mr. E. Lovett who was present as a visitor, exhibited a collection of Micro-Lepidoptera from the neighbourhood of Grahamstown, Cape Colony, and made some remarks on their great resemblance to British species. They were collected by Mr. H. F. Billingham.

Mr. T. R. Billups exhibited specimens of the following Aculeate Hymenoptera captured at Chobham during the past season:—*Lasius umbratus*, Nyl., *Stenamma Westwoodii*, Westw., *Myrmosa melanocephala*, Fabr., *Myrmecina Latreillii*, Curt., *Methoca ichneumonoides*, Latr., *Pompilus pectinipes*, Lind., *P. spissus*, Schiöde, *P. viaticus*, Fabr., *P. niger*, Fabr., *P. chalybeatus*, Schiöde, *P. Wesmaeli*, Thoms., *Priocnemis obtusiventris*, Fabr., *P. affinis*, Lind., *P. hyalinatus*, Fabr., *P. exaltatus*, Fabr., *Agenia punctum*, Fabr., *Ceropales maculata*, Fabr., *Ammophila hirsuta*, Scop., *A. sabulosa*, L., *Tachytes pectinipes*, L., *Miscophus bicolor*, Jur., *Stigmus pendulus*, Panz., *Diodontus minutus*, Fabr., *Mimesa equestris*, Shuck., *Psenater*, Fabr., *Cerceris arenaria*, L., *Trypoxylon attenuatum*, Smith, *Entomognathus brevis*, Lind., *Crabro dimidiatus*, Fabr., *C. capitosus*, Shuck., *C. palmarius*, Schreb., *C. scutellatus*, Schreb., *C. Wesmaeli*, Lind., *C. podagricus*, Lind., *C. peltarius*, Schreb., *Harpactus tunidus*, Panz., *Oxybelus uniglumis*, L., *Odynerus antilope*, Panz., *O. sinuatus*, Fabr., *O. trimarginatus*, Zett., *O. reniformis*, Gmel., *O. parietinus*, L., *Eumenes coarctata*, L. Also *Ellampus Panzeri*, Fabr., from the burrows of *O. reniformis*, *Hedychrum fervidum*, St. Farg., and *Chrysis cyanea*, L.

Mr. Billups also exhibited the following Ichneumonidæ, &c., collected in various localities during the present year:—*Ichneumon vaginatorius*, L., *Trogus lutorius*, Fabr., bred from *Charocampa porcellus*, *Phygadeuon curvus*, Schr., *Cryptus titillator*, Gr., *Pezomachus insolens*, Först., *P. geocharis*, Först., *Paniscus virgatus*, Fourc., *Casinaria tenuiventris*, Gr., *Limneria*

crassicornis, Gr., *L. difformis*, Gmel., *L. majalis*, Gr., and cocoons, *Canidia subcineta*, Gr., *Banchus falcator*, Fabr., *Ædemopsis scabriculus*, Gr., *Pimpla melanocephala*, Gr., *P. rufata*, Gmel., *Glypta scalaris*, Gr., *Lissonota segmentator*, Fabr., *L. sulphurifera*, Gr., *Spathius clavatus*, Panz., *Sigalphus obscurellus*, Nees, from cabbage galls of *Ceuthorhynchus sulcicollis*, *Microgaster flavipes*, Hal., bred from *Boarmia repandata*, *M. minutus*, Reinh., bred from *Cleora glabraria*, *Protelus chrysophthalmus*, Nees, *Macrocentrus linearis*, Fabr., and group of cocoons, *Diapria carinata*, Nees, and *D. nigra*, Nees.

Mr. A. S. Olliff exhibited *Aciphus singularis*, recently described in the 'Entomologists' Monthly Magazine,' from Brazil. It had the appearance of one of the *Staphylinidæ*, but was a *Cucujus* strongly resembling *Diagrypnodes Wakefieldii*, Waterh., from New Zealand.

Mr. R. M'Lachlan exhibited specimens of Trichoptera lately collected in Unst, North Shetland, by Mr. C. A. Briggs (see Ent. Mo. Mag. xxi, 153).

Mr. C. O. Waterhouse exhibited a specimen of *Julodis Finchi* from Karachi, a Buprestid of nearly twice the size of the largest hitherto known species, recently described by him in the 'Annals and Magazine of Natural History.'

The Rev. Leonard Blomfield contributed a note on the capture of a second specimen of, as was supposed, *Acanthocinus ædilis* near Bath in October last, which was found on a man's back who was engaged in chopping blocks of wood which proved to be North-American pine, and which contained numerous burrows of the Longicorn. Mr. Blomfield alluded to the first notice of the occurrence of this species in a paper which he read before the Bath Natural History Society on December 12th, 1883, a copy of which was presented to the Society's library.

Messrs. Waterhouse, Champion, and Janson pointed out that the insect referred to was a *Monohammus*, and the former gentleman identified the species as *M. titillator*, Fabr.; a specimen in the National Collection was found alive at Caterham Valley, Surrey. It was also remarked that the *Acanthocinus* was indigenous at Rannoch, and occurred commonly at many other localities, such as Manchester, Hull, in the Durham coal-pits, and even a living specimen in the British Museum, being frequently distributed in scaffold-poles and other imported timber.

Paper read.

Mr. H. J. S. Pryer contributed a paper "On two remarkable cases of mimicry from Elopura, British North Borneo, with remarks on Mr. George Lewis' paper read before the Society on 4th October, 1882." The cases of mimicry referred to was that of a large coleopteron (*Nothopeus fasciati-pennis*, n. s., C. O. Waterhouse) mimicking an equally large hymenopteron

(*Mygymia aviculus*, Sauss.), and of a large lepidopteron (*Scoliomima*, n. g., Butler, *insignis*, n. s., Butler) mimicking a large hymenopteron (*Triscolia patricialis*, Burm.).

Mr. A. G. Butler made some remarks upon the very interesting cases of mimicry alluded to, and contributed a description of the moth, for which he formed a new genus of *Ægeriida*, coming next to the African genus *Toosa* (= *Ninia*). He also referred to the remarkable mimetic resemblance between the two species of *Myrmecopsis*, Newman, with their distinctly petiolated abdomen, and species of *Polybia* or *Agenia*. Mr. Butler said it was both interesting and curious to find that in India the female *Argynnis Niphe*, Linn., mimics *Danais Chrysippus*, Stoll; while in Australia the sexes of the representative of *A. Niphe* (*A. inconstans*, Butl.) are similar, the Australian *Danais* being so small that it is not worth mimicking. The well-known case of *Papilio Merope*, Cram., was also interesting: furthermore, that the *Catocalinæ* were directly opposed to Mr. Lewis' views, since the upper surface of the hind wings, which are least exposed to the action of the sun's rays, are the most brilliantly coloured portion of these insects.

Mr. C. O. Waterhouse remarked upon and exhibited specimens of the following two cases of mimicry: a species of *Myocoris* (Hemiptera) and a species of *Joppa* (Hymenoptera) from the Amazons; a dipteran allied to *Dasygogon*, the hymenopterous *Abispa australis*, and the coleopterous *Hesthesis ferrugineus*, M'L., from Australia. Mr. Butler said the lepidopterous genus *Dycladia* would complete the trio in the first-mentioned case. Mr. Waterhouse did not think it possible that the Longicorn could be parasitic on the wasp, as was suggested by Mr. Pryer. Mr. Fitch thought if there was any community of habitat it would be that the wasp nested in the burrows of the Longicorn.

Several members took part in a discussion upon the various points raised by Mr. Pryer's criticism of Mr. Lewis' paper.

New Part of 'Transactions.'

Part IV. of the 'Transactions' for 1884 was on the table.

ANNUAL MEETING,

January 21, 1885.

J. W. DUNNING, Esq., M.A., F.L.S., &c., President, in the chair.

An abstract of the Treasurer's accounts for 1884 was read by Mr. H. T. Stainton, one of the Auditors.

The Secretary read the following:—

REPORT OF THE COUNCIL FOR 1884.

In accordance with the Bye-Laws, the Council begs to present the following Report:—

During the year 1884 the Society has lost, by death, one Honorary Member (Prof. J. C. Schiödte, of Copenhagen), and two Ordinary Members (Sir Sidney Saunders and Sir Arthur Scott); the former of whom was an Original Member, a former President, and at the time of his death one of our Vice-Presidents. The names of five other Members have been removed, by resignation or otherwise. Sixteen new Members have been elected, and two Subscribers have become full Members.

The list of Honorary Members has received three additions; Dr. Fritz Müller, Dr. A. S. Packard, and Baron Osten-Sacken having been chosen to fill the places vacated by Prof. Zeller, Dr. Leconte, and Prof. Schiödte.

The Council has great pleasure in announcing that Mr. W. B. Spence, one of our few remaining Original Members, has presented to the Society the Entomological Library of his father, the late Mr. Wm. Spence. This addition will serve as a welcome reminiscence of our former Honorary Member, the co-adjutor with the Rev. Wm. Kirby in the preparation of the famous 'Introduction to Entomology.'

The Transactions for the year (exclusive of the Proceedings) form a volume of 517 pages, containing twenty-five memoirs contributed by nineteen authors, and illustrated with fifteen plates, of which four are coloured. The Council has to thank Lord Walsingham for the presentation of Plate 4 (North-American Tortricidæ). To give effect to the Resolution that all Members shall be entitled to receive the Transactions, it has been thought advisable to print an additional hundred copies, and the style has been altered by printing the descriptive portions of papers in a smaller type. This necessitates some little additional expenditure, but the Council trusts that the alterations will commend themselves to the Society generally.

The following is an abstract of the financial operations for the year:—

RECEIPTS.	PAYMENTS.
Balance from 1883 £4	Rent and Office Expenses - £126
Contributions of Members - 257	Publications - 275
Sale of Publications - . . 78	Library - 23
Interest on Consols - . . 9	
Donations - 79	
<u>£427</u>	<u>£424</u>

The application for a Royal Charter of Incorporation, which was unanimously approved at the Special Meeting held on March 5th last, is still under the consideration of Her Majesty in Council. But as regards all internal affairs, the retrospect for the year is highly satisfactory: the number of members has increased, valuable additions have been made to the Library, and the Librarian has been exceptionally busy, the Meetings have been better attended than at any previous period, and the Memoirs published in the Transactions maintain the reputation of the Society and form a volume which is a worthy successor to the thirty-one which have preceded it. The Council is well pleased with the progress made in 1884, and trusts that the Members will not relax their efforts to advance the interests of the Society and promote its objects, namely, the improvement and diffusion of Entomological Science.

11, Chandos Street, Cavendish Square, W.,
21st January, 1885.

The Secretaries not having received any notice proposing to substitute other names than those in the lists prepared by the Council, the following Members form the Council for 1885:—T. R. Billups, H. Druce, J. W. Dunning, E. A. Fitch, H. Goss, F. Grut, W. F. Kirby, R. M'Lachlan, R. Meldola, E. Saunders, J. W. Slater, S. Stevens, and J. J. Weir.

The following are the officers elected:—*President*, R. M'Lachlan, F.R.S.; *Treasurer*, E. Saunders, F.L.S.; *Secretaries*, E. A. Fitch, F.L.S., and W. F. Kirby; *Librarian*, F. Grut, F.L.S.

The President then delivered an address, at the conclusion of which Mr. H. T. Stainton proposed a cordial vote of thanks to Mr. Dunning for his services as President during the year, and requested that he would allow his address to be printed with the 'Proceedings.' The proposal was seconded by Jonkheer May, and carried unanimously. The President returned thanks.

Mr. M'Lachlan proposed a vote of thanks to the Treasurer, Secretaries, and Librarian, which was seconded by Mr. Waterhouse, and carried unanimously.

Messrs. Saunders, Fitch, Kirby and Grut made some remarks in acknowledgment.

ABSTRACT OF RECEIPTS AND PAYMENTS FOR 1884.

Receipts.		Payments.	
	£ s. d.		£ s. d.
To Balance, 1 Jan. 1884	- 3 19 9	By Rent, Salary, Office Ex- penses, &c. - - - }	125 18 0
Subscriptions, 1884	- 178 12 6	Printing - - -	191 1 9
Entrance Fees - - -	- 31 10 0	Colouring, Plates, &c. -	83 12 3
Arrears - - - - -	- 13 13 0	Books, Binding, &c. -	22 12 4
Compositions - - -	- 31 10 0		
Donations - - - - -	- 79 3 6		
Transactions - - - -	- 77 19 1		
Interest on £313 4s. 8d. }	9 4 0	Balance, 1 Jan. 1885 -	2 7 6
Consols - - - - - }			
	<u>£425 11 10</u>		<u>£425 11 10</u>

ASSETS.

	£ s. d.
Balance - - - - -	2 7 6
Subscriptions due, considered good—say - - -	10 10 0
Consols, £313 4s. 8d. - - - - - (cost)	293 4 0
	<u>£306 1 6</u>

LIABILITIES.

(None.)

Audited and found correct. { H. T. STANTON.
J. JENNER WEIR.
J. W. MAY.

January 14th, 1885.

THE PRESIDENT'S ADDRESS.

GENTLEMEN,

The recurrence of another Annual Meeting imposes on me the pleasant duty of saying a few words by way of retrospect of the year's proceedings; and, on yielding up the Presidency, I beg to renew my thanks for the undeserved distinction you have conferred upon me, to express my hope that during the last two years the position of the Society has not deteriorated, to repeat my ardent wish for the prosperity of our body, and to declare my firm belief in its future.

I had hoped that it would have fallen to my lot to announce that our petition for the grant of a Royal Charter of Incorporation had received a gracious response. It is with regret that I can say nothing more than that the petition is still under the consideration of the Lords of the Council, who have not arrived at any decision as to what advice should be tendered to Her Majesty on the subject.

If the year 1884 has not been marked by any striking incident, it has not been one of retrogression or stagnation. If we have not advanced by leaps and bounds, our onward progress is none the less sure for being gradual and regular. Development is the order of the day, and even an incorporeal entity like the Society cannot escape the universal law of Evolution.

From lower to higher, from simple to complete,
This is the pathway of the Eternal Feet;
From earth to lichen, herb to flowering tree,
From cell to creeping worm, from man to what shall be.
This is the solemn lesson of all time,
This is the teaching of the voice sublime;
Eternal are the worlds, and all that them do fill;
Eternal is the march of the Creative Will;
Eternal is the life of man, and sun, and star,
Ay, even though they fade awhile, they are;
And though they pause from shining, speed for ever still.

During the past year Death has not deprived us of many of our colleagues ; but if he has been lenient in point of number, of the three whose loss we have to deplore one was an Honorary Member, and another was a Past-President and actual Vice-President at the time of his decease.

JÖRGEN CHRISTIAN SCHIÖDTE was born in Copenhagen on the 20th April, 1815, and died there on the 22nd April, 1884. His 'Genera og Species af Danmark's Eleutherata' was published when he was only twenty-six years of age, and in the following year he was appointed Director of the Entomological Department of the Museum at Copenhagen, a post which he filled down to the time of his death. In 1854 the title of Professor was conferred upon him. From 1836 he has been a continuous contributor to many scientific publications on the Continent, the bulk of his contributions relating to the order Coleoptera. For upwards of twenty years he edited the 'Naturhistorisk Tidsskrift,' and published in it the series of beautifully-illustrated papers on the transformations of Coleoptera, which may be said to constitute his most notable work. His *Specimen Faunæ Subterraneæ*, originally appearing in the Transactions of the Royal Danish Society of Science (1849), was, at the request of Mr. Spence, translated into English by Dr. Wallich, and the translation, with some additional remarks by the author himself, was published in our own Transactions (1851). In the Proc. Zool. Soc. 1853, p. 101, is a short paper by Schiödte "On some *Staphylinidæ* found in the nests of *Termites*," at the end of which it is stated that "this paper will be printed in full, illustrated with plates from the Author's drawings, in the Transactions of the Society." I cannot find that this intention was ever carried into effect, but a paper on the same subject, "*Corotoca* og *Spirachtha*, Staphyliner som föde levende Unger og ere Husdyr hos en Termit," was published in the Danish Transactions in 1856. It was in 1870 that Schiödte was chosen one of our Honorary Members, and four years later a similar honour was bestowed upon him by the Entomological Society of France. His meritorious career has now closed ; and though, perhaps, his reputation may decrease even in the short perspective of a generation or two, his countrymen are justified in regarding him as the worthiest successor of Fabricius whom Denmark has yet produced ; all must admit that he

did good service in his day, and deserves to be remembered as the Danish Coleopterist of his time.

SIDNEY SMITH SAUNDERS was born at Wandsworth in June, 1809, and very early in life he entered the Consular Department of the Foreign Office; in 1835 he was appointed British Consul in Albania, was transferred to Alexandria in 1859, and was Consul-General for the Ionian Isles from 1864 to 1870, when he returned home to England. His long and meritorious services earned him the Companionship of the Order of St. Michael and St. George in 1860, and shortly after his retirement he received the honour of knighthood. He was one of the original Members of our Society, President for 1874 and 1875, a Vice-President in 1873 and 1876, and on the 6th February last I had the pleasure of nominating him as one of my Vice-Presidents for 1884. He read a paper at that meeting, On the Caprification of Figs, and a second paper at the April meeting, On the *Pediculus Melittæ* of Kirby. Those who were present on that occasion cannot fail to recollect the self-obliviousness and the youthful enthusiasm with which our venerable friend, then in his 75th year, read his abstruse and closely-reasoned communication; or to recall the shock with which we learned that, less than a fortnight afterwards, and before the proofs had been corrected, Sir Sidney was no more. He died on the 15th April, 1884.

The following is, I believe, a complete list of Sir Sidney Saunders' published papers:—

1. Descriptions of some new species of Coleopterous Insects lately received from Monte Video. Trans. Ent. Soc. Lond. i. 149 (read 6th October, 1834).

2. Account of the attacks of various Insects upon Wine Corks. Proc. Ent. Soc. Lond. 1835, p. lv.

3. Description of a Species of *Mygale*, from Ionia, with its Nest. Trans. Ent. Soc. Lond. iii. 160. (1842).

4. Additional Observations on the habits of *Mygale*. Trans. Ent. Soc. Lond. iii. 165. (1842).

5. Description of a new genus of Diptera allied to *Stratiomys*. Trans. Ent. Soc. Lond. iv. 62. (1845).

6. Descriptions of two new Strepsipterous Insects from Albania, parasitical on Bees of the genus *Hylæus*, with some account of their habits and metamorphoses. Proc. Ent. Soc. Lond. 1850, p. viii; Trans. Ent. Soc. Lond., 2 Ser., i. 43.

7. Descriptions of some new Aculeate Hymenoptera from Epirus. Proc. Ent. Soc. Lond. 1850, p. xvi; Trans. Ent. Soc. Lond., 2 Ser., i. 69.

8. Notices of some new Species of Strepsipterous Insects from Albania, with further observations on the habits, transformations, and sexual economy of these parasites. Trans. Ent. Soc. Lond., 2 Ser., ii. 125. (1853).

9. Observations on the habits of the Dipterous Genus *Conops*. Trans. Ent. Soc. Lond., 2 Ser., iv. 285. (1858).

10. *Stylopidarum*, ordinem Strepsipterorum Kirbii constituentium, mihi tamen potius Coleopterorum Familiæ, Rhipiphoridis Meloidisque propinquæ, Monographia. Trans. Ent. Soc. Lond. 1872, p. 1.

11. On the habits and economy of certain Hymenopterous Insects which nidificate in Briars, and their parasites. Trans. Ent. Soc. Lond. 1873, p. 407.

12. On the adult larvæ of the *Stylopidæ* and their puparia. Trans. Ent. Soc. Lond. 1877, p. 195.

13. On the habits and affinities of *Apocrypta* and *Sycophaga*, of the Hymenopterous family *Agaonidæ*, with description of a new species of *Apocrypta* from the figs of *Ficus Sycomori* of Egypt. Trans. Ent. Soc. Lond. 1878, p. 313.

14. Caprification of the Sycamore fig—Correction of an Error. Ent. Mo. Mag. xv. 190 (1879).

15. Capture of a *Dufourea* in Hants, a genus of Hymenoptera new to Britain. Ent. Mo. Mag. xvi. 181. (1880).

16. On the habits and affinities of the Hymenopterous Genus *Scleroderma*, with descriptions of new Species. Trans. Ent. Soc. Lond. 1881, p. 109.

17. Capture of rare Hymenoptera on the South Coast of England. Ent. Mo. Mag. xviii. 160. (1881).

18. Notes on the *Euchalcis vetusta*, Dufour (Fam. *Chalcididæ*); and on the terminal segments of the females in *Halticella* and its allies. Trans. Ent. Soc. Lond. 1882, p. 291.

19. Error as to Fig-insect from *Ficus religiosa*. Ent. Mo. Mag. xix. 163. (1882).

20. Descriptions of three new Genera and Species of Fig-insects allied to *Blastophaga*, from Calcutta, Australia, and Madagascar; with notes on their parasites and on the affinities of the respective races. Trans. Ent. Soc. Lond. 1883, p. 1.

21. On the *Cynips caricæ* of Hasselquist, and other Fig-insects allied thereto; with description of a new Species from Australia. Trans. Ent. Soc. Lond. 1883, p. 383.

22. Further notes on the Caprification of domestic Figs, with reference to Dr. Paul Mayer's comments thereon. Trans. Ent. Soc. Lond. 1884, p. 97.

23. On the *Pediculus Melittæ* of Kirby, and its affinities, with reference to the larvæ of *Meloe*. Trans. Ent. Soc. Lond. 1884, p. 107.

Thus from 1834 to 1884 Sir Sidney Saunders was a contributor to our Transactions, and all his important memoirs have appeared in the Society's publications. It has been truly

said that his published writings were far too few to represent his extensive knowledge of our science. I cannot doubt, however, that many of his memoirs, *e. g.*, those on the *Stylopidæ* or bee-parasites, on the briar-insects, the fig-insects, and other Hymenoptera, will have an enduring value and preserve him from oblivion. His carefulness and accuracy in observation and research, his kindly encouragement of those who needed it, and his unfailing courtesy to all, combined to constitute a man with whom it was a pleasure to be associated; and to us, at least, who have known him personally, and been allied with him as Members of this Society, the memory of our late colleague will continue ever green.

The only other Member of our Society of whom, during the past year, we have been deprived by a too early death is Sir ARTHUR DOUGLAS BATEMAN SCOTT, Bart., who had but recently joined us, and died in March last in the 24th year of his age.

Though he was not one of our body, I cannot refrain from a passing reference to the loss of EDWIN BIRCHALL. A native of Leeds, he was for some years resident in Dublin, and the best portion of his entomological career was spent in the sister isle; whilst the latter part of his life was passed in the Isle of Man, where he died on the 2nd May, 1884, at the age of sixty-five years. His papers in the Ent. Mo. Mag. (vol. iii., 1866, with a supplement in vol. x., 1873) are, perhaps, his most important contributions to Entomological knowledge; and of these it may be said that they tell us all we know—but how much less than we ought to know—of the Lepidoptera of Ireland. Is it too much to hope that the Entomology of Ireland may no longer be left to the casual investigation of a Yorkshire Lepidopterist? and that the day is at hand when the Irish themselves will study the insects of Ireland, and establish an Entomological Home Rule?

The Nestor of Swedish Entomologists, OLOF IMMANUEL FÄRREUS, passed quietly away on the 28th May last. He was one of twin brothers, born on the 23rd March, 1796, in the Island of Gothland; having graduated at Upsala, he entered the service of the Swedish Government, and was employed in the Customs Department, to the head of which he eventually rose.

From 1840 to 1847 he was a Member of the Royal Council, and performed the functions of Chancellor of the Exchequer and afterwards of Home Secretary. In 1847 he was appointed Governor of the province of Gothenburg; in 1864 he returned to Stockholm, and sat in the First Chamber as Member for Gothenburg; for several years he was Deputy Speaker of the House, and not until 1878 did he retire from public life. Combining practical statesmanship with a love of Natural History, and especially of Entomology, he was associated with Schönherr (1837-42), describing no less than 480 new species in the 'Genera et Species Curculionidum,' and with Boheman (1851-57) in the preparation of the "Insecta Caffraria annis 1838-45 a J. A. Wahlberg collecta," describing the *Buprestidæ*, *Lycidæ*, *Histeridæ*, and a considerable portion of the *Scarabæidæ*. Between 1870 and 1872 he also published in the Transactions of the Stockholm Academy of Sciences five separate papers, entitled "Coleoptera Caffrariæ a J. A. Wahlberg collecta." Elected a member of that Academy in 1840, he was its President in 1847, and in 1879 he was chosen an Honorary Member of the Entomological Society of Stockholm.

Another veteran Coleopterist, AUGUSTE CHEVROLAT, has lately been removed. He was one of the foundation Members and for the last ten years an Honorary Member of the Entomological Society of France; and from 1831 to his death he has been a constant writer in the 'Annales' and other entomological periodicals, the whole of his communications relating to Coleoptera, to the study of which Order of Insects he exclusively devoted his attention. The first volume of our Transactions (1836) contains his "Description d'un nouveau Genre de Curculionites" (read 7th July, 1834), and another paper from his pen will be found in the first volume of the Journal of Entomology (1862). M. Chevrolat was for many years engaged at the Administration de l'Octroi, but it is more than a quarter of a century since he retired from his official duties. He lived all his life in Paris, and died there on the 16th December, 1884, in the 86th year of his age.

Our annual volume of Transactions contains twenty-five memoirs, of which, if I were at liberty to make a selection, several might be mentioned as of more than ordinary interest

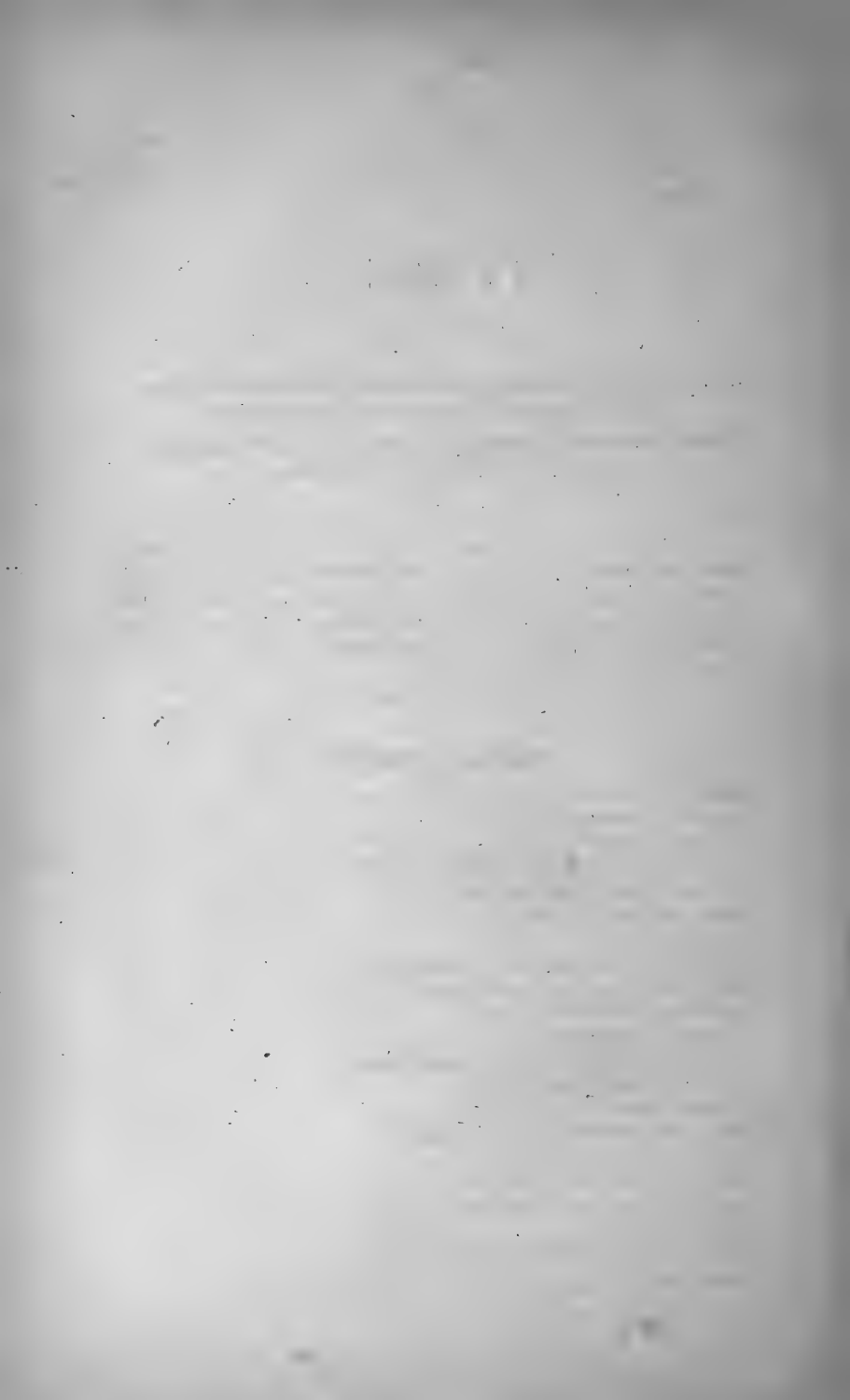
and value. With the exception of 1873, this is the first year in the history of the Society that we have published nothing from the pen of Prof. Westwood; but I rejoice to add that our venerable Life-President has completely recovered from the serious accident which befell him in the spring. The Transactions are now delivered gratis to every Member, in town and country alike, whose subscription for the year has been paid; this has necessarily caused some little increase in our expenditure and some diminution in our receipts; but I trust this will be more than counterbalanced by the increased number of our Members, which ought to be the natural consequence of the more liberal policy adopted under the auspices of our Treasurer.

No small portions of the publications for 1884 of the Linnean and Zoological Societies have been devoted to entomological subjects. Thus, the second part of the Rev. A. E. Eaton's "Revisional Monograph of recent *Ephemeridæ*," and an important paper by Mr. Lowne, "On the Compound Vision and the Morphology of the Eye in Insects," have appeared in the Linnean Transactions, whilst the Journal of the same Society contains a memoir by Mr. H. W. Bates, "On the Longicorn Beetles of Japan." In the Proceedings of the Zoological Society there are nine entomological papers, the authors being Prof. Wood-Mason, the Rev. O. Pickard-Cambridge, Colonel Swinhoe, and Messrs. C. O. Waterhouse, Godman, Salvin, Druce, H. W. Bates, and Distant. But perhaps the most striking entomological work produced in this country during the year that has just expired is Mr. A. D. Michael's volume on 'The British *Oribatidæ*,' issued by the Ray Society as the volume for 1883. When it is remembered that Mr. Buckton's 'Monograph of the British *Aphides*' has only just been completed, that the volume for 1884 (now on the eve of distribution) is another instalment of Mr. Cameron's 'Monograph of the British Phytophagous Hymenoptera,' and that the volume for 1885 is to be the first portion of Mr. Buckler's "Lepidopterous Larvæ," I think it must be admitted that the Ray Society has done well for British entomologists, and merits all our support. It is perhaps to be regretted that these entomological works cannot all be issued to the public from one and the same source, and some day or other this will have to be effected, by the co-operation or affiliation of different societies and a classification of subjects. But that day

has not yet arrived, and in the meantime it is pleasant to find that so many bodies are independently, but in perfect harmony, assisting in the advancement of that branch of Science to which we are devoted, and the furtherance of which is the sole object of our corporate existence.

I beg again to congratulate you upon the smooth working of our new electoral law. The redistribution of the seats in our Council has been accomplished without a jar, and I have again to announce an unopposed return. No other candidate having been nominated, I have to declare that Mr. McLachlan is the President for 1885 ; that the Treasurer, Secretaries and Librarian have been re-elected ; and that Messrs. Billups, Druce, Dunning, Goss, Meldola, Slater, Stevens and Weir are the other Members of the Council for the coming year.

And now, Gentlemen, it only remains for me to say Farewell. To the Officers and other Members of the Council my warmest thanks are due for their co-operation and support. The attendance at the Council Meetings has been unprecedented. It may seem invidious to make any selection, but from the necessity of the case the successful conduct of the Society's affairs mainly depends upon the activity and tact of the gentlemen who occupy the posts of Treasurer, Secretary and Librarian. Those offices well filled, the Society can survive a *roi fainéant* ; but pardon me if I warn you against a repetition of the experiment of electing a mere dabbler in Science to be your President. Believe me, I am deeply grateful to each and all of you for your kindness to myself personally ; but I heartily rejoice that my term of office has expired, and that I am to be succeeded by one who is an Entomologist in fact as well as in name. Fifteen years ago I resigned the acting Secretaryship into the hands of ROBERT McLACHLAN : it is with far greater pleasure that I now vacate for him the Presidential Chair.



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the description will be found on the page referred to.

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Zebronia aurolinealis, synonym of *N. cassalis*, 311.—*cassalis*, new genus for, 311.—*meritalis*, a *Conchylodes*, 310.—*plexippusalis*, synonym of *C. meritalis*, 310.
Zinckenia, 308. *Z. perspectalis*, from Australia, 309.—*primordialis*, synonym of *Z. perspectalis*, 309.—*recurvalis*, from Australia, 308.

NEUROPTERA.

Chrysopa perla, exhibited, with photographs of wings, xxii.

Crocothemis erythræa, exhibited from Egypt, xi.

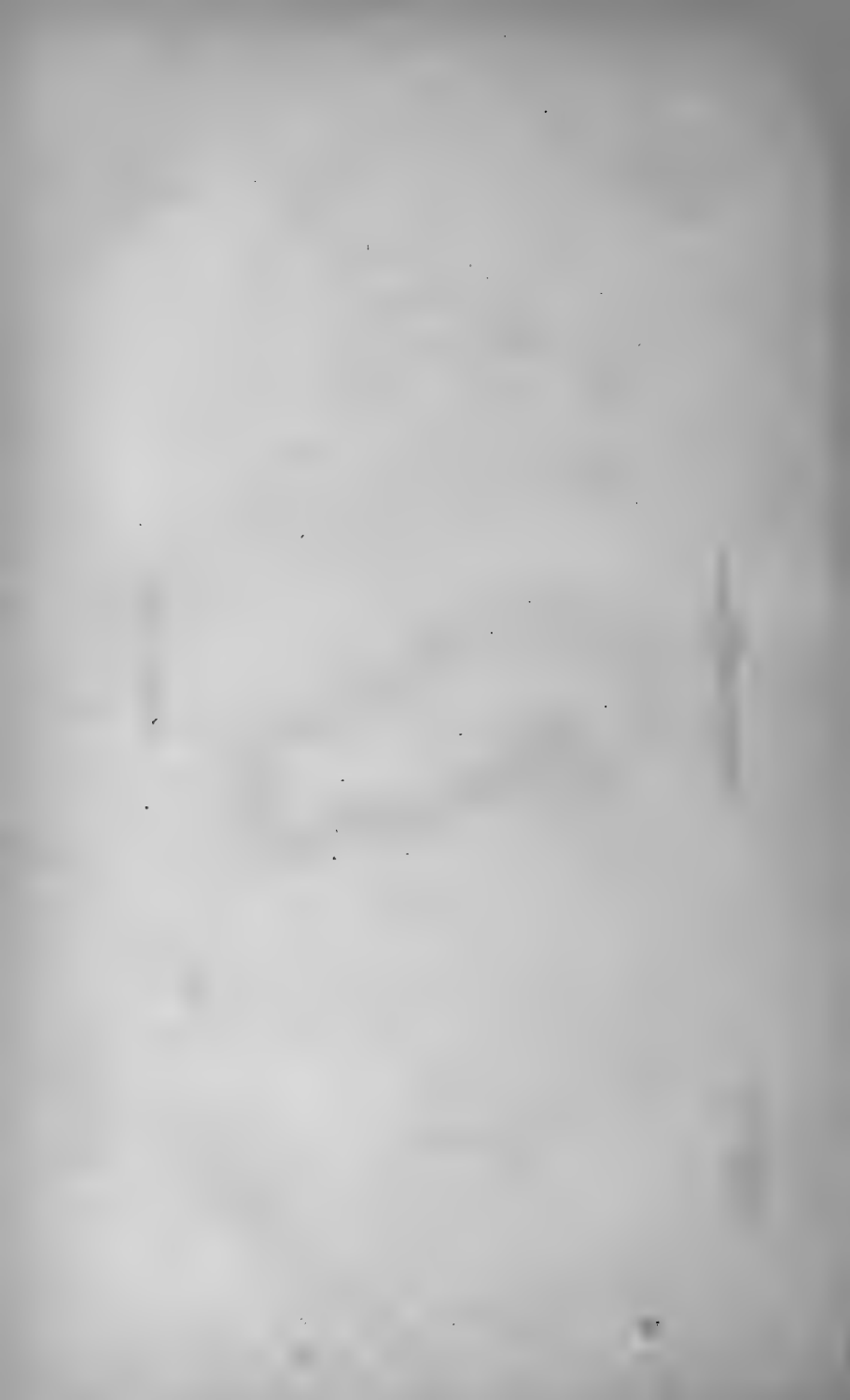
Nemopteridæ, specimen from Coquimbo exhibited, xxviii.

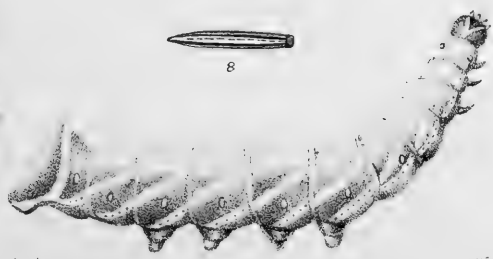
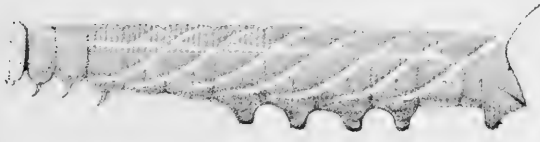
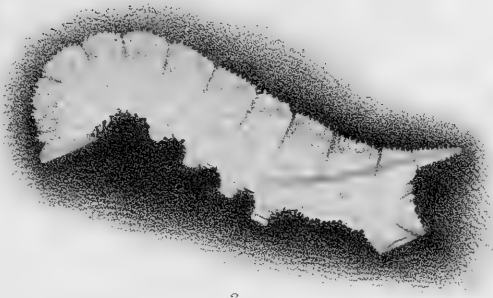
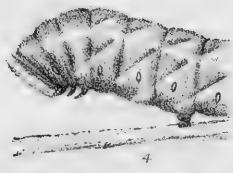
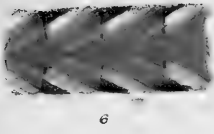
Trichoptera from Unst, exhibited, xxxiii.

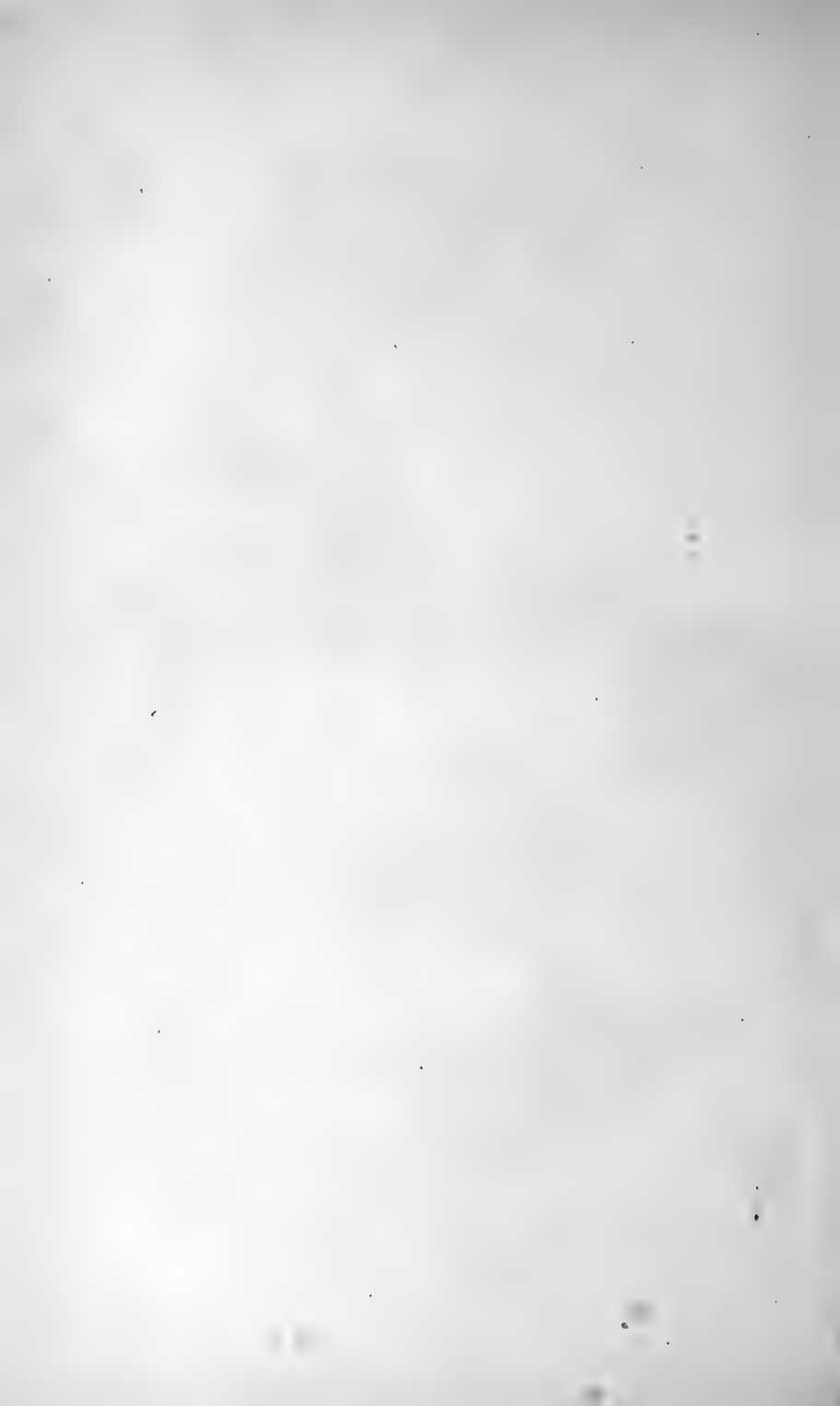
Trithemis rubrinervis, exhibited from Egypt, xi.

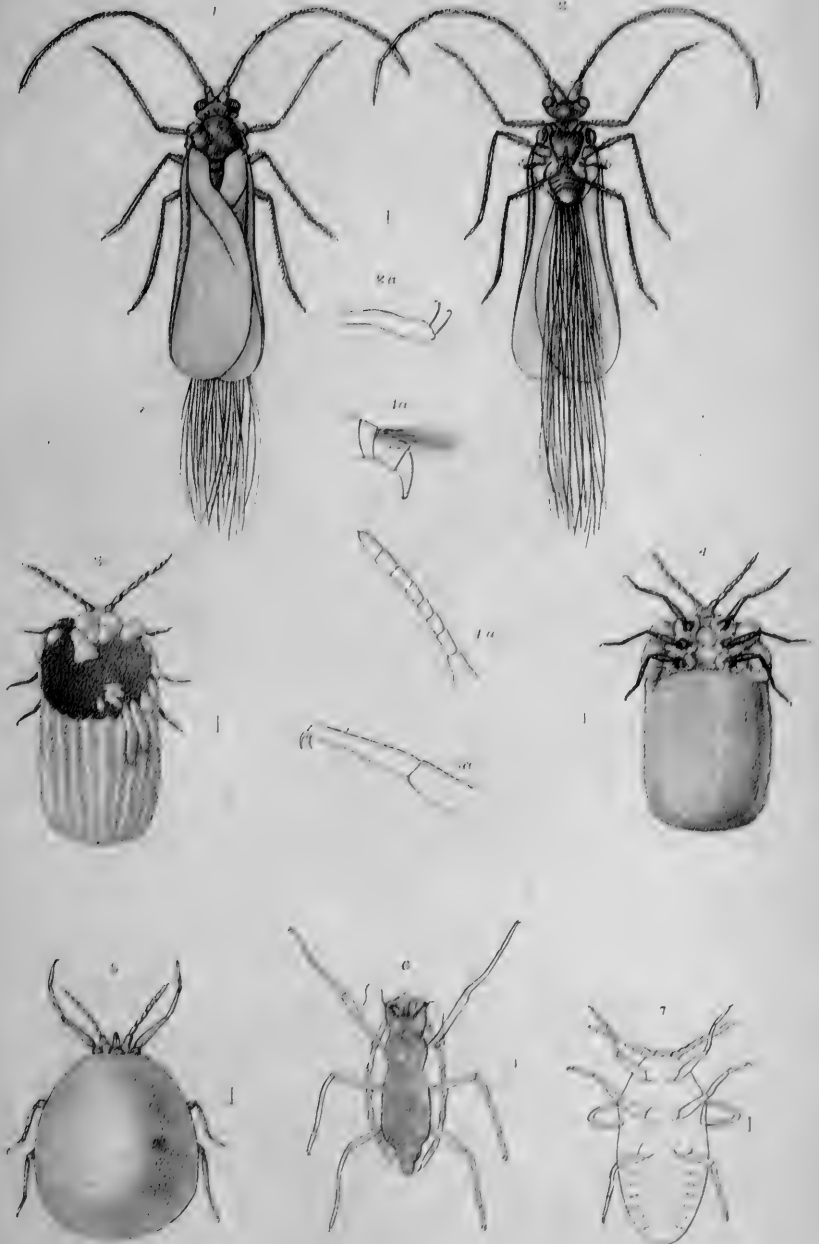
ORTHOPTERA.

Locust from Kalachari desert, exhibited, xxvii.



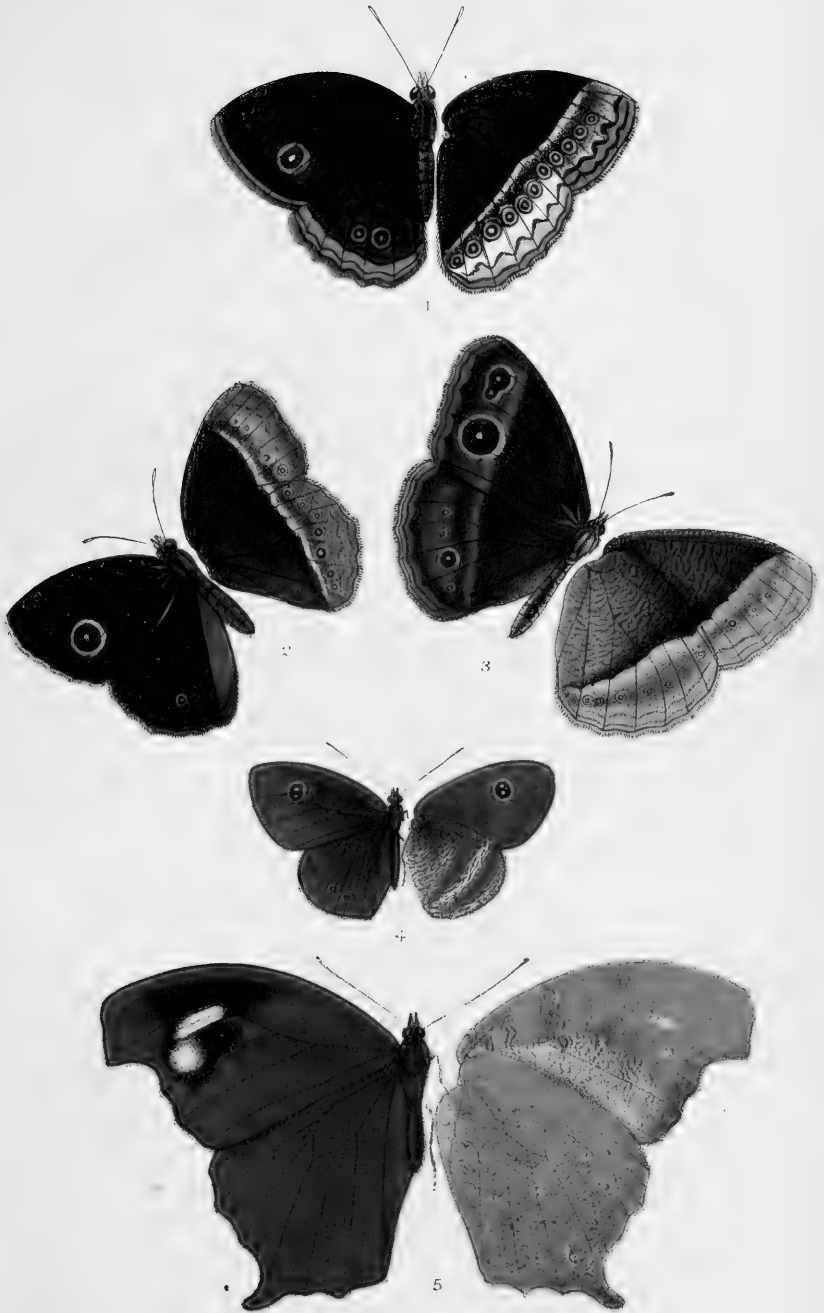






Orthozia *var. aeneus* etc.

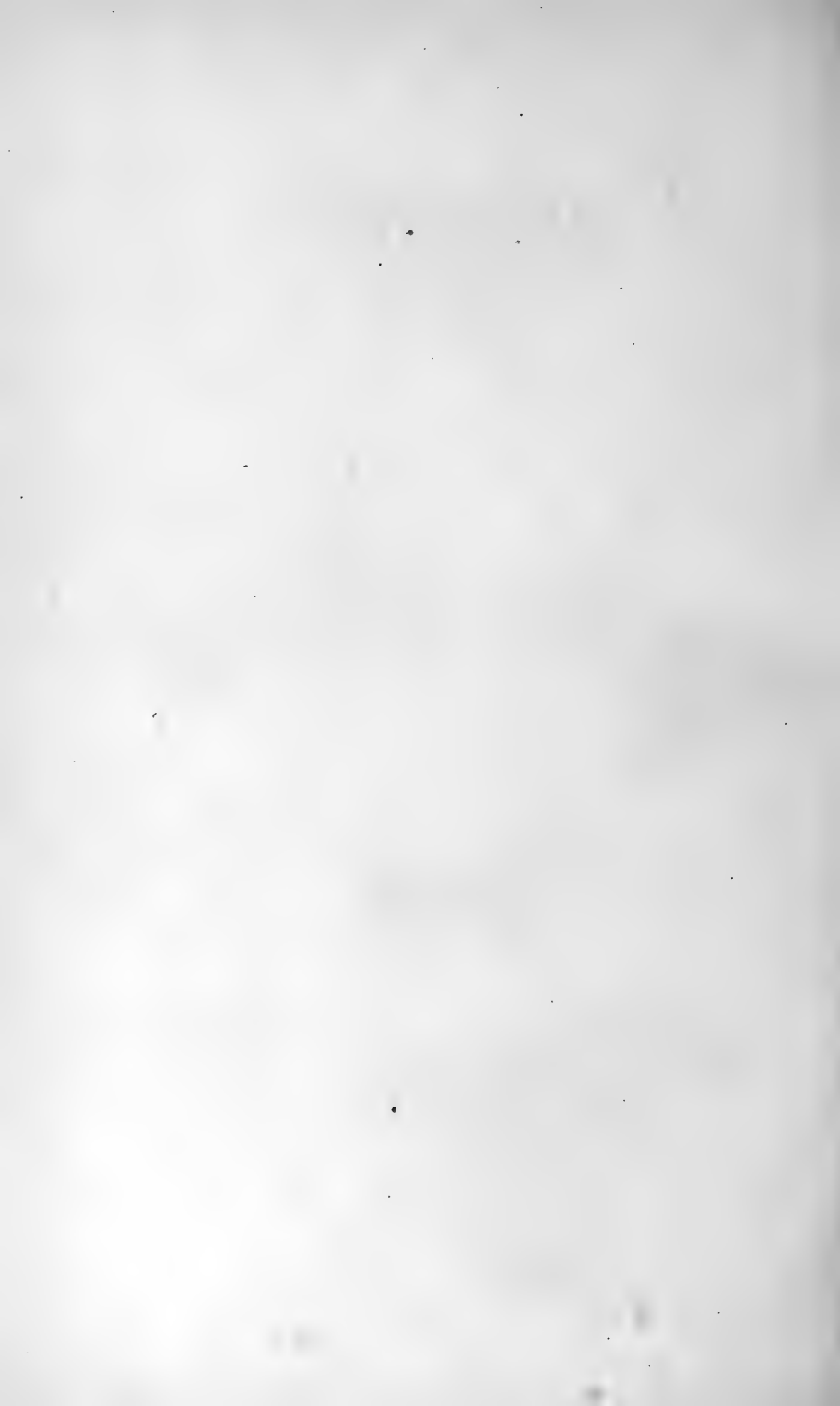


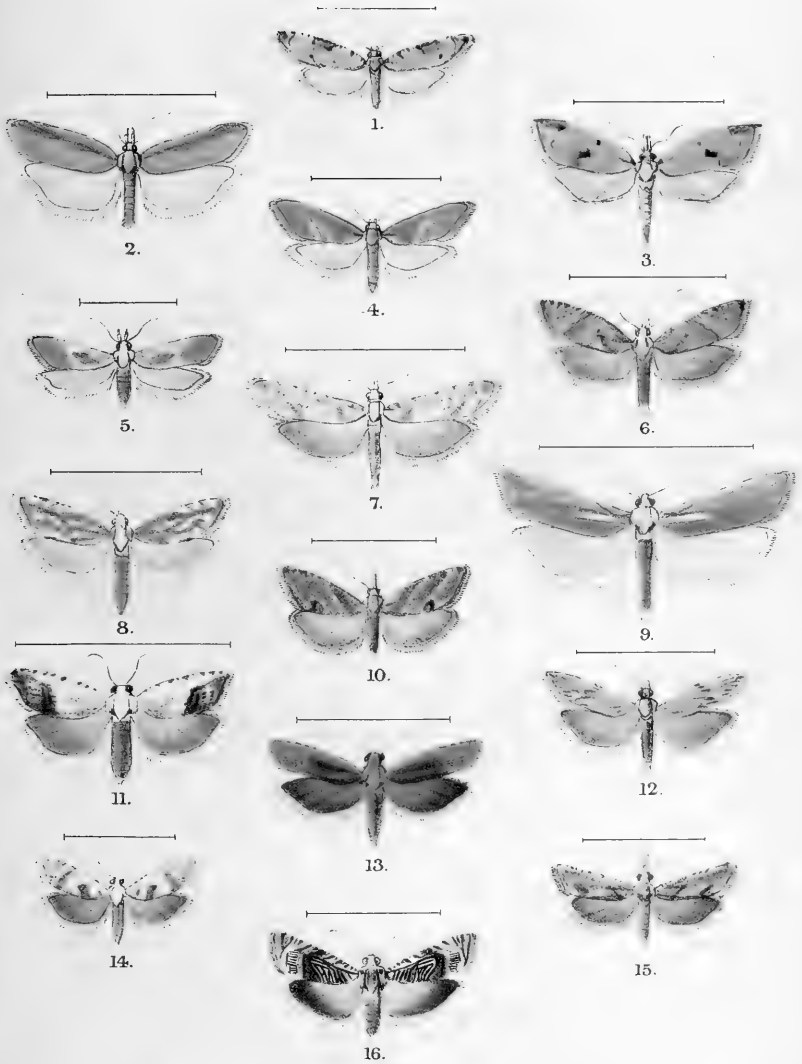


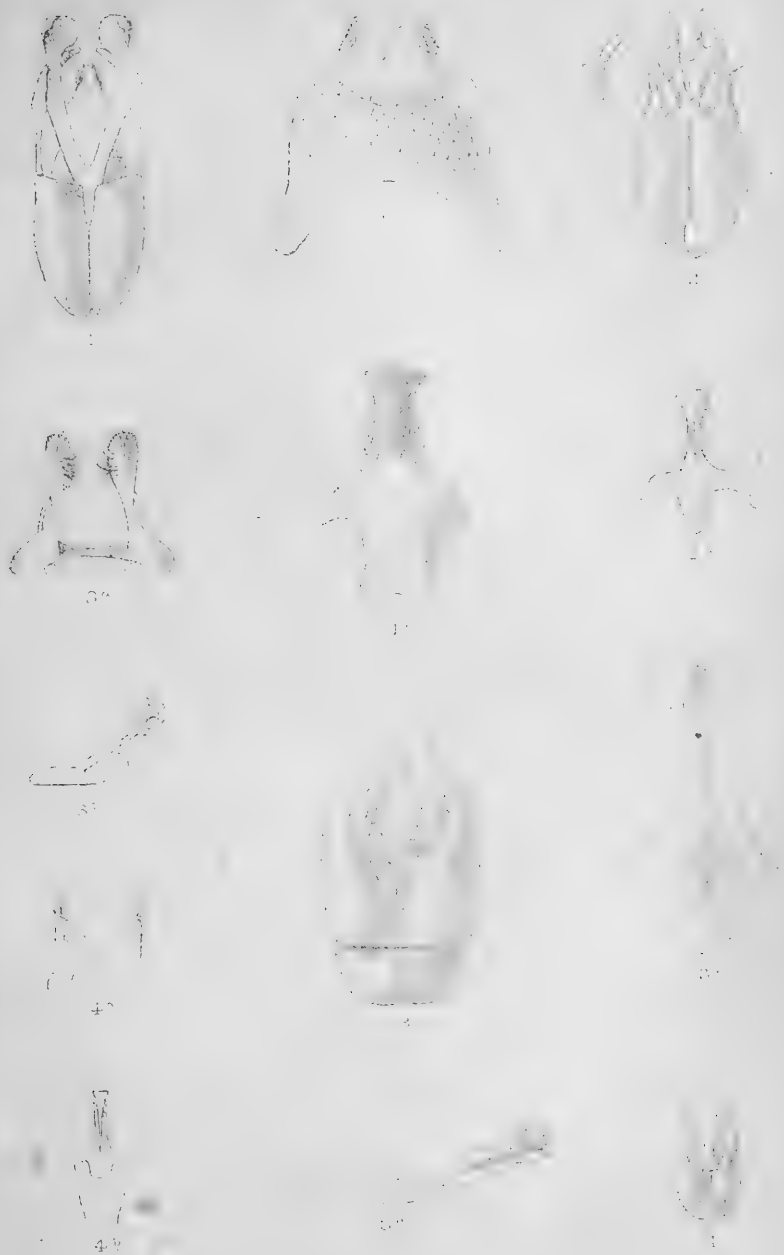
G. L. Chuckerbety
& H. Knight, del.

West Newman & Co
chromo. lith

Indian and East-African Satyridæ.



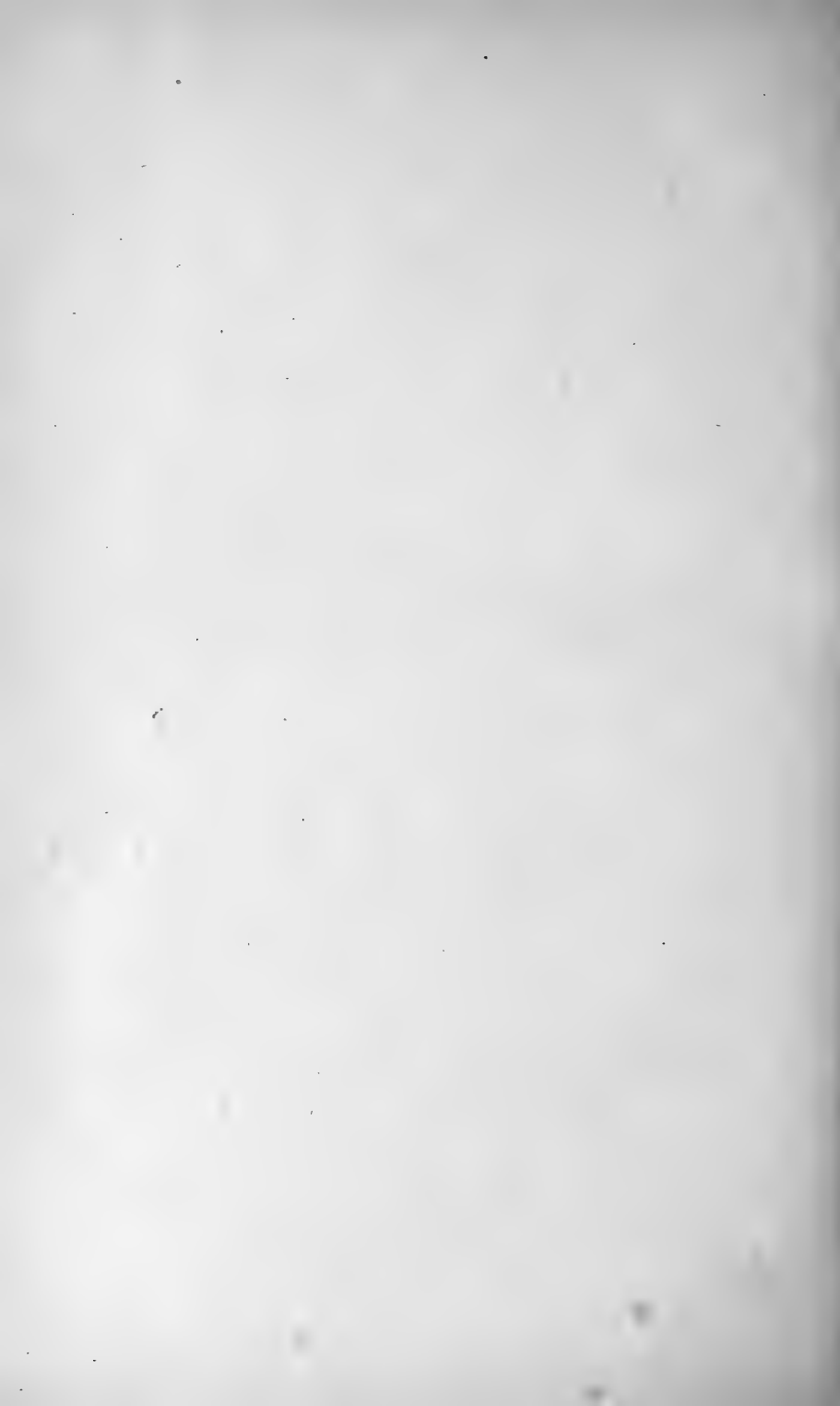




G. S. Saunders del. et lith.

West Newman & Co. Imp.

Male genital armature &c of British Hymenoptera.

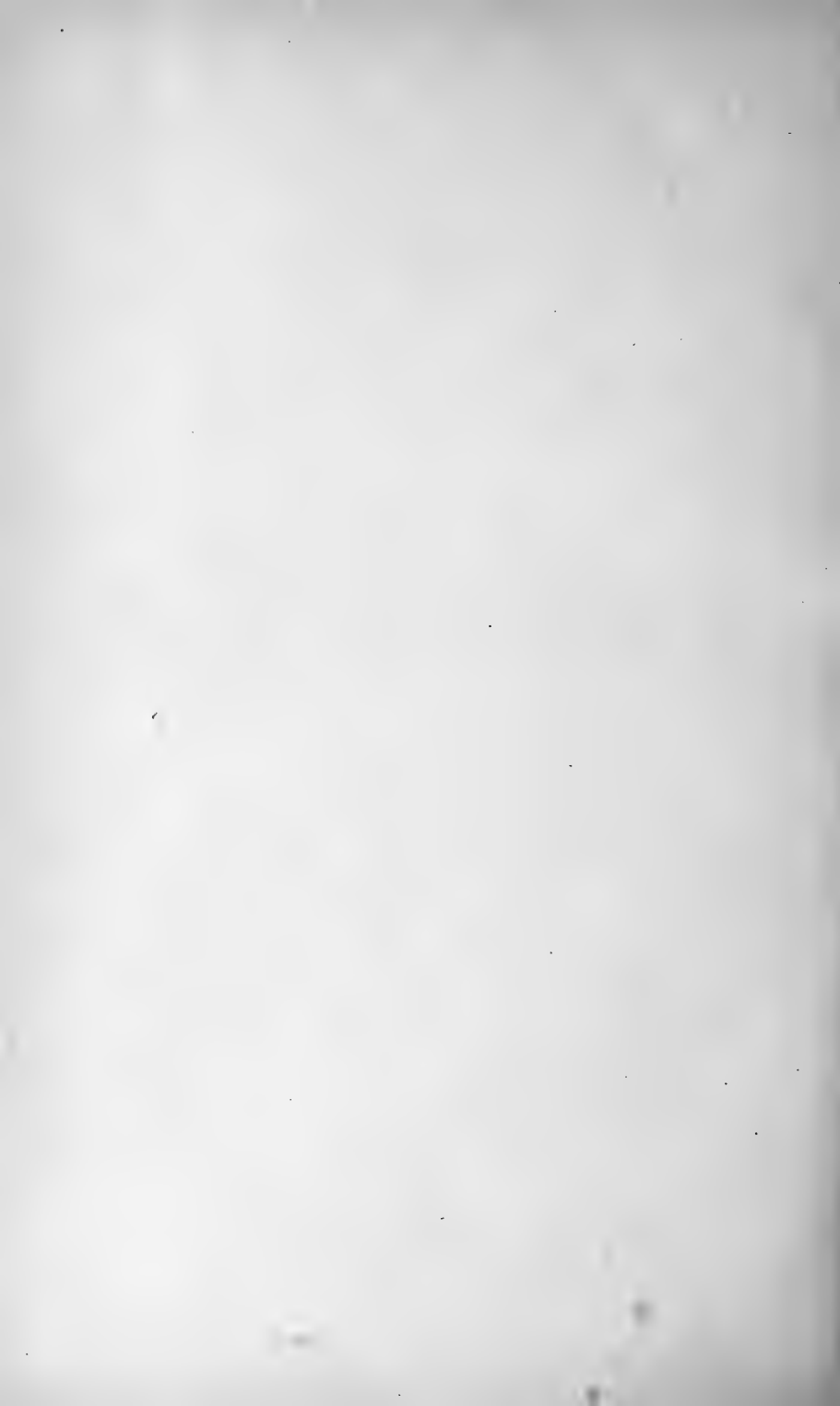




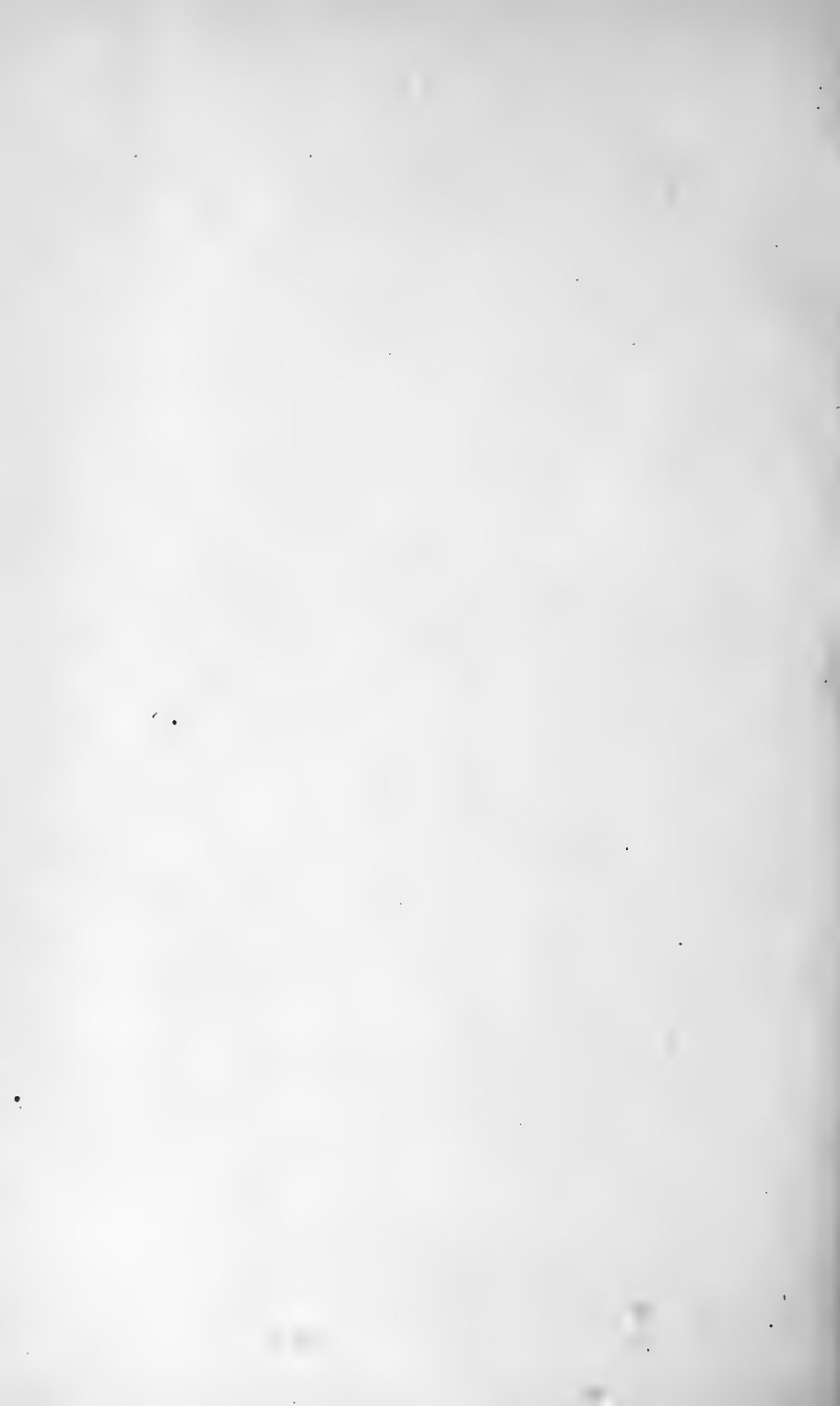
Ed. Saunders del. et lith. sculp.

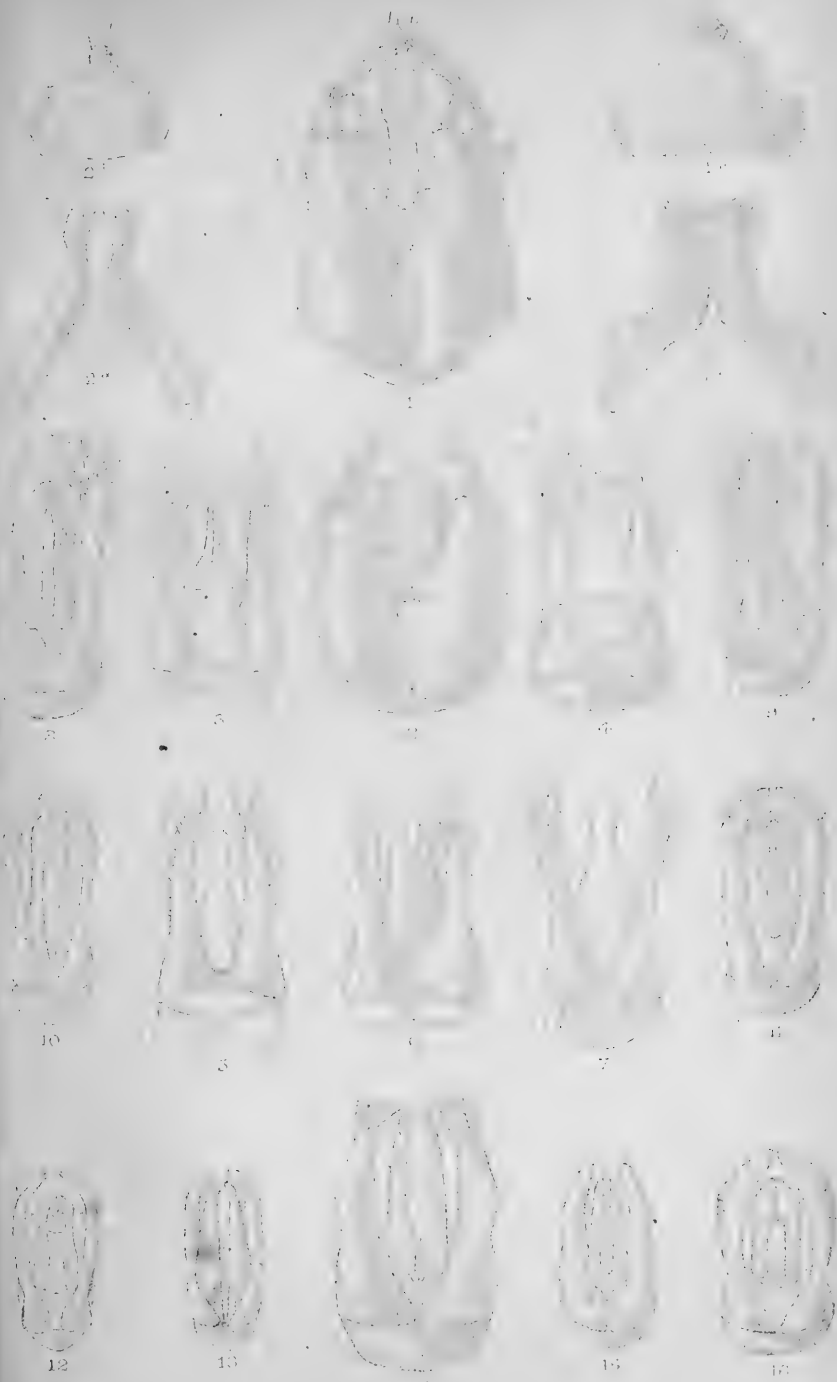
West Newman & Co imp.

Male genital armature ♂ of British Hymenoptera.







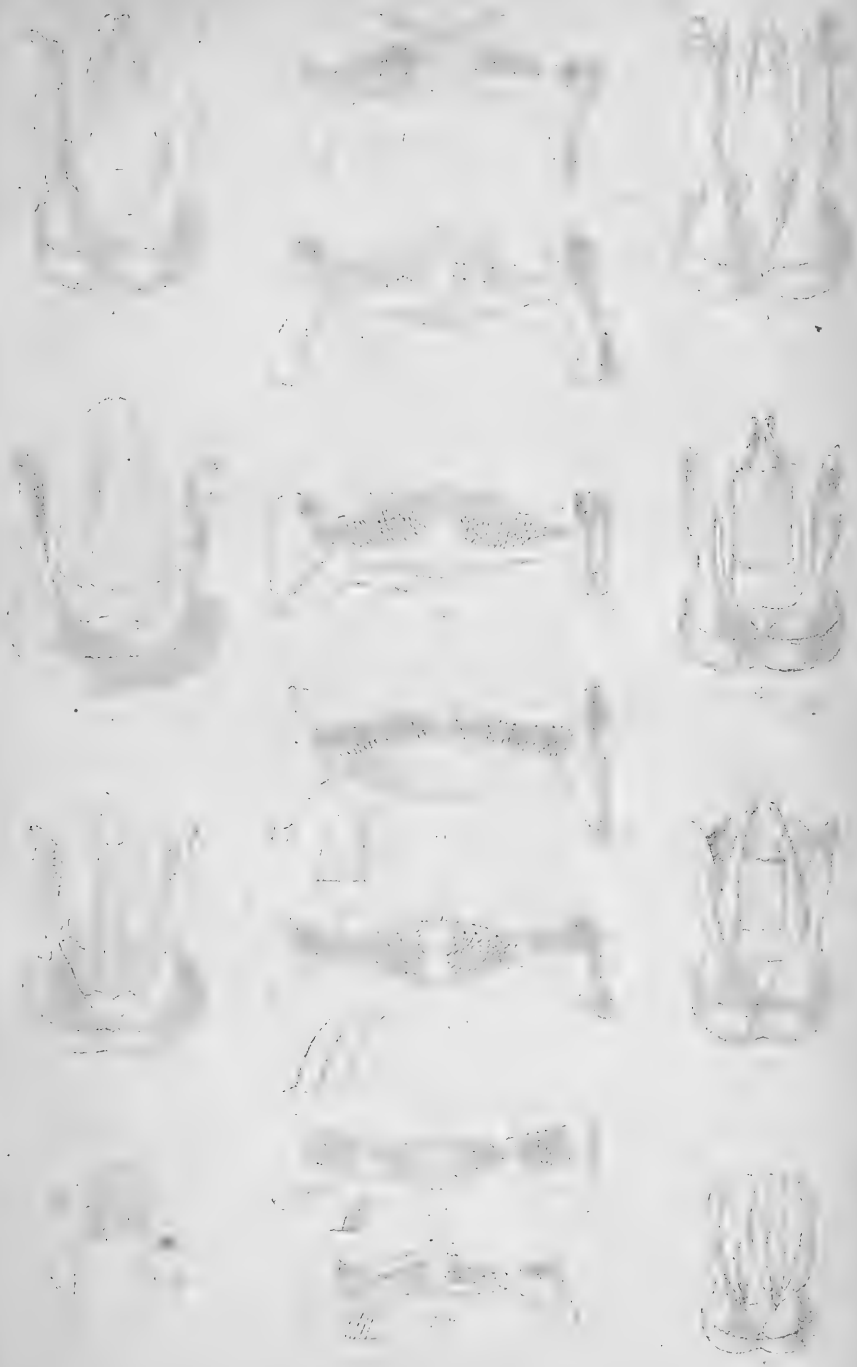


Dr. S. Saunders del. et lithogr.

West Houseman & Co. imp.

Male genital armature ♂ of British Hymenoptera.

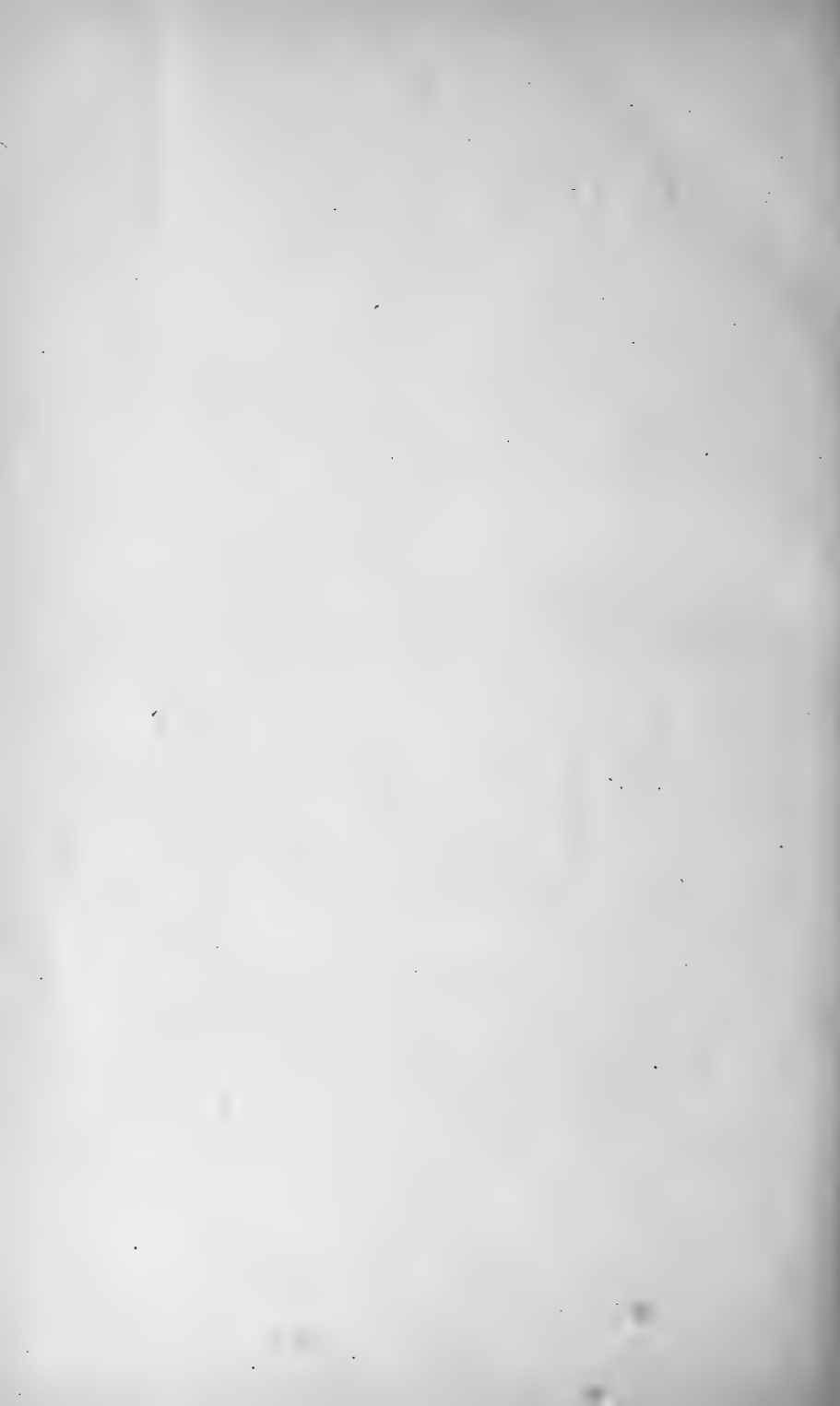


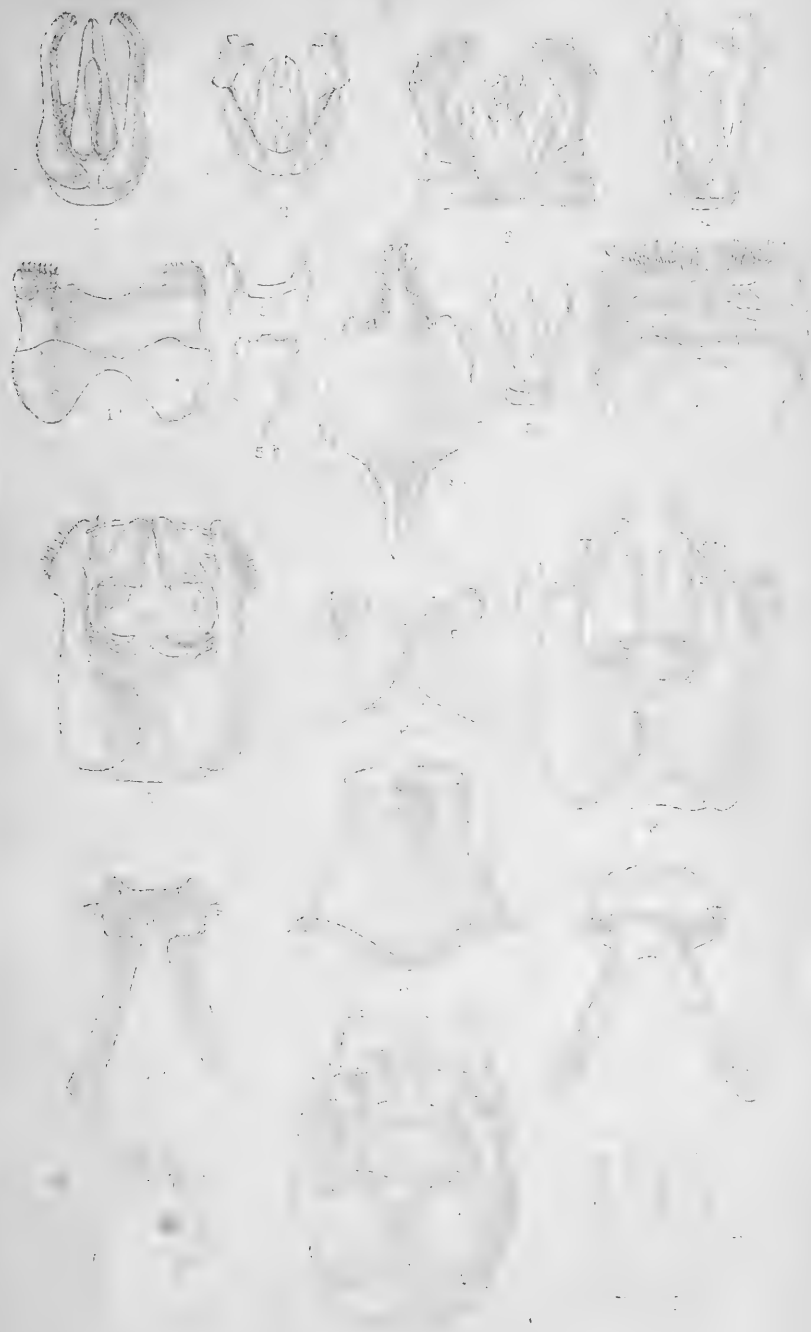


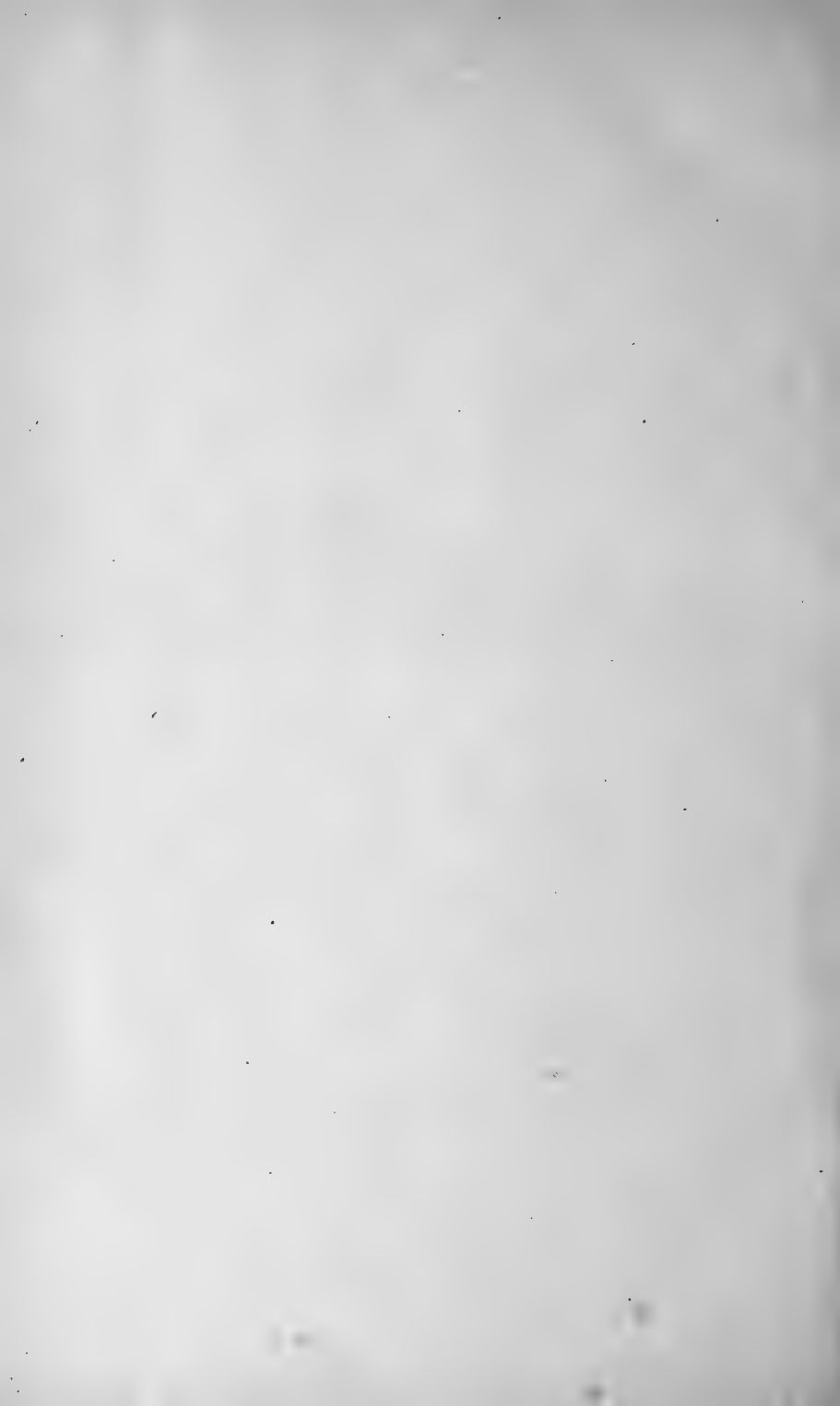
G.S. Saunders del. et lith. 22. 22. 22.

West Newman & Co. imp.

Male genitalia, armature &c. of British Hymenoptera.



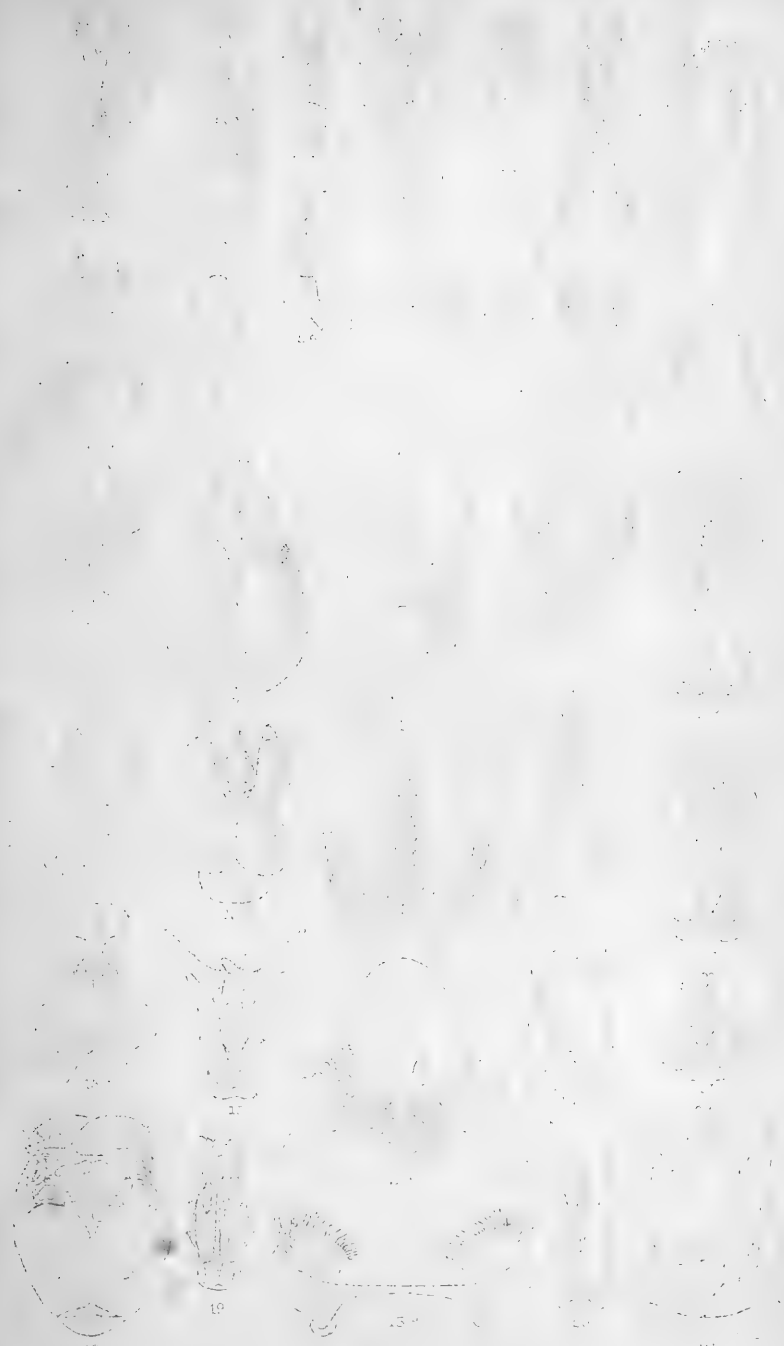










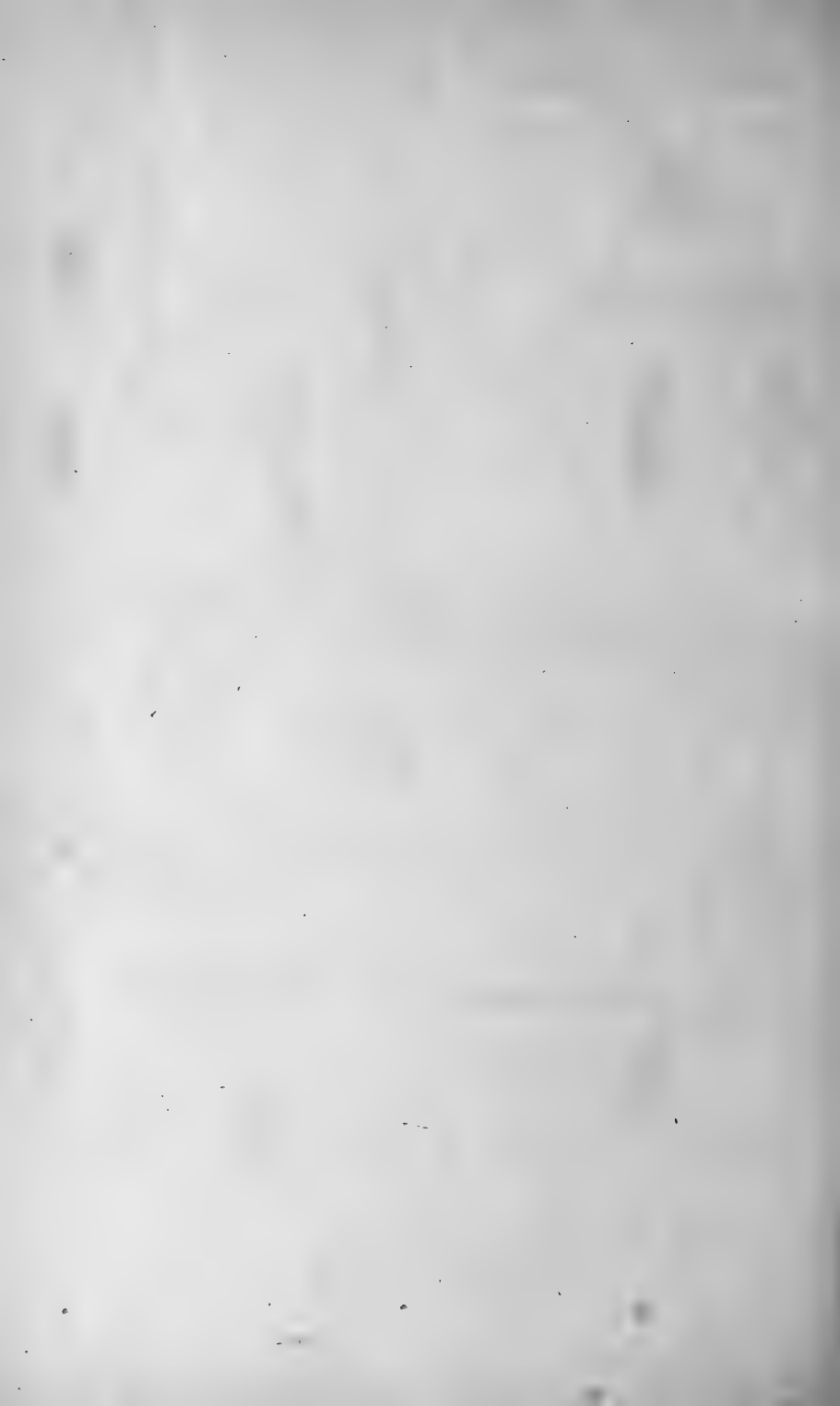


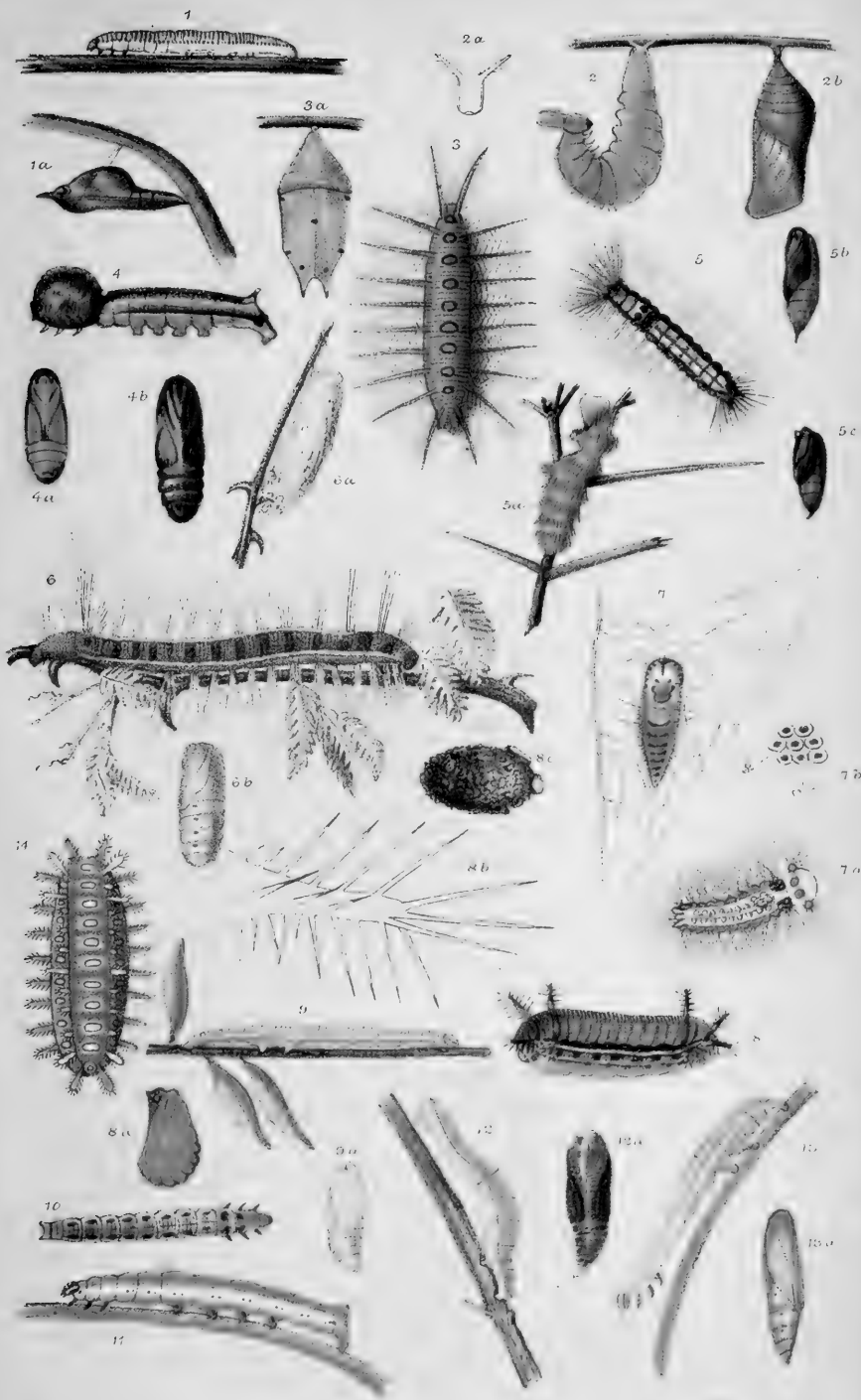
18

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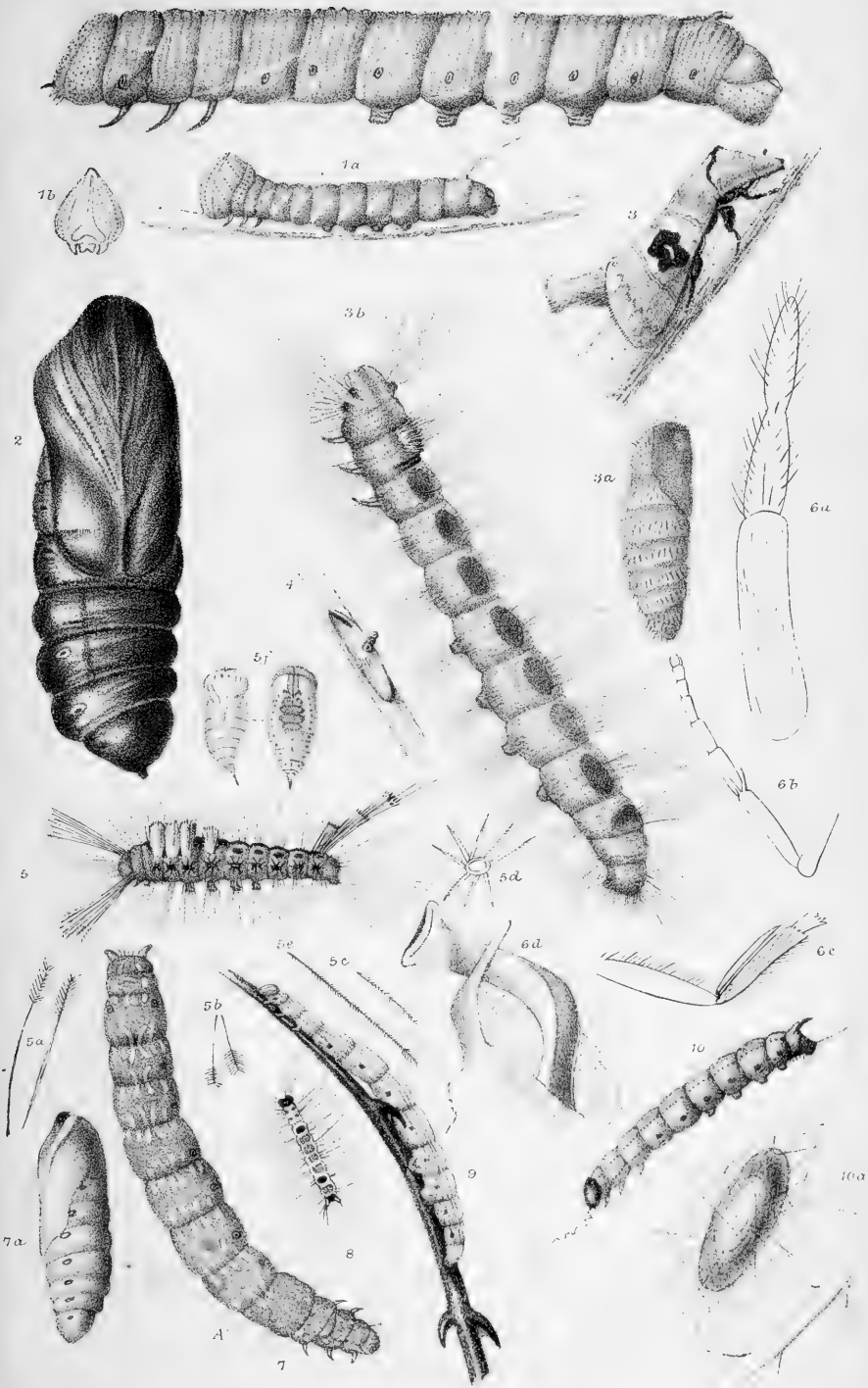
G.S. Saunders del. et lith. ad nat.

West Newman & Co imp.







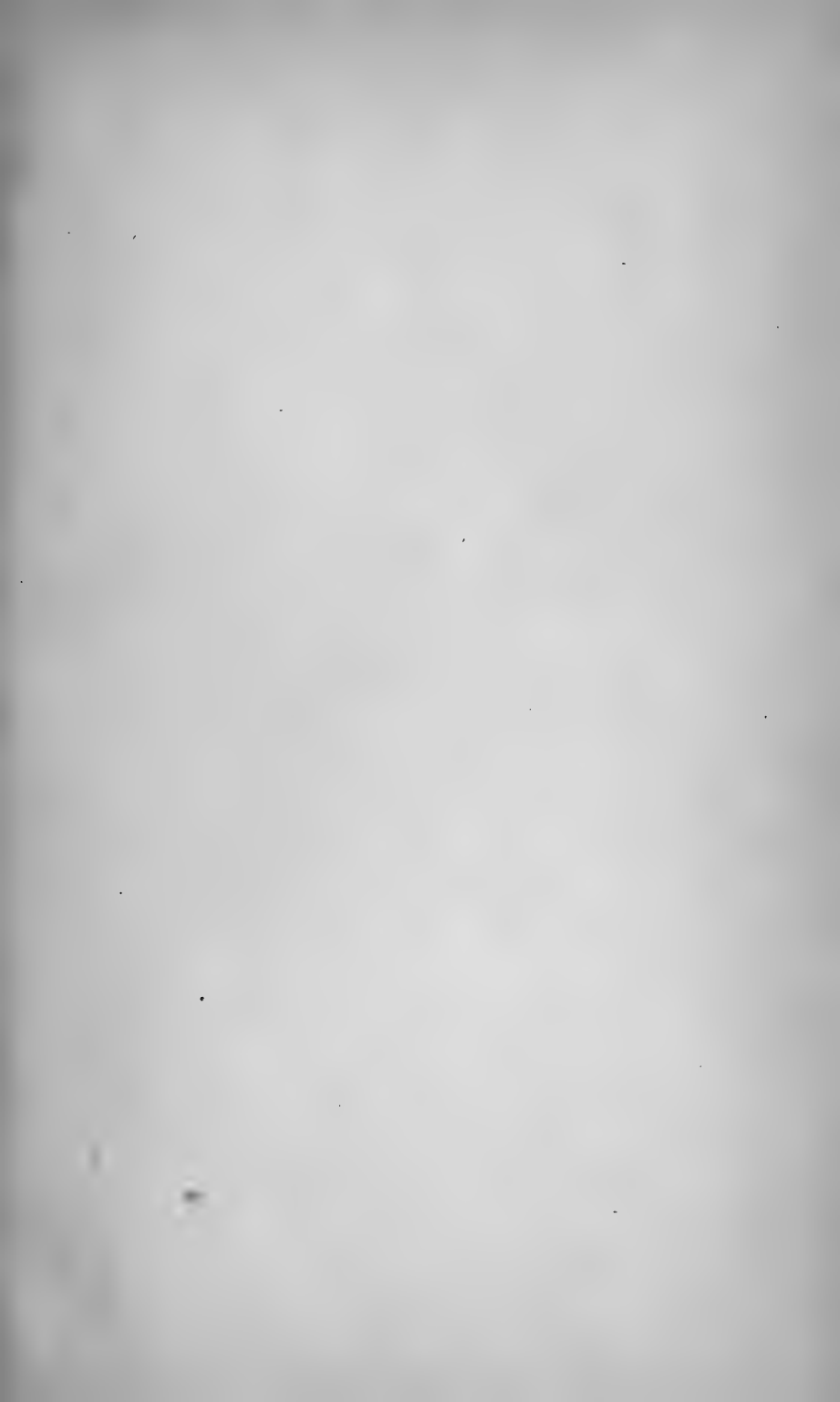


R.W. Forsyth del.

Indian Lepidoptera

West Newman & Co. lith.











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