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The Canadian Entomologist.

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OPHIOGOMPHUS.

BY JAMES G. NEEDHAM, LAKE FOREST, ILL.

This genus of dragon flies is one of the groups whose members are accounted rare in collections, though quite abundant in nature. With the exception of three species, two of which have only been obtained in numbers by breeding, few imagoes have been taken. Although I have collected carefully for several years in localities where a few species were common enough, I have seen but three imagoes at large, but I have bred one species by hundreds, and have seen the exuviæ upon the banks of streams by tens of thousands.

Nymphs of this genus seem to prefer the sandy or gravelly beds of clear, rapid streams, flowing through rocky woods. What becomes of the countless imagoes which issue from such places by night in early summer I have not as yet been able to find out.

So long as the collector of these insects depends entirely upon an air net for his imagoes they are likely to remain rare in his collection; but even a single occasional capture of a good specimen may still add to our knowledge of the genus, since variation is considerable, descriptions are fragmentary, and specimens of most species are few.

This paper is but an excuse for the accompanying plate (5), whose figures are mainly drawn from the types of species and show the structures chiefly used in characterizing them. In its preparation I have had free use of the Hagen collection at Cambridge and of the Lintner collection at Albany—thanks to the kindness of Mr. Henshaw and of Dr. Felt, respectively. This plate and the few annotations on species which follow will serve to bring our species together in one view, and will also indicate the chief gaps in our knowledge of them.

Secondary sexual characters have been mainly used for separating Ophiogomphus from its nearest allies, Onychogomphus (fig. 32) of the Old World, and Herpetogomphus of the western United States and southward. The most salient of the differential characters used for the two American genera have been the form of the inferior abdominal appendage in the male, and the length of the vulvar lamina in the female. These have proved unsatisfactory, especially for the males (of which more are known), yet without destroying faith in the validity of the two genera as natural groups. I wish to point out that there is a venational character, applicable to both sexes, which seems to segregate these two genera sharply. It is the anal loop (see figs. 31 and 33). In Ophiogomphus (fig. 31) the first and second branches of the anal vein (1 and 2) are approximated near their origin to enclose, together with a cross vein connecting them, a distinct anal loop (*a*) of two to four (normally of three) cells. In Herpetogomphus (fig. 33) these veins are not so approximated, and no such semicircular enclosure is formed, but two ordinary cells lie between the veins at their origin.

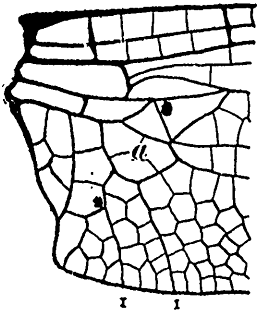

Fig. 31.—Ophiogomphus.

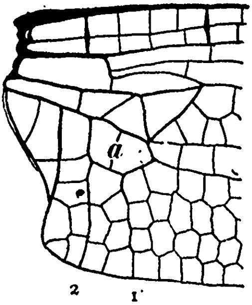

Fig. 32.—Onychogomphus.

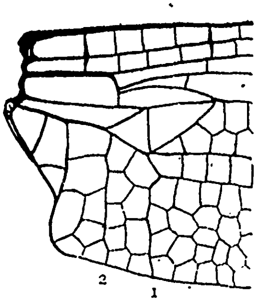

Fig. 33.—Herpetogomphus.

The genus Ophiogomphus includes, besides four European and Asiatic species, the following thirteen nominal species found in the United States, named in the order of their discovery :

1. O. colubrinus, Selys.—Maine and northward. ♂ and ♀ known.
2. O. rupinsulensis, Walsh.—Eastern U. S. ♂ and ♀ known.
3. O. Mainensis, Packard.—Northeastern U. S. ♂? and ♀ known.
4. O. bison, Selys.—Nevada. ♀ known.
5. O. severus, Hagen.—Colo. ♂ and ♀ known.
6. O. montanus, Selys.—Mont. ♂ known.
7. O. Morrisoni, Selys.—Nev. ♂ and ♀ known.
8. O. occidentis, Hagen.*—Wash. ♂ and ♀ known.
9. O. Carolinus, Hagen.*—N. Car., Ky.? ♂ and ♀ known.
10. O. aspersus, Morse.—♂ and ♀ known.

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*Imago undescribed.

11. O. Johannus, Needham.—N. Y. ♂ known.
12 O. Carolus, Needham.—N. Y. ♂ and ♀ known.
13. O. anomalus, Harvey.—Maine. ♂ known.

STRAY NOTES ON SOME OF THE SPECIES.

O. anomalus, Harvey (Ent. News, IX., 60. ♂. Pl. V., fig. 1.), is like Herpetogomphus in the form of the terminal abdominal appendages of the male. I have before me the hind wing of the type (which Professor Harvey has kindly sent me), and the anal loop is of the typical semicircular three-celled form of Ophiogomphus.

O. Colubrinus, Selys, is the most sharply marked species of the genus. It is like the preceding in the generally darker coloration of the body and in having the face transversely lineate with black, but it is unlike all the others in extreme length of the inferior abdominal appendage in the male, and in the straightness of the lobes of the vulvar lamina in the female (Pl. 5, figs. 7 and 34).

O. Johannus, Ndhm., and *O. Carolinus*, Hag., are distinguished by a second bifurcation of the inferior abdominal appendage in the male. The figures of *O. Johannus*, drawn from the type, which was a somewhat imperfect specimen and apparently not quite mature, may not fully represent the species; but the tips of the appendages and the genital hamules were at least well developed (figs. 9, 18 and 27 of Plate 5). The thicker parts of appendages are subject to some distortion in drying in immature specimens. As to *O. Carolinus*, Hag., the types are in the Hagen collection at Cambridge, undescribed; but a female nymph skin from Bee Spring, Ky., Hagen has described and referred by supposition to this species (Trans. Amer. Ent. Soc., XII., 258, 1885). This is especially unfortunate, because the nymphs in this genus are well-nigh undeterminable. If now the Kentucky nymphs should yield another species of imago—a thing entirely possible—there would be synonymic confusion of a rather unique sort. With small likelihood of settling the question of the correctness of Hagen's supposition as to the nymph, it would seem best to regard the name as rightfully belonging to the imagoes from N. Carolina to which it was originally applied, and the types fixed by the figures herewith presented (figs. 8, 17, 26 and 35 of Plate 5).

O. Mainensis, Pack. (Proc. Ac. Nat. Sci., Phila., 1863, p. 255), and *O. Carolus*, Ndhm. (CAN. ENT., XXIX, 183, 1897), are very closely allied, perhaps identical. If the males in the Hagen collection were the types, I should unhesitatingly pronounce *O. Carolus* a synonym. But the original female type there preserved is very different from any females of *O. Carolus* I have seen, especially in the form of the occiput (see Plate 5, figs. 10 and 19). The occiput is variable, to be sure, but I have shown the full extent of variability exhibited by a very large series of females of *O. Carolus* in these pages (CAN. ENT., XXIX., Pl. 7, figs. 1–4), and have found nothing approximating the conformation of the type *O. Mainensis*. Since it is possible that the males associated with this female type may not belong with it, one must show before uniting the species either that the normal variation of the occiput includes such forms, or else that the female type is a freak. The specimens in the Lintner collection, determined by Hagen as *O. Mainensis*, agree entirely (both males and females) with *O. Carolus*.

Of the three closely allied far-western species, *O. severus*, Hag., *O. montanus*, Sel., and *O. Morrisoni*, Sel., I have seen very few specimens: of *montanus*, none at all. *Montanus* was first described as a variety of *O. severus*, but was ranked as a species by De Selys in his Revision des Ophiogomphus (C. R. Ento. Soc. Belg., 1879, p. lxiv.), and so listed by Kirby in his Catalogue of the Odonta. These three species constitute a group within the genus characterized by De Selys by the simple (hornless) occiput of the female—a thing not distinctive, as we have seen, but apparently entirely characteristic of these species.

The remaining species constitute a troublesome lot, among which *O. aspersus*, Morse, seems pretty sharply defined; but variation in the form of the accessory genitalia is very considerable. Only two of the species, *O. rupinsulensis* and *O. occidentis*, are known from more than a few specimens. The figures herewith given for these two species seem distinct enough, yet the specimens in the Hagen collection show them to intergrade almost completely. *O. bison* was dropped by De Selys from the list given in his Revision *(op. cit.)*—whether intentionally or not, I do not know—but the female in the Hagen collection is certainly very much like O. rupinsulensis. (See Plate 5, fig. 3?.) I desire at this point to correct a very serious error of my own: Misled by the upturned inferior appendages of the male, and having too great faith in the constancy of genital characters, I described as Herpetogomphus pictus (CAN. ENT., XXIX, 181, 1897), some exceptionally finely coloured males of *O. rupinsulensis*. Since studying a large series, I do not retain the name even for a reliable variety.

I figure here for O. occidentis (Pl. 5, figs. 4, 13 and 22), the bred specimen in the Hagen collection, which must be considered the type, since its cast skin is described (Trans. Amer. Ent. Soc., XII., 259).

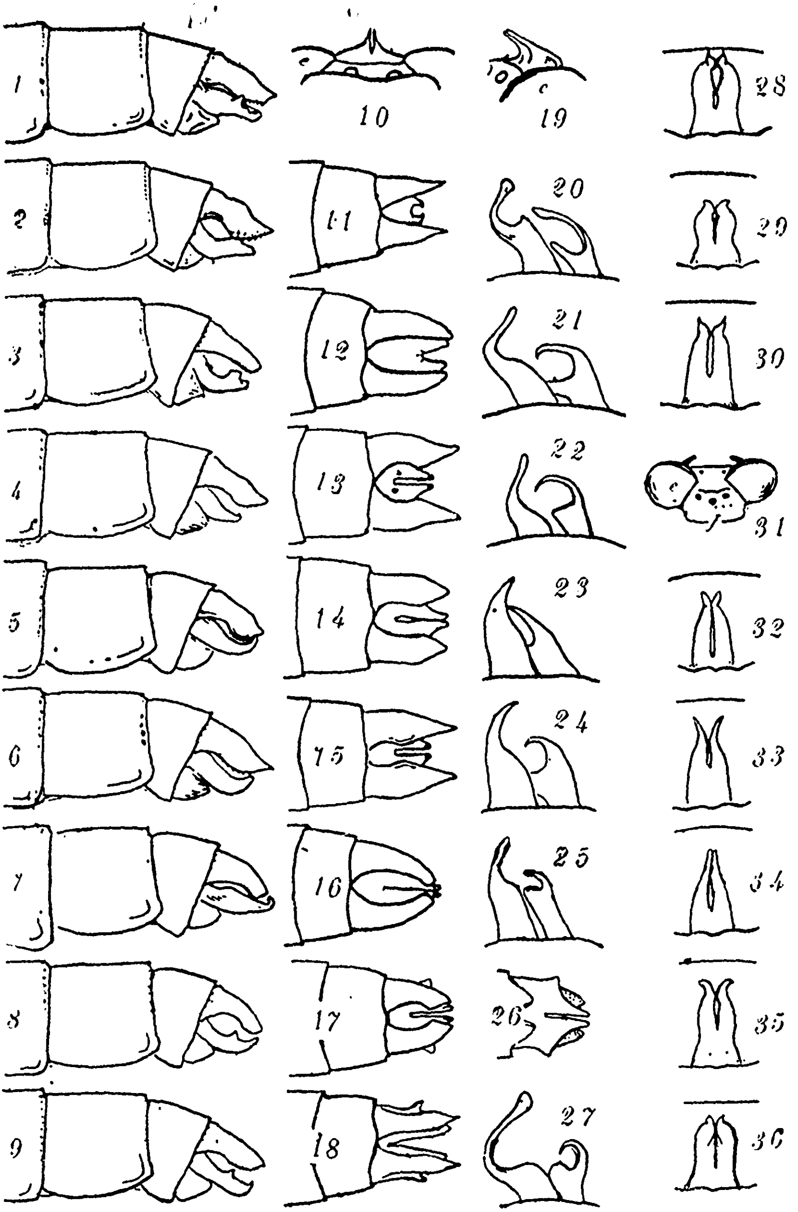

PLATE 5.—STRUCTURAL DETAILS OF OPHIOGOMPHUS.

OPHIGOMPHUS.

Explanations of Plate 5.

Figs. 1 and 28—O. Carolus, Ndhm.
Figs. 10, 19 and 36—O. Mainensis, Pack.
Figs. 2, 11, 20 and 29—O. aspersus, Morse.
Figs 3, 12, 21, 30 and 31—O. rupinsulensis, Walsh.
Figs. 4, 13 and 22—O. occidentis, Hag.
Figs. 5, 14 and 23—O. Morrisoni, Sel.
Fig. 32—O. bison, Sel.
Figs 6, 15, 24 and 33—O. severus, Hag.
Figs. 7, 16, 25 and 34—O. colubrinus, Sel.
Figs. 8, 17, 26 and 35—O. Carolinus, Hag.
Figs 9, 18 and 27—O. Johannus, Ndhm.

The figures in the first column represent lateral views of the terminal abdominal appendages of the males; those in the second column, dorsal views of the same; those in the third column, the genital hamules of the males, inverted and viewed from the side; those in the fourth column, vulvar lamina of females upon the sternum of the 9th abdominal segment:—*excepting* figs. 10, front, and 19, oblique fronto-lateral views of the occipital process of the female type of O. Mainensis; fig. 26, ventral view of male abdominal appendages; and fig. 31, dorsal view of the head of O. rupinsulensis, showing the curious post-ocular tubercles: *e*, eye; *f*, frons.

CLASSIFICATION OF THE ENTOMOPHILOUS WASPS, OR THE SUPERFAMILY SPHEGOIDEA.

BY WILLIAM H. ASHMEAD, ASSISTANT CURATOR, DIVISION OF INSECTS, U. S. NATIONAL MUSEUM.

(Paper No. 4.)

FAMILY XVIII.—Bembicidæ.

The sessile abdomen, always without a constriction between the first and second segments, but above all the very large, free, triangularly elongated labrum, which is always much longer than wide at base, the sinuate or ?-shaped transverse median nervure in the hind wings, and the aborted ocelli, at once distinguished the family.

Most authorities have confused, or at least included this family with the family Stizidæ, which also has a more or less prominent labrum; but in the Stizidæ the ocelli are *always* distinct, normal, the labrum is most frequently semicircular, always wider than long, while the middle tibiæ have *two* distinct apical spurs, characters of great taxonomic value, readily recognizable, and which at once separate them from the Bembicidæ.

The genera are not numerous, and may be separated as follows:

Table of Genera.

Anterior ocellar cicatrice elliptic, round or reniform.................2.
Anterior ocellar cicatrice linear, transversely arcuate.
  Metathorax excavated posteriorly, compressed laterally; last ventral segment in ♂ ending in 3 spines; mandibles dentate; maxillary palpi 6-, labial palpi 4-jointed......... ......Bembidula, Burm.
  Metathorax flat or convex posteriorly, not compressed laterally; last ventral segment in ♂ ending in a single spine.
    Mandibles dentate; maxillary palpi 4-, labial palpi 2-jointed...................................Bembex, Fabr.
    Mandibles edentate; maxillary palpi 3-, labial palpi 1-jointed.............................Microbembex, Patton.
2. Front ocellar cicatrice round or reniform; maxilla short; maxillary palpi 6-, labial palpi 4-jointed..... ....Monedula, Latr.
  Front ocellar cicatrice elliptic; maxilla long, attaining the hind coxæ; maxillary palpi 3-, labial palpi 1-jointed.............Steniola, Say.

North American Species.

(1) BEMBIDULA, Burmeister.
  (1) B. variegata, Olis.
  (2) B. quadrifasciata, Say.
  (3) B. insidiatrix, Hdl.
  (4) B. parata, Prov.
  (5) B. capnoptera, Hdl.
    var. mesillensis, Ckll.
  (6) B. fodiens, Hdl.
  (7) B. diodenta, Handl.
  (8) B. decisa, Taschaub.
  (9) B. viduata, Handl.
  (10) B. Burmeisteri, Handl.
(2) BEMBEX, Fabricins.
  (1) B. amoena, Hdl.
  (2) B. Belfragei, Cr.
    =(Cressoni, Hdl.)
  (3) B. insignis, Hdl.
    =Belfragei, Cr., pars.
  (4) B. spinolæ, Lepel.
    (=fasciatus, Auct.)
  (5) B. similans, Fox.
  (6) B. Sayi, Cr.
  (7) B. texana, Cr.
  (8) B. troglodytes, Hdl.
  (9) B. convexus, Fox.
  (10) B. cinerea, Hdl.
  (11) B. nubilipennis, Cr.
  (12) B. pruinosa, Fox.
  (13) B. occidentalis, Fox.
  (14) B. u-scripta, Fox.
  (15) B. multipicta, Smith.
  (16) B. pallidipicta, Smith.

(17) B. mimas, Handl.
Mierobembex, Patton.
(1) M. monodonta, Say.
(3) Monedula, Latreille.
(1) M. signata, Linn, ♀ ♂.
(2) M. carolin, Fabr., ♀ ♂.
(3) M. spinosa, Cr.
=formosa, Cr.
(4) M. serrata, Hdl.
(5) M. pulchella, Hdl.
=minatula, Hdl.
(6) M. tuberculata, Fox.
(7) M. plana, Fox.
(8) M. emarginata, Cr.
(9) M. femorata, Fox.
(10) M. pictifrons, Smith.
(11) M. tenuicornis, Fox.
(12) M. scitula, Fox.
(13) M. exiqua, Fox.
(14) M. villosa, Fox.
= mamillata, Fox nec Hedl.
(15) M. usetata, Fox.
(16) M. pulla, Hdl.
(17) M. nigrifrons, Prov.
(18) M. heros, Fabr., ♀ ♂.
(19) M. surinamensis, De Geer, ♀.
(20) M. maculata, Fabr., ♀ ♂.
(21) M. punctata, Fabr., ♀ ♂.
(22) M. dives, Handl.
(23) M. mexicana, Handl.
(4) Steniolia, Say.
(1) S. duplicata, Say.
=scolopacea, Handl.
(2) S. obliqua, Cr.
(3) S. tibialis, Hdl.
(4) S. longirostra, Say.

Family XIX.—Larridæ.

This family seems to be closely allied to the family Bembicidæ, but is readily separated from it by the *small*, not free, labrum, which is usually completely hidden under the clypeus; the ocelli are distinct or, at most, with only the hind ocelli aborted or represented by cicatrices; the front wings have always a distinct stigma, while the cubitus in the hind wings originates most frequently beyond the transverse median nervure, the latter being straight, or at least never ∫-shaped.

The family is a most extensive one, and widely distributed into all quarters of the globe, the temperate regions being especially rich in genera and species.

Four distinct groups have been recognized, which I designate as subfamilies, distinguishable as follows:

Table of Subfamilies.

Hind ocelli normal, distinct.......................................2.
Hind ocelli more or less distorted, obsolete or subobsolete, or indicated by cicatrices; mandibles most frequently emarginate on under side.................................Subfamily I., Larrinæ.

2. Second cubital cell never petiolate, receiving both recurrent nervures, or the first and second submarginal cells each receive a recurrent nervure; pronotum long.................Subfamily II., Lyrodinæ.

Second cubital cell petiolate or triangular, or more rarely entirely wanting; pronotum most frequently short, transverse.

Front wings with one or two cubital cells, or with none; pygidial area wanting.......................Subfamily III., Nitelinæ.

Front wings with two or three cubital cells; pygidial area present; marginal cell most frequently, but not always, truncate, with an appendage.......................Subfamily IV., Pisoninæ.

SUBFAMILY I.—Larrinæ.

The aborted hind ocelli, represented at the most by cicatrices, readily separate this subfamily from the others.

The table of genera, which follows, is almost a literal translation from Dr. Franz Kohl.

Table of Genera.

Anal lobe of hind wings very large and extending to or beyond the apex of the submedian cell; third cubital cell, along the radius, shorter than along the cubitus; mandibles most frequently emarginate beneath..2.

Anal lobe of hind wings much shorter, *not* extending to the apex of the submedian cell; third cubital cell, along the radius, as long or longer than along the cubitus; second cubital cell triangular or petiolate, receiving both recurrent nervures, or the second recurrent is interstitial; abdomen with the segments depressed at apex as in *Cerceris;* pygidial area sharply defined in both sexes.......Palarus, Latreille.

2. Eyes in ♂ *not* converging and meeting above as in *Astatus;* first and second dorsal abdominal segments with an acute margin laterally; ventral segments 6–7 free, 2–5 exhibiting in part prominent transverse swellings; marginal cell short, very broadly truncate; third transverse cubitus uniting with radius a little before the truncature; tarsal comb developed. ♂. (♀ unknown.)..Homogambrus, Kohl.

3. First abdominal segment not strikingly elongate... ....4.

First abdominal segment elongate, longer than the widest part, narrower towards base, imperfectly petioliform.

Face *without* a trace of swelling or longitudinal fold along the inner eye margin, usually with a rounded central swelling on the upper part of the vertex; pronotum lying deeply beneath the apex of the mesonotum; clypeus with 4 median teeth anteriorly; pygidium bare; hind tibiæ without special characters, the tarsi of usual length, the basal joint hardly half as long as the tibiæ; comb of front tarsi short. (♂ unknown.)............................Parapiagetia, Kohl.

Face with slight, blister-like swellings in the middle appearing as a strong transverse swelling; no swelling on the upper frontal part; the hind ocelli lying in a flat basis; pronotum only slightly impressed beneath the apex of the mesonotum, the collar long; metanotum as long, or nearly, as wide; pygidial area almost bare, with small bristles only at apex; hind femora at basal third beneath emarginate and with a tooth, often only with a blunt process; tarsi elongate, the basal joint of hind tarsi very distinctly longer than half the length of the tibiæ; teeth of front tarsal comb weak, short and slender........Piagetia, Ritsema.

4. Face *without* a swelling or fold along the inner eye margin; pronotum more or less deeply impressed beneath the apex of the mesonotum; metanotum usually shorter than the mesonotum; claws simple; mandibles emarginate beneath..............................11.

Face *with* a swelling or fold along the inner eye margin...........5.

5. Second cubital cell not petiolate, always sessile.................6.

Second cubital cell petiolate; mandibles *without* a tooth within, emarginate beneath on outer side; front tibiæ on outer side spinous; pygidial area bare, with the sides converging posteriorly; legs, especially the femora, stout; hind tibiæ not ridged; ventral plate of second segment without swelling...............Larraxena, Smith.

6. Mandibles *with* an emargination on under side...................8.

Mandibles *without* an emargination on under side; pronotum impressed beneath the apex of the mesonotum, especially laterally; claws unusually long, simple..............................7.

7. Mandibles with a subbasal tooth and a strong subapical tooth within (♀); hind margins of the dorsal abdominal segments distinctly depressed; pygidial area (♀) and the dorsal plate with very distinct scattered punctures, appearing (without taking into account the scattered erect hairs) bare and shining; hind tibiæ not ridged; front tibiæ outwardly not spinous; body and legs with long hairs......................................Paraliris, Kohl.

Mandibles within, not far from the base, with one tooth in ♂, with two teeth in ♀; in the latter case the second tooth is distinctly smaller than the first; no subapical tooth within; hind margins of dorsal abdominal segments *not* distinctly depressed; pygidial area in ♀ clothed with shorter hair and stiff bristles towards apex; dorsal segments thickly tomentose, or at least with a fine pubescence; metanotum not emarginate behind; hind tibiæ longly ridged behind; front tibiæ outwardly usually spinous..........Liris, Fabr.

8. Mandibles *without* a tooth within; pygidial area in ♀ bare, *without* stiff bristles, at most with a very fine pubescence at apex only; hind tibiæ behind not ridged, or the ridge scarcely indicated. ....10.

Mandibles *with* one or two teeth within before the middle, near the base; pygidial area with stiff bristles, usually indistinct at apex; lateral margins of the pygidium convergent behind; front tarsal comb with stiff spines.... ....9.

9. Metanotum longer than the mesonotum; pygidial area clothed with a silvery pubescence; anterior femora in ♂ *not* marginate near the base. ....Notogonia, Costa.

Metanotum shorter than the mesonotum; pygidial area bare towards the base, but with short, stiff hairs at apex; anterior femora in ♂ emarginate near the base... ....Ancistromma, Fox.

10. Claws *not* unusually long, simple; front femora either toothed or simple; lateral ridges of the pygidial area (♀) feebly curved, not distinctly convergent; ventral plate of the second abdominal segment without deplanate places; punctuation of the head and thorax distinct, proportionately not fine; abdomen in ♂ usually densely punctured, with or without a pygidial area; mesosternal suture wanting.... ....Larra, Fabr.

Claws unusually long, with a median tooth; pronotum only slightly impressed beneath the apex of the mesonotum, more towards the sides than medially; front femora without a tooth; pygidial area with the lateral margins parallel or, in only a few cases, convergent posteriorly; ventral plate of the second abdominal segment with two deplanated places at the base, which are separated by a keel-like elevation; abdomen in ♀ shining, with the margin of the segments slightly tomentose; legs rather stout; ♂ with the claws simple, the mesosternal suture distinct posteriorly....Motes, Kohl.

11. Face medially *without* a swelling, at the most with two small tubercles above the base of the antennæ; legs unusually stout; abdomen not coarsely punctured; second dorsal segments not margined at sides.... ....12.

Face medially *with* a well defined, rounded, smooth, shining swelling, placed at an equal distance between the front ocellus and the base of the antennæ; epicnemia of mesepisternum distinct; front femora in ♂ without an emargination; tarsal comb in ♀ composed of very long flexible bristles; abdomen very coarsely punctured; second dorsal segment sharply margined at sides; pygidial area in both sexes bare.............................Prosopigastra, Costa.

12\. Pygidial area clothed with short, stiff bristles; hind ocellar cicatrices linear, hooklike; tarsal comb in ♀ with rather short spines; front femora in ♂ either simple or emarginate near base beneath.............................. ...Tachytes, Panzer.

Pygidial area bare; hind ocellar cicatrices oval; tarsal comb in ♀ with long, flexible spines...................Tachysphex, Kohl.

SUBFAMILY II.—Lyrodinæ.

In this subfamily the ocelli are always distinct, normal, never aborted, the pronotum usually long, while the second cubital cell is never petiolate or triangular.

The distinct ocelli easily separate the group from the Larrinæ, while the venation of the front wings and the longer pronotum separate it from the Nitelinæ and the Pisoninæ.

The known genera may be recognized with the aid of the following table:

Table of Genera.

Marginal cell at apex truncate, or rarely rounded, but always *with* a more or less distinct appendage; two or three cubital cells......2.

Marginal cell lanceolate, *without* an appendage; three cubital cells.

Submedian cell shorter than the median, the second cubital cell receiving both recurrent nervures, the second recurrent entering it very close to the apex; eyes convergent above; mandibles not excised beneath.. ....Heliocausus, Kohl.

Submedian cell a little longer than the median, the second cubital cell receiving only one recurrent nervure at or near its middle, the first recurrent nervure received by the first cubital cell near its apex; eyes only slightly convergent above; mandibles deeply excised beneath; cubitus in hind wings originating far beyond the transverse median nervure...............Zoyphium, Kohl.

2\. Front wings with two cubital cells...........................4.

Front wings with three cubital cells.

Second cubital cell receiving both recurrent nervures............3.

Second cubital cell receiving only one recurrent nervure—the second, the first recurrent nervure received by the first cubital cell near its apex.

Transverse median nervure interstitial with the basal nervure, or uniting with the median vein a little before it; cubitus in hind wings originating *beyond* the transverse median nervure; eyes somewhat convergent above; mandibles excised beneath beyond the middle.............Sericophorus, Smith.
= Tachyrhostrus, Sauss.

3. Transverse median nervure interstitial with the basal nervure; cubitus in hind wings originating somewhat *beyond* the transverse median nervure; collar long; eyes parallel; mandibles strongly excised beneath ....Lyroda, Say.

Transverse median nervure uniting with the median nervure *before* the origin of the basal nervure; cubitus in hind wings originating much *before* the transverse median nervure.

Eyes submarginate within, convergent above; clypeus transverse, the anterior margin arcuate; mandibles at apex acute, unarmed; beneath excised beyond the middle ....Laphyragogus, Kohl.

Eyes not at all emarginate within, strongly convergent above; clypeus large; mandibles excised beneath with two blunt teeth on inner margin................Leianthrena, Bingham.

4. Submedian cell much shorter than the median; second cubital cell receiving both recurrent nervures; cubitus in hind wings originating beyond the transverse median nervure......Gastrosericus, Spinola.

SUBFAMILY III.—Nitelinæ.

In this group the ocelli are also distinct, but the venation of the front wings is quite distinct from the Lyrodinæ, while the pronotum is shorter, transverse. From the Pisoninæ it is also distinguished by venation, and by having *no* pygidial area.

The genera falling in this group are distinguished as follows:

Table of Genera.

Front wings *with* a marginal cell.............................2.

Front wings *without* a marginal cell.

Cubital and discoidal cells wanting, the cubital vein alone present, but much abbreviated; eyes slightly convergent above; mandibles excised beneath ....Miscophoides, Brauns.

2. Front wings with two recurrent nervures. ....4.

Front wings with only one recurrent nervure.

With two cubital cells.......................................3.

With only one cubital cell; submedian cell in both wings much shorter than the median.

Marginal cell large, longer than the first cubital cell, subtruncate at apex, with a slight appendage; mandibles acute, *not* excised beneath......................Nitela, Latreille.

Marginal cell rather small, much shorter than the first cubital cell, somewhat rounded at apex, without an appendage; mandibles acute, but excised beneath......Nitelopterus, Ashm.

3. Wings abbreviated, the stigma not developed; marginal cell small, triangular; cubital cell very large, rhomboidal; collar well developed, as long as the metathorax, narrowed anteriorly; mandibles deeply excised beneath, pointed at apex, without teeth within ....Saliostethus, Brauns.

Wings normal, the stigma small but distinct; marginal cell as in *Miscophus;* submedian cell shorter than the median; eyes large, extending to base of mandibles, and only slightly convergent above; mandibles beneath deeply excised from a little before the basal half to apex; antennæ filiform, slightly tapering off towards apex; clypeus not separated from the face by a suture; occiput with a transverse furrow between the occipital margin and the base of the vertex; metathorax fully as long as the mesonotum, with a delicate median carina......................Miscophinus, Ashm.
[=Hypomiscophus, Ckll.]

4. Marginal cell without an appendage at apex; second cubital cell receiving the second recurrent nervure towards apex; cubitus in hind wings originating far beyond the transverse median nervure; eyes convergent above ....Miscophus, Jurine.

SUBFAMILY IV.—Pisoninæ.

In this group the front wings have two or three cubital cells, the second always triangular and most frequenly petiolate; the eyes are often emarginate within; the ocelli distinct; while the pygidium in the females always has a distinct pygidial area.

The group is very closely allied to the *Miscophinæ*, the only reliable character to distinguish it being the distinct pygidial area, although, as a rule, the tibial spurs and the pronotum are shorter than in the latter group.

Thirteen genera have been recognized, distinguished as follows:

Table of Genera.

Marginal cell at apex truncate or rounded, with an appendage........3.
Marginal cell lanceolate, not truncate at apex, or at most narrowly rounded, without an appendage.
Front wings with three cubital cells.........................2.
Front wings with two cubital cells, each receiving a recurrent nervure.
Transverse median nervure *interstitial* with the basal nervure...............................Taranga, Kirby.
Transverse median nervure *not* interstital joining the median vein *before* the origin of the basal nervure........Parapison, Smith.

2. Transverse median *not* interstitial joining the median vein *before* the origin of the basal nervure.
Second cubital cell larger, more briefly petiolate, receiving both recurrent nervures, or the first recurrent nervure is interstitial with the *first* transverse cubitus; mandibles excised beneath; eyes only slightly emarginate within...Pisonopsis, Fox.
Second cubital cell small, longly petiolate, receiving one or both recurrent nervures, or the second is interstitial with the second transverse cubitus: mandibles *not* excised beneath.
Second cubital cell receiving both recurrent nervures, or the second recurrent is interstitial with the second transverse cubitus...............................Pison, Spinola.
Second cubital cell receiving only one recurrent nervure — the second, the first recurrent nervure received by the first cubital cell a little *before* the first transverse cubitus. ....Pisonitus, Shuckard.
Transverse median nervure interstitial, the second cubital cell triangular, receiving the second recurrent nervure near its apex, the first recurrent nervure interstitial with the first transverse cubitus; cubitus in hind wings originating *beyond* the transverse median nervure; hind femora much thickened towards apex, especially in the ♀, roughened and serrated on outer face.......Bothynostethus, Kohl.

3. Second cubital cell receiving only one recurrent nervure ....4.

Second cubital cell receiving both recurrent nervures, or the first is interstitial with the first transverse cubitus.

Submedian cell shorter than the median; cubitus in hind wings originating *beyond* the transverse median nervure; eyes within nearly parallel; mandibles excised beneath..Sphodrotes, Kohl.

Submedian and median cells equal or nearly, the transverse median nervure being interstitial or nearly, with the basal nervure; cubitus in hind wings originating *beyond* the transverse median nervure; eyes convergent above; mandibles excised or sinuate beneath.

Hind tibiæ smooth, not serrate........Niteliopsis, Saunders.

Hind tibiæ strongly serrate and also spinose; mandibles with a deep emargination beneath; clypeus transverse, truncate and with a transverse impression along the anterior margin; hind coxæ normal, without a spine or tubercle....(Africa).

Pseudohelioryctes, Ashm., n. g.

(Type P. Foxii, Ashm.*)

Submedian cell a little longer than the median; cubitus in hind wings originating *before* the transverse median nervure; eyes more or less divergent above; mandibles beneath with a deep incision before the middle................Scapheutes, Handl.

4. Second cubital cell receiving the second recurrent nervure at the extreme apex, being almost interstitial with the second transverse cubitus..5.

Second cubital cell receiving the second recurrent nervure at or near the middle.

Transverse median nervure interstitial with the basal nervure or nearly; first recurrent nervure *interstitial* with the first transverse cubitus.........................Solierella, Spinola.

Transverse median nervure *not* interstitial, joining the median vein a little *beyond* the origin of the basal nervure; first recurrent nervure *not* interstitial with the first transverse cubitus.................................Sylaon, Picciola.

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* Pseudohelioryctes ? Foxii, n. sp.

= Helioryctes melanopygus, Fox nec Smith, Proc. Acad. Nat. Sc., Phil., 1896, p. 554.

Female.—Length, 14 mm. Head, thorax, antennæ, and all coxæ and trochanters, black; rest of legs and the abdomen, except the pygidium above (which is dusky), ferruginous; wings fuscous black.

5. Submedian cell somewhat shorter than the median; cubitus in hind wings originating *far* beyond the transverse median nervure; anterior tarsi in ♀ with a comb; tibiæ spinous; eyes large, convergent above.................................Plenoculus, Fox.

North American Species.

Subfamily I.—*Larrinæ.*

(1) PALARUS, Latreille.
(2) HOMOGAMBRUS, Kohl.
(3) PARAPIAGETIA, Kohl.
(4) PIAGETIA, Ritsema.
(5) LARREXENA, Smith.
(6) PARALIRIS, Kohl.
(7) LIRIS, Fabr.
(8) NOTOGONIA, Costa.
    (1) N. argentata, Beauv., ♀ ♂.
    (2) N. nigripennis, Fox, ♀.
    (3) N. aequalis, Fox.
    (4) N. violaceipennis, Cam., ♀.
    (5) N. montezuma, Cam., ♀.
    (6) N. Championi, Cam., ♀.
    (7) N. truncata, Cam.
    (8) N. argentifrons, Cam.
    (9) N. beata, Cam., ♂.
    (10) N. chrysura, Cam., ♂.
    (11) N. argenticauda, Cam., ♂.
    (12) N. apicipennis, Cam., ♂.
    (13) N. panamensis, Cam., ♂.
(9) ANCISTROMMA, Fox.
    (1) A. aurantia, Fox.
    (2) A. copax, Fox.
    (3) A. distincta, Smith.
    (4) A. dolosa, Fox.
    (5) A. tenuicornis, Smith.
    (6) A. discreta, Fox.
    (7) A. conferta, Fox.
    (8) A. divisa, Patt.
    (9) A. consimilis, Fox.
    (10) A. rugosa, Fox.
    (11) A. vegeta, Fox.
    (12) ? A. canescens, Smith, ♀ (Larra).
    (13) ? A. arcuata, Smith, ♀ (Larra).
    (14) ? A. vinulenta, Cr.
(10) LARRA, Fabr.
    (1) L. analis, Fabr.
    (2) L. Cressonii, Fox.
    (3) L. Godmani, Cam., ♀.
    (4) L. rubritarsis, Cam., ♂.
    (5) L. sonorensis, Cam., ♀.
    (6) ? L. rufipes, Prov.
    (7) L. interpennis, Cr., ♀ ♂.
    (8) L. rufipennis, Fabr., ♀ ♂.
(11) MOTES, Kohl.
    (1) M. fulviventris, Guer.
    (2) M. splendens, Ashm.
(12) PROSOPIGASTRA, Costa.
(13) TACHYTES, Panzer.
    (1) T. validus, Cr.
    (2) T. mandibularis, Patt., ♀.
    (3) T. harpax, Patt., ♂.
    (4) T. calcaratus, Fox, ♂.
    (5) T. exornatus, Fox, ♀.
    (6) T. breviventris, Cr., ♀.
    (7) T. praedator, Fox.
    (8) T. columbiæ, Fox.
    (9) T. crassus, Patt.
    (10) T. pepticus, Say.
    (11) T. fulviventris, Cr.
    (12) T. spatulatus, Fox.

(13) T. aurulentus, Fabr.
(14) T. contractus, Fox.
(15) T. distinctus, Smith.
(16) T. elongatus, Cr.
(17) T. sericatus, Cr.
(18) T. rufofasciatus, Cr.
(19) T. abdominalis, Say, ♀.
(20) T. obscurus, Cr., ♀.
=texanus, Cr., ♂.
(21) T. parvus, Fox.
(22) T. abductus, Fox,
(23) T. mergus, Fox.
(24) T. dives, Lepel.
(25) T. yucatensis, Cam., ♀.
(26) T. gautemalensis, Cam., ♀.
(27) T. andreniformis, Cam.
(28) T. argentipes, Cam.
(29) T. ornatipes, Cam.
(30) T. ferrugineipes, Cam., ♂.

(14) Tachysphex, Kohl.
(1) T. Ashmeadii, Fox, ♀.
(2) T. Belfragii, Cr., ♀.
(3) T. spinosus, Fox, ♀.
(4) T. posterus, Fox, ♀.
(5) T. tarsatus, Say, ♀ ♂.
(6) T. texanus, Cr., ♀ ♂.
(7) T. pissatus, Fox, ♂.
(8) T. dubius, Fox, ♂.
(9) T. semirufus, G., ♀.
(10) T. asperatus, Fox, ♀.
(11) T. antennatus, Fox, ♀.
(12) T. parvulus, Cr., ♂.
(13) T. fuscipennis, Fox, ♀.
(14) T. fusus, Fox, ♀ ♂.
(15) T. terminatus, Smith, ♀ ♂.
(16) T. apicalis, Fox, ♀ ♂.
(17) T. acutus, Patt.
(18) T. amplus, Fox, ♀ ♂.
(19) T. montanus, Cr.
(20) T. decorus, Fox, ♀.
(21) T. inusitatus, Fox, ♂.
(22) T. excatus, Fox, ♀.
(23) T. consimilis, Fox, ♀ ♂.
(24) T. quebecensis, Prov., ♀ ♂.
(25) T. compactus, Fox, ♂.
(26) T. triquitrus, Fox, ♀.
(27) T. aethiops, Cr., ♀ ♂.
(28) T. nigrior, Fox, ♀ ♂.
(29) T. pauxillus, Fox, ♀ ♂.
(30) T. punctifrons, Fox, ♀ ♂.
(31) T. mundus, Fox, ♀.
(32) T. minimus, Fox.
(33) T. psilocerus, Kohl.
(34) T. rufomaculatus, Cam., ♀.
(35) ? T. laevifrons, Smith (Larra).
(36) ? T. pennsylvanicus, Beauv. (Larra).

Subfamily II.—*Lyrodinæ*.

(15) Heliocausus, Kohl.
(16) Zoyphium, Kohl.
(17) Sericophorus, Smith.
(18) Lyroda, Say.
(1) L. triloba, Say.
(2) L. subita, Say.
(19) Laphyragogus, Kohl
(20) Leianthrena, Bingham.
(21) Gastrosericus, Spinola.

Subfamily III.—*Nitelinæ*.

(22) Miscophoides, Brauns.
(23) Nitela, Latreille.
(24) Nitelopterus, Ashmead.
(1) N. slossonæ, Ashm.
(25) Saliostethus, Brauns.
(26) Miscophinus, Ashmead.
= Hypomiscophus, Ckll.
(1) M. laticeps, Ashm.

- (2) M. californicus, Ashm.
- (3) M. texanus, Ashm.
- (4) M. arenarum, Ckll.

(27) Miscophus, Jurine.
- (1) M. americanus, Fox, ♀ ♂.

Subfamily IV. — *Pisoninæ.*

(28) Taranga, Kirby.

(29) Parapison, Smith.

(30) Pisonopsis, Smith.
- (1) P. clypeata, Fox, ♀ ♂.
- (2) P. triangularis, Ashm., ♀.

(31) Pison, Spinola.
- (1) P. laevis, Smith.
- (2) P. conformis, Smith.
- (3) P. fasciatum, Kohl.

(32) Pisonitus, Shuckard.

(33) Bothynostethus, Kohl.
- (1) B. distinctus, Fox, ♀ ♂.
- (2) B. Saussurei, Kohl.

(34) Sphodrotes, Kohl.

(35) Niteliopsis, Saunders.
- (1) N. inermis, Cr.
- (2) N. plenoculoides, Fox.
- (3) N. striatipes, Ashm., ♀.

(36) Pseudoheliorycte s, Ashmead.

(37) Scapheutes, Handlirsch.

(38) Solierella, Spinola.

(39) Sylaon, Picciola.

(40) Plenoculus, Fox.
- (1) P. Davisii, Fox.
- (2) P. propinquus, Fox.
- (3) P. punctatus, Ashm.
- (4) P. Cockerellii, Ashm.
- (5) P. abdominalis, Ashm.
- (6) P. niger, Ashm.
- (7) P. Peckhami, Ashm.
- (8) P. albipes, Ashm.

CONTRIBUTIONS TO THE KNOWLEDGE OF MASSACHUSETTS COCCIDÆ.—IV.

BY GEO. B. KING, LAWRENCE, MASS.

Diaspinæ (concluded).

(71) *Chionaspis furfurus*, Fitch; 1856–1869. N.

A very common species in Massachusetts, recorded from Amherst, Worcester, Andover, Lawrence, and Methuen, on wild red cherry, pear, wild and cultivated apple, flowering quince, choke-berry, shad-bush, and black alder. It is known from Virginia, Maryland, Pennsylvania, Illinois, Indiana, West Virginia, North Carolina, Ohio, New York, Kentucky, Rhode Island, Connecticut, Georgia, Utah, Kansas, New Jersey, and Washington, D. C., on choke-cherry, wild red cherry, wild and cultivated apple, crab apple, pear, peach, Japan quince, cherry currant, red flowering currant, and European mountain ash.

(72) *Chionaspis furfurus*, var. fulva, King; 1899–1898. N.

Found at Lawrence, Mass., on buckthorn, *Rhamnus catharticus*, L.

(73) *Chionaspis spartinæ*, Comst.; 1883. N.

On salt marsh grass, at Woods Holl, Mass. Coll. Prof. Trelease.

(74) *Chionaspis Lintneri*, Comst.; 1883–1898. I.

An abundant species at Stoneham, Ballardvale, Andover, North Andover, and Methuen, Mass., on Alnus, *Benzoin odoriferum*, *Corylus americana* and *Amelanchier canadensis*. Described from New York.

(75) *Chionaspis pinifoliæ*, Fitch; 1855–1895. N.

Mr. R. A. Cooley (in litt.) informs me that he has found this species common at Reading and Amherst, Mass., and has known it to occur in this State for at least four years. How much longer, it is impossible to tell, as there is no references to its occurrence in literature. I did not find it until May 30th of this year, at Methuen, Mass., on our native hard pine, *Pinus rigida*. It has been recorded from Maine, New York, Ohio, Colorado, New Mexico, Michigan, Missouri, and Illinois.

(76) *Ischnaspis longirostris*, Sign.; 1882–1898. I.

Collected by Mr. J. W. Folsom at the Botanic Gardens, Cambridge, Mass., 1898 (Ckll. in litt.).

(77) *Fiorinia fioriniæ*, Targ.; 1867–1898. I.

Collected by Mr. J. W. Folsom at the Botanic Gardens, Cambridge, Mass., 1898 (Ckll. in litt.). It is recorded from Washington, D.C., Maryland, Colorado, and California, on Camellia, Japan quince, *Arabia* and *Ficus elastica*.

Lecaniinæ, subjoined.

(78) *Lecanium Canadense*, Ckll.; 1895–1898. N.

On white oak at Lawrence, Mass. Prof. S. J. Hunter records it from Kansas on *Ulmus americana*. It was originally described from Canada as *Lecanium caryæ*, var. *Canadense*, Ckll. It is also recorded from Maine on *Ulmus*.

(79) *Lecanium Cockerelli*, Hunter; 1899–1897. N.

Described by Prof. Hunter from Kansas on *Ulmus americana* and *Juglans nigra*. This is the most common and conspicuous *Lecanium* found in Massachusetts, and is found on *Quercus alba*, *Q. rubra*, *Q. ilicifolia*, and sweet fern, *Comptonia asplenifolia*, at Lawrence, Methuen, Dracot, and Andover.

Five species have been added to our list since the publication of the first article. The above last two are added to complete the list up to date, and include all the described Massachusetts Coccidæ known to me, but by no means all that really exist, as I have many others not yet studied, and expect to find many more new to our fauna.

NOTES.

(1) Reviewing the preceding literature on the Coccidæ of Massachusetts, we find 79 species and varieties to inhabit the State, leading all others by 7. New Mexico* comes next with 73. California at least 65, and Colorado 37 species.

(2) Massachusetts has 44 native and 35 introduced species, with one whose home is as yet unknown, but no doubt is introduced, which would make 36. Greenhouses produce 16, all of which are introduced species, 10 ant-nest coccids, with 5 attended by ants, 3 of these sometimes found in nests of ants, and 6 species have been found on fruit exposed for sale.

(3) The locality in which the writer has been collecting Coccidæ is about six miles each way, the City of Lawrence being in the centre; in this small district he has found (11) *eleven* species that had been previously recorded from Massachusetts, 39 new to the fauna of the State, 15 new species and 7 new varieties and one genus new to the United States.

(4) The first ant-nest coccid known to occur in the United States was found by Prof. Cockerell in Colorado in 1891. Previous to this there had been only one other species known to inhabit ant-nests—a very peculiar pearl-like creature found in the West Indies. We have now 24 species of coccids normally inhabitants of ant-nests; 15 of these are found in the United States, 10 of which have been found by the writer in Massachusetts. England has 4, New Zealand, Trinidad, Ceylon, France, and the West Indies, 1 each.

(5) I am very much indebted to Prof. Cockerell for his valuable assistance in the study of our Massachusetts Coccidæ, and in no instance have I passed upon the identity of a single species. All have been studied and determined by him. Furthermore, he has had the kindness to look over all my MS. and made such changes as he, in his good judgment, saw fit, and no less than 41 letters have been written by him to me in connection with the Coccidæ of Massachusetts. It should be said, also, that Dr. L. O. Howard has taken much interest in all the parasites sent him, reared by me from coccids. And also Prof. J. D. Tinsley, who has described jointly with me some of my new species of Dactylopiids. I wish to publicly thank them and acknowledge their many kindnesses.

*(6) Since the above was written, Prof. Cockerell and Mr. Parrott have described five new species and varieties from New Mexico.

A CHECK-LIST OF THE MASSACHUSETTS COCCIDÆ

- *Icerya*, Sign.
  - I. Purchasi, Mask., 1878.
- *Eriococcus*, Targ.
  - E. azaleæ, Comst, 1881.
  - E. quercus, Comst., 1881.
- *Gossyparia*, Sign.
  - G. ulmi, Geoff., 1764.
- *Ripersia*, Sign.
  - R. lasii, Ckll., 1896.
  - R. Kingii, Ckll., 1896.
  - R. flaveola. Ckll., 1896.
  - R. Blanchardii, King and Ckll., 1897.
  - R. minima, Tinsley and King, 1899.
- *Dactylopius*, Costa.
  - D. citri, Risso. 1813.
  - D. adonidum, L., 1769.
  - D. sorghiellus, Forbes, 1885.
  - D. sorghiellus, var. Kingii, Ckll., 1897.
  - D. claviger, King and Tinsley, 1897.
  - D. Cockerelli, King and Tinsley, 1898.
  - D. pseudonipæ, Ckll., 1897.
- *Phenacoccus*, Ckll.
  - P. aceris, Sign., 1875.
  - P. americanæ, King and Ckll., 1897.
- *Sphæroccus*, Mask.
  - S. sylvestris, Ckll. and King, 1898.
- *Asterolecanium*, Targ.
  - A. quercicola, Bouche, 1851.
- *Orthezia*, Bosc.
  - O. insignis, Dougl., 1887.
- *Kermes*, Auctt.
  - K. galliformis, Riley, 1881.
  - K. pubescens, Bogue, 1898.
  - K. nivalis, King and Ckll., 1898.
  - K. Kingii, Ckll., 1898.
- *Lecanopsis*, Targ.
  - L. lineolatæ, King and Ckll., 1897.
- *Lecanium*, Illig.
  - L. hesperidum, L., 1758.
  - L. hemisphæricum, Targ. (=coffeæ, Auctt., not of Walker.)
  - L. quercifex, Fitch, 1856.
  - L. quercifex, Fitch, var., 1898.
  - L. filicum, Boisd., 1868.
  - L. corylifex, Fitch, 1856.
  - L. cynosbati, Fitch, 1856.
  - L. tessellatum, Sign., 1873.
  - L. Kingii, Ckll., 1898.
  - L. tarsale, Sign., 1873, var.
  - L. Fletcheri, Ckll., 1893.
  - L. nigrofasciatum, Perg., 1898.
  - L. pallidior, Ckll. and King, 1899.
  - L. caryæ, Fitch, 1856.
  - L. canadense, Ckll., 1895.
  - L. (saissetia) anthurii, Boisd., 1868, var.
  - L. Cockerelli, Hunter, 1899.
- *Pulvinaria*, Targ.
  - P. innumerabilis, Rathv., 1854.
  - P. innumerabilis, var. tiliæ, King and Ckll.
  - P. Macluræ, Kennicott in Fitch, 1855.
- *Lichtensia*, Sign.

- L. viburni, Sign., 1873, var.
- *Aspidiotus*, Bouche.
  - A. hederæ, Vall., 1829.
  - A. aurantii, Mask., 1878.
  - A. perniciosus, Comst., 1881.
  - A. ancylus, Putn., 1877.
  - A. ficus, Ashm., 1888.
  - A. cyanophylli, Sign., 1869.
  - A. articulatus, Morg., 1889.
  - A. Forbesi, Johnson, 1896.
  - A. Fernaldi, Ckll., 1898.
  - A. smilacis, Comst., 1883.
  - A. sp. prob. young of A. dictyospermi, Morg., 1889.
  - A. Crawii, Ckll., 1897.
- *Diaspis*, Costa.
  - D. carneli, Targ., 1868.
  - D. amygdali, Tryon, 1889.
- *Aulacaspis*, Ckll.
  - A. rosæ, Bouche, 1833.
  - A. bromeliæ, Kerner, 1788.
  - A. Boisduvalii, Sign., 1869.
  - A. elegans, Leon.
- *Parlatoria*, Sign.
  - P. proteus, Curt., var. Pergandii, Comst., 1881.
  - P. zizyphus, Lucas, 1853.
  - P. (prob. proteus) var. crotonis, Ckll., 1895.
- *Mytilaspis*, Sign.
  - M. pomorum, Bouche, 1851.
  - M. citricola, Pack, 1870.
  - M. Gloverii, Pack, 1869.
- *Pinnaspis*, Ckll.
  - P. pandani, Comst., 1881.
- *Chionaspis*, Sign.
  - C. furfurus, Fitch, 1856.
  - C. furfurus, var. fulva, King, 1899.
  - C. pinifoliæ, Fitch, 1855.
  - C. spartinæ, Comst., 1883.
  - C. Lintneri, Comst., 1883.
- *Ischnaspis*, Dougl.
  - I. longirostris, Sign., 1882.
- *Fiorinia*, Targ.
  - F. fioriniæ, Targ., 1867.

NOTES ON SOME HYMENOPTERA.

BY T. D. A. COCKERELL, N. M. AGR. EXP. STA.

Vespa diabolica, Sauss., mut. *Fernaldi* (Lewis).—Prof. C. H. T. Townsend collected last year some specimens of *V. diabolica* and *V. occidentalis* on the Rio Ruidoso, N. M. Among the former I find an example which exactly agrees with the description of *V. Fernaldi*, Lewis, but it is evidently only a form of *diabolica*.

Bembidula mesillensis, Ckll.—This was described as a variety of *B. caproptera*, but the discovery of the female shows it to be a distinct species. The ♀ differs from the ♂ by having the thoracic markings cream-colour instead of deep yellow; the clypeus entirely creamy-yellow, it and the narrow lateral marks densely covered with silvery pubescence; the marks on scutellum round instead of pear-shaped; the anterior tarsi with a well-formed blackish comb. The last dorsal segment is strongly punctured, with a smooth median line, and has a yellowish spot on each side. The lateral ridges are only indicated posteriorly, and that feebly. Legs as in the ♂, except for the tarsal comb. This ♀ was taken by Prof. Townsend at La Cueva, Organ Mts., N. M., 5,300 ft., Sept. 3, 1898, at flowers of *Lippia Wrightii.*

Sphecodes perlustrans, Ckll.—This was described from a single specimen; a second was taken at Mesilla Park, N. M., March 30th, 1899, by Mr. S. MacGregor. A new examination shows the mandibles to be notched, not simple as described.

Perdita grandiceps, Ckll.—Described from a single ♂. Prof. Townsend took 3♂ 1♀ (♂ ♀ in cop.) at flowers of *Fallugia paradoxa*, var. *acuminata*, Wooton, La Cueva, Organ Mts., N. M., Sept. 3rd, 1898. The ♀ runs to 21 in my *Perdita* table in Bull. Lab. Denison Univ., 1898, and to 23 in the table in Proc. Phila. Acad., 1896. It differs from *P. phymatæ* by its colourless nervures; from *P. verbesinæ*, var. *nigrior*, by being only 5 mm. long; from *P. sidæ* by having the flagellum pale ochreous (instead of orange) beneath, the upper edge of the clypeus not at all whitish, the mesothorax more bare, with considerably shorter hairs, and the marginal cell broader in proportion to its length. From the ♂ *grandiceps* it differs by having the head of ordinary shape and size, the cheeks unarmed, and the face wholly without light markings. The tip of the abdomen is brownish-orange.

Melissodes grindeliæ, Ckll.—To the localities for this species must be added Los Vegas, N. M., where I took a ♂ in July.

BEES AND FLOWERS.

Prunus (garden plum).—At Santa Fé, N. M., in the spring of 1898, Miss Myrtle Boyle collected from the flowers *Andrena prunorum*, Ckll. (♀♂, the ♂ a var. with antennæ wholly black), *Halictus sisymbrii*, Ckll. (♀), and *Osmia lignari*, Say (♂).

Ungnadia speciosa (det. E. O. Wooton).—At Dripping Spring, Organ Mts., N. M., April 23rd and 24th, I found this beautiful shrub in full bloom. On April 23rd the following bees were visiting it: *Osmia lignaria*, Say (♂ ♀, abundant); *Xylocopa arizonensis*, Cr. (abundant); *Agapostemon texanus*, Cr. (1 ♀); *Augochlora neglectula*, Ckll. (abundant); *Halictus amicus*, Ckll. (♀, abundant); *Bombus Morrisoni*, Cr. (a few); and *Anthophora lesquerellæ*, Ckll. (♂, rare).

Dithyræa wislizeni.—On the campus of the N. M. Agricultural College, Mesilla Park, May 7th, 1898, the following bees were at the flowers: *Anthidium larreæ*, Ckll. (one); *Neolarra pruinosa*, Ashm. (many); *Perdita callicerata*, Ckll. (♀); *P. exclamans*, Ckll. (♂), and *P. punctosignata*, Ckll. (♀). The species of *Perdita* had appeared before their proper flowers (*Baileya* and mesquite) were out, so they resorted to the *Dithyræa.*

SOME NEW SPECIES OF HADENA.

BY JOHN B. SMITH, RUTGERS COLLEGE, NEW BRUNSWICK, N. J.

Hadena (Xylophasia) runata, n. sp.

Ground colour smoky brown or blackish, varying in shade even to a reddish admixture. Head usually a little reddish, with a black band crossing the front. Collar usually paler at the base, crossed by a black line about the middle; usually tipped with paler scales. Thorax with a distinct divided crest, which often contains an admixture of lighter vestiture, patagiæ with paler tips, a blackish submargin, and a disk as dark as the general ground colour. Primaries powdery, mottled, with all the markings well defined; no contrasts, save that the median space is usually darker than the rest of the wing. Basal line geminate, black, including a few whitish scales, and reaching to a narrow, short basal line which ends at the point of junction with the transverse marking. T. a. line black, geminate, the outer defining line well marked, the inner vague, except at the internal margin, where an oblique black shade extends inward along the margin. The line is well removed from the base, outcurved as a whole and in the interspaces. T. p. line geminate, blackish, the inner portion lunulate and best marked, the outer more even, less defined, marked with blackish dots on the veins. As a whole, it is outwardly bent on the costa, and then runs very evenly and almost parallel with the outer margin. A vague median shade is visible on the costa and between the ordinary spots, but becomes lost below that point. S. t. line white or very pale brown, only a little irregular, except where it forms a distinct, though small, W on veins 3 and 4. Two or three sagittate black spots precede the line at the W, and a dusky shade may extend the full length, sometimes adding other spots, or again losing all of them. Terminal space darker, except at apex. A series of black terminal lunules. Fringes cut with pale and a similar line at base, giving a festooned appearance. Claviform short, broad, more or less black filled, a black or blackish shade extending to the t. p. line and broadening outwardly. Orbicular oval, oblique, with a black ring inwardly edged by pale scales, of the palest ground colour. Reniform large, kidney-shaped, upright, incomplete above and below, outlined in black outside of a paler line, the centre of the ground colour. As the median space is darker than the rest of the wing, these spots are relieved and somewhat contrasting. Secondaries smoky gray, paler at base, fringes yellow at base; there is a dusky discal lunule and a blackish terminal line. Beneath powdery dull gray, primaries with a vague discal blotch, secondaries with a lunule and an exterior line.

Expands 1.25–1.60 inches = 30 to 40 mm. .

Habitat: Winnipeg, Manitoba, June and July (Hanham); Pullman, Washington (Piper).

A good series of specimens shows little variation save in the shade of the ground colour. In genital structure the insect resembles *desperata;* but in general appearance it is much more like *indirecta*, *mactata* or *divesta.*

Hadena (Xylophasia) Barnesii, n. sp.

In general appearance resembling *auranticolor*, and heretofore confused with that species. It is smaller, however, in average expanse, much paler and less red in ground colour, and altogether a more sordid, less brilliant species. The violet shading in the s. t. space of the old species is replaced by gray or whitish in the new form, and the secondaries are of a dull, even smoky gray, without a trace of yellow or red in the ground or whitish at the base. All the markings are present on the primaries, less strigate and better defined than in *auranticolor;* but without preceding dashes to the W, or interspaceal streaks in the terminal space.

Expands 1.50–1.68 inches = 37–42 mm.

Habitat: South Dakota (Truman); Glenwood Springs, Colorado, in September; Yellowstone Park, Wyoming (Dr. Barnes).

A series of seven specimens has been compared with a similar number of *auranticolor* before the species was decided to be distinct. There is no difficulty in separating the two forms, but it is not so easy to localize the differences. The much duller primaries and the very evenly dark secondaries are the most obvious features.

The sexual parts of the male are disproportionately small, but of the same general type as in *auranticolor.*

Hadena (Xylophasia) dionea, n. sp.

Ground colour an even, obscure fuscous gray without contrasts. Head with a dusky frontal line, collar with a blackish, central line, patagiæ with a black submargin. Abdomen mouse gray. Primaries with all the maculation present, but obscure. A short black basal streak. Basal line geminate, smoky, marked on the costa only. T. a. line geminate, smoky, incomplete, outwardly curved, and with small outcurves in the interspaces, marked by an oblique black streak on the inner margin. T. p. line geminate, very even, well out-curved over the cell, but only a little indrawn below; inner portion blackish, narrow, interrupted; the outer punctiform and sometimes obsolete. S. t. line paler, broken, very vague, with a W reaching the outer margin, preceded by a series of blackish spots or shadings, which may be in part or altogether obsolete. A series of smoky terminal lunules. Ordinary spots concolorous. Claviform well defined by a narrow black line, extending across the median space to the t. p. line, or connected with it by a black shade. Orbicular moderate or large, varying somewhat in form, with a smoky, often incomplete, outline. Reniform large, upright, well defined at the sides only. Secondaries evenly mouse gray, the fringes paler. Beneath smoky, powdery, with a common outer line and discal spots on all wings.

Expands 1.40–1.60 inches = 35–40 mm.

Habitat: Volga, South Dakota (Truman).

This is the species which I called *idonea*, Grt., in my revision of the species of *Xylophasia*, Proc. U. S. N. M., XIII., 438, 1890, and credited from Mr. Grote's original description to Texas, Arizona, and Wisconsin. The species resembles *cariosa* in general type of maculation, but is entirely even in ground colour, and, as I pointed out, unquestionably good. I found when studying the genus originally that there were three allied forms generally mixed under *cariosa.* I separated the most intensely marked species, resembling *verbascoides* as much as it did *cariosa*, under the name *nigrior;* from specimens named by Mr. Grote I identified the form here described as *idonea.* Later I had an opportunity of comparing the Guenée and Grote types directly in the British Museum, and found, to my surprise, that both names were applied to one species. Comparing the two original descriptions, it will be seen that Guenée had a specimen distinctly shaded with reddish, while Mr. Grote had one in which this was replaced by a dirty luteous gray.

The present name is based on four males in rather bad shape, received from Mr. P. C. Truman; but I have seen others sufficient to indicate that there is very little variation.

Hadena (Luperina) virguncula, n. sp.

Ground colour dull reddish gray. Thoracic vestiture interspersed with gray hairs, giving it a hoary appearance; no markings. Primaries without contrasts, median space a little darker above the middle, terminal space evenly dusky, s. t. space dusky on the costa. Basal line indicated by a few black scales. T. a. line geminate unusually far from base, outer defining line blackish, inner scarcely traceable, except for the somewhat paler included shade, outwardly oblique, irregularly outcurved in the interspace, and reaching the inner margin at about its middle. T. p. line geminate, not much out-curved over the cell, and only a little in-curved below ; inner defining line blackish and partly lunulate, outer even smoky, broken and almost lost below vein 3. S. t. line very even, of the ground colour, defined by the darker terminal space and a dusky preceding shade. A series of black, small, terminal lunules. Orbicular barely indicated by a few blackish scales. Reniform large, upright, subquadrate, as a whole paler than the ground colour, so as to be relieved and somewhat prominent. Secondaries smoky, fringes whitish. Beneath smoky with pale powderings, a common outer line, and on secondaries with a discal spot. Vestiture of the legs and breast with a reddish tinge.

Expands 1.60 inches = 40 mm.

Habitat : Garfield Co., Colorado, 6,000 feet (Bruce).

A single female which has been awaiting a mate some ten years or more. The species has the wing-form and general habitus of *passer*, Gn., but it is unlike any of the forms of that variable species. It has scarcely a trace of a claviform, and the complete neatly defined s. t. line, and very oblique irregular t. a. line, will serve as further distinctive features.

Hadena allecto, n. sp.

In maculation almost like *mactata*, all the observed differences being well within the range of variation ; but without a trace of the reddish or brown shadings of the old species ; all is black and gray. The median space is the darkest part of the wing, the ordinary spots being very large and of the paler ground, save for a central filling in the orbicular.

Expands 1.40 inches = 35 mm.

Habitat : Calgary, Sept. 17 (Dod) ; Brandon, Manitoba (Hanham); Volga, So. Dakota (Truman).

Six specimens, representing both sexes, are before me, and do not vary a single mm. in expanse. I considered them for a long time as a local race of *mactata*, and so named them for my correspondents who have other specimens of this species. In actual ornamentation there is no appreciable difference, but the difference in colour is constant, and the genitalia of the male confirm the distinctness of the more western form, though the general type is the same.

Hadena catalina, n. sp.

Ground colour a pale reddish luteous, more or less powdered with leaden gray, which, on the primaries, may darken all save the median space, and strongly mark even this. Basal line geminate, leaden gray, reaching into the submedian interspace. T. a. line blackish, geminate, outwardly oblique and slightly out-curved in the interspaces. T. p. line blackish, geminate, inner portion narrow, crenulate, outer punctiform, the black being followed by white dots; as a whole slightly and evenly bisinuate. S. t. line pale, irregularly sinuate. A row of small blackish terminal lunules. Fringes dusky, with a pale line at base, and cut with pale. A vague leaden gray median shade is marked on the costa between the ordinary spots, is lost in the reniform, but sometimes reappears below, running close to and parallel with the t. p. line to the inner margin. Claviform small, outlined by gray scales; evident in all specimens. Orbicular moderate, rather irregular, outlined in blackish and with a leaden gray centre. Reniform large, oblique, a little constricted centrally, black ringed and filled with blackish, forming the most prominent feature of the ornamentation. Secondaries with a smoky shade which darkens outwardly; a dusky discal lunule, and a narrow median line; fringes yellow, with a smoky interline. Beneath paler, powdery; the wings darker outwardly, both pairs with discal spots and outer dusky lines. Head and thorax immaculate, or the collar may have a leaden gray central line and the patagiæ a blackish submargin.

Expands 1.12–1.28 inches = 28–32 mm.

Habitat: Catalina Springs, Arizona, April 8–12.

Five specimens from the U. S. National Museum, collected by Mr. E. A. Schwarz. In wing-form the species resemble *mactata*, and the secondaries are distinctly excised below the apex. The ground colour and the contrasting dark reniform give a resemblance to certain forms of *Mamestra* allied to *trifolii*, and there is nothing in *Hadena* with which this species is likely to be confused.

The male genitalia are simple; the harpe is enlarged at tip, oblique, inwardly fringed with spinules; the clasper is stout, moderate in length, not much curved, and blunt at tip.

Of the locality above given (not to be found on any map), Mr. Schwarz says it is "a small spring at the foot of the Sta. Catalina Mountains, 15 or 16 miles north-west of Tucson, and about 2,900 feet above sea level; situated within the giant Cactus forest, directly above the region of *Larrea mexicana*."

Hadena pausis, n. sp.

Ground colour powdery fuscous gray or brown. Head a little paler, with a darker frontal line. Collar with a broken dusky central shading, patagiæ with a blackish submargin. Primaries with all the usual markings present, but broken and not contrasting. A curved black streak in the submedian interspace, from the base to the t. a. line, is the most prominent feature of the wing. Basal line geminate, broken, brown, reaching to the black streak, and within this is the palest part of the wing. T. a. line geminate, blackish, broken, a little out-curved in the interspaces, and moderately out-curved as a whole. T. p. line geminate, blackish, very even; outwardly oblique from costa to vein 6, then forming between 5 and 6 an almost right angle, and nearly evenly oblique from that point to the inner margin. S. t. line pale, very irregular and obscure; broken and scarcely traceable in some specimens. A crenulated, black terminal line. Fringes interlined with blackish. Little dusky rays are sent into the terminal space on the interspaces. A blackish or black quadrate spot connects s. t. and t. p. line in the submedian interspace, and a similar connection may be made by a narrow black line opposite the cell. Claviform large, extending more than half way across the wide median space; outlined in blackish, else concolorous. Orbicular irregular, moderate in size, outlined in blackish, brown centred. Reniform narrowed above, dilated below, and constricted in the centre; oblique, outlined in black and with a blackish central shade. A vague median shade is traceable on the costa only. Secondaries smoky, paler at base, with a vague discal lunule. Beneath dark gray, powdery, with a common outer line and a discal lunule on all wings; but all this may be wanting, and the wings be evenly powdered.

Expands 1.2c–1.40 inches = 30–35 mm.

Habitat: Los Angeles County, California, in June (Coquillett); San Francisco, Cal.

This species belongs to the *binotata* series, and agrees with it in wing-form. The primaries have the outer margin a little toothed; the secondaries are excised below the apex. In the eight specimens before me there is little variation, the only obvious features being the black basal streak and, to a less extent, the black patch in the s. m. interspace connecting the t. p. and s. t. lines.

The genitalia of the male are somewhat complex. There is an oblique triangular patch at the tip of the harpes densely set with spinules, and there are two claspers, both of them stout, curved and obtusely terminated.

Hadena ethnica, n. sp.

Ground colour an even, dark, smoky brown. Head and thorax immaculate. Primaries with all the usual markings present, but so slightly relieved that at first sight they seem altogether wanting. Ordinary lines geminate, marked on the costa by pale spots which form the only visible contrasts. T. a. line nearly upright, feebly out-curved in the interspaces. T. p. line punctiform, the points being followed by minute white dots, very evenly bisinuate. S. t. line irregular, marked by scattered white scales, and by a very slight difference between s. t. and terminal space. A series of evident terminal lunules. Claviform very short and broad. Orbicular rather large, round, darker filled. Reniform large, upright, a little constricted centrally, with a somewhat darker filling. Secondaries smoky brown, with a coppery tinge and a dusky terminal line. Fringes yellow at base, and tipped with whitish. Beneath smoky brown, powdery, secondaries with a darker discal spot.

Expands 1.80 inches = 45 mm.

Habitat: Yosemite, California; emerged July 23rd, 1891, from a larva on Manzanita.

This is an overgrown species of the *binotata* series. The fringes on both wings are unusually long, on the primaries just a little scalloped, on the secondaries distinctly excised below the apex. The size and inconspicuous markings should separate it without difficulty from its allies.

The male genitalia are very simple; the harpes subparallel, tip oblique and fringed with spinules, clasper moderate in length, slender, curved and acute at tip.

Hadena laetabilis, n. sp.

Head and thorax dull brown, immaculate, save that the tips of collar, edge of patagiæ and dorsal tuftings are sprinkled with bluish. Abdomen pale mouse gray, with a brown tuft on the basal segment. Primaries, median space smoky brown, basal and s. t. spaces a light sapphire blue, appearing almost transparent in fresh specimens, markings brown. Basal line brown, marked on the costa only, this region being more or less brown powdered to the t. a. line. There is also a brown powdering at the inner margin in some specimens. T. a. line marked by the difference in colour between basal and median space, nearly upright to the submedian vein, then with a long out-curve to the inner margin. T. p. line single, black, lunulate, outwardly curved on the costa and over cell, slightly in-curved below. S. t. line visible as a slender blue thread through the brown costal region, then lost in the blue of the s. t. space, this tinge extending to a series of submarginal blackish lunules, and beyond them to the slender dark terminal crescents. Fringes brown, with narrow yellowish interlines, and cut with whitish. Claviform small, black margined, concolorous, a blackish shading extending toward the t. p. line. A slender brown median shade line is marked on the costa, and is again traceable below the reniform, running close to and parallel with the t. p. line. Orbicular moderate or small, contrasting blue, centred with brown. Reniform large, broad, a little constricted centrally, somewhat indefined above and below, blue and contrasting. Secondaries whitish, with a slender, smoky extra-median line, and a broad, blackish outer margin. Fringes brown, with a yellow line at base. In one specimen with a vague discal lunule. Beneath, primaries smoky gray, powdery, with a blackish extra-median line, a pale or dusky spot marking the orbicular, and a yellowish lunule marking the reniform of the upper side. Secondaries white, yellowish toward and on costa, smoky at outer margin, with a narrow smoky outer line, and a dusky discal spot which may be absent.

Expands 1–1.20 inches = 25–30 mm.

Habitat: Santa Fé, New Mexico, July and August (Cockerell), Nos. 1657, 1827 and 3906.

Three male specimens of this very handsome species are at hand. It belongs to the series of which *Smaragdina transfrons* and *Bridghami* are examples, and when fresh is prettier than either. Unfortunately, the beautifully transparent blue dulls rapidly, and appears then like a thin wash of ultamarine over a layer of white. It cannot be easily confused with any other of our species.

The male genitalia are very simple; the harpes narrow obliquely to a somewhat acute tip, which has a fringe of spinules inwardly; the clasper arises from its middle, and is a slender, moderately long and only slightly curved hook.

Hadena viridimusca, n. sp.

Head and thorax brown, powdered with darker scales; head paler in front. Collar with a dark median line, sometimes paler than the thoracic disc. Thoracic tuftings distinct, the posterior paler and sometimes quite contrasting. Abdomen smoky; in the male the edges of the segments distinctly white-marked. Primaries smoky red-brown, more or less overlaid by mossy yellow-green scales which normally fill the basal, terminal and part of the s. t. space, the centre of the ordinary spots and patches in the median space. Basal line evident, geminate, defining lines not well marked, included space pale and sometimes white-marked. T. a. line geminate, upright a little irregular, defining lines incomplete and not well marked, included space white, forming a somewhat prominent patch on the costa and extending inward a little on the inner margin. T. p. line geminate, not well defined, broken, out-curved over the reniform, then almost upright, included space more or less marked with white scales, especially in the costal region. S. t. line very irregular, marked by the contrast between the mossy powdering of the terminal and darker shading of the s. t. spaces. A series of blackish terminal lunules, followed by a series of pale or yellowish blotches at the base of the fringes and opposite the termination of the veins. A median shade line is traceable below the reniform. Orbicular small, round, black ringed, green centred. Reniform upright, moderate in size, incompletely outlined, a little constricted centrally. Claviform extending half way across the median space, outlined by black scales, yellow-green filled, and this greenish shade is usually continued beyond the spot across the median space. Secondaries deep smoky-brown, hardly paler at the base, fringes with a pale line at the base. Beneath gray, powdery, outer margins paler; with a common extra-median line and a black discal spot on all wings. Primaries with a whitish cloud on the costa at the inception of the extra-median line.

Expands 1.05–1.12 inches = 27–29 mm.

Habitat: Columbus, Ohio; VI., 20; VII., 9, at sugar (N. W. Tallant); Texas, V., 16 (Belfrage); New Jersey.

Four specimens, 2 males and 2 females, are at hand, and I have seen others. The species is allied to *miseloides* in appearance, but is smaller, with much narrower, stumpy wings. It is, perhaps, nearer to *marina*, with which I tried hard to identify it, but is not so bright as that species, the fringes are even, and the form of the primaries is different. The variation consists partly in the amount and intensity of the mossy green, which fades to yellow in old examples, and partly in the prominence of the white filling of the ordinary lines.

A NEW PLAGODIS.

BY HARRISON G. DYAR, WASHINGTON, D. C.

Plagodis approximaria, n. sp.

Fore wings dark ochreous, paler about the faint purplish cloud that rests on internal margin; a cluster of blackish strigæ in centre of basal space on internal margin and a larger cluster in the black cloud; otherwise the ground colour is without strigæ. T. a. and t. p. lines slightly curved, broad, somewhat clouded, nearer together than usual, blackish brown, the t. p. line the more distinct. Hind wings paler, largely overspread by a purplish shading that extends from a large cluster of dense blackish strigæ at inner angle. Thorax ochre, purplish in front and on the head. Expanse 50 mm.

Two males, Portland, Oregon, April 23rd, 1892. U. S. National Museum, type No. 4110.

SYNOPSIS OF SPECIES OF PLAGODIS.

Notch at inner angle of primaries nearly like the subapical excavation, so that the outer margin looks produced centrally.

  Pale yellow, t. p. line diffuse, sinuate, shaded below; other lines obsolete.................... ....*serinaria*, H.-S.

  Ochreous, strigose, t. p. line distinct, straight, t. a. line fainter; discal dot a ring..................................*alcoolaria*, Guen.

Notch at inner angle pronounced, the margin looking straight with a notch below.

  T. a. line very faint and diffuse or absent.

    Fore wing straw colour, notch moderate.

      T. p. line present, not obscured.

        No large purplish cloud beyond t. p. line; at most some strigose markings.. ...... *fervidaria*, H.-S.

        A purplish cloud beyond t. p. line..*keutzingaria*, Pack.

      T. p. line absent, lost in a large purplish cloud that reaches middle of wing....................*nigrescaria*, Hulst.

    Fore wing cinerous clay colour; notch large.*emarginaria*, Guen.

  T. a. line if faint, not diffuse; usually distinct.

      T. a. and t. p. lines remote, narrow and discreet; hind wings usually with a narrow submarginal line ....*phlogosaria*, Guen.

      T. a. and t. p. lines approximate, rather broad and a little clouded; hind wings without any line, a strigose cloud at inner angle...... ....*approximaria*, Dyar.

A NEW DACTYLOPIUS (FAM. COCCIDÆ) FROM ARIZONA.

BY T. D. A. COCKERELL, N. M. AGR. EXP. STA.

Dactylopius hymenocleæ, n. sp.—♀. Black when dry, entirely covered and concealed by the firm snow-white ovisac, forming a rounded mass about 4 mm. diam. These masses are adherent to one another, forming very conspicuous white cottony balls on the plant, having a diameter of from ten to twelve mm. The surface of the ovisac is rough, but not at all ribbed. The female, boiled and flattened under a coverglass, is oval, about 4 mm. long. After being boiled in caustic soda, soaked in alcohol, and mounted in balsam, the insect is found to exhibit two different pigments: one a pale magenta, the other a dark bluish green. Skin with very numerous small circular glands, and a good many rather large dagger-shaped spines, in the caudal region. Legs and antennæ pale brown; legs fairly stout; coxa 99. Femur with trochanter 144, tibia 72, tarsus with claw 60 μ; claw digitules slender, with a very small knob; claw with a minute denticle on the inner side just before the tip; antennæ 7-segmented, the segments measuring as follows in μ:—(1) 28. (2) 25–30. (3) 23–25. (4) 23–31. (5) 15–19. (6) 24–28. (7) 59–64. Embryonic larva large.

Hab.—On *Hymenoclea monogyra* in the river bottom, about six miles from Tucson, Arizona; collected three years ago by Prof. J. W. Toumey. I learn from Prof. Toumey that he had partially described this interesting species; but he has mislaid his MSS., and has no time at present to attend to the matter, so he has asked me to publish a description.

D. hymenocleæ is evidently related to *D. filamentosus*, Ckll., by its 7-segmented antennæ, its bluish-green pigment, and its manner of collecting in globular masses on the plant. The legs of *filamentosus* are larger (coxa 120, femur with trochanter 177, tibia 90, tarsus with claw 75 μ); and the denticle on the inner side of the claw, instead of being almost at the tip, is about half way between base and tip, and is quite large.

D. filamentosus has a large anal ring, with very large bristles upon it, and the region around it, while presenting a good many circular glands, does not have the dagger-shaped spines.

I will take this opportunity to record that Prof. Toumey sent me *Lecaniodiaspis rufescens* (Ckll.), collected at Tucson on *Fouquiera splendens*. I now consider this to be a valid species, distinct from *yuccæ*, as many specimens from various localities preserve the distinctive characters.

IN RE SPILOSOMA CONGRUA, WALK.

BY A. RADCLIFFE GROTE, A. M., ROEMER MUSEUM, HILDESHEIM, GERMANY.

In reference to the present controversy my testimony is as follows: I examined, in 1867, Mr. Walker's material. This represented a form unknown to me, undoubtedly a *Spilosoma*, not a species or form of *Hyphantria*. I was so struck with this that I drew up a description and carefully compared the palpi and antennæ. From these and the slightly larger size, I felt confident that it was a *Spilosoma* unknown to me at the time. The description is published in Trans. Am. Ent. Soc., 1868, but I have no copy, unfortunately, at this writing, of the paper. My memory is vivid that I compared it with *Hyphantria cunea*, and it was not that species nor any form of it. I conjectured even, at the time, that the material might be European with a wrong locality, so dissimilar was it from *S. virginica* or *S. latipennis*, the latter form being known to me from Stephen Calverley's collections from Long Island before, long before, its description by Stretch. Years afterwards, Dr. Thaxter sent me specimens from the East, which I at once recognized as *S. congrua* from my memory and my notes. These specimens belonged to *S. antigone*, which I set down accordingly as a synonym of *S. congrua* in the pages of the CANADIAN ENTOMOLOGIST.

There is, finally, one point to which I call attention. In 1867 Mr. Walker was arranging the collection. I directed his notice at the time to the fact that he had quite often mixed up different species under one name. It may be, then, that there were two species under *congrua*, but I think not. Mr. Walker adopted, at the moment, some of my suggestions, but the time was too brief to allow me to overhaul the whole of the American material, about which, as a whole, I knew besides, at the time, too little. But I knew *Spilosoma* and *Hyphantria* sufficiently as to give my determination weight. Now, it is a fact that Mr. Butler sorted over the collection, and as to this work Prof. Smith's Cat. No. 44 gives us, incidentally, valuable information. And it is a fact that I found in the Noctuids, in 1867, more mixing of species than comes out after Butler and Smith's sorting and taking or fixing of Mr. Walker's types. This was done without sufficient study of Mr. Walker's text in the B. Mus. Lists. Mr. Walker's material bore no type label; it was in 1867 (and, I think, again in 1880) simply stuck above the printed name, cut out of the B. M. Lists, as I remember. Misidentifications of Walker's description or determination occur in the genera *Apatela*, *Hadena*, *Mamestra*, *Hypena*, etc. See my papers in the CANADIAN ENTOMOLOGIST and in the Proc. of the American Philosophical Society.

BOOK NOTICE.

THE PSYCHICAL POWERS OF ANTS.*—By E. Wasmann, S. J.

In this folio volume of 135 pages, which appears as "Zoologica, Heft 26," the author has given us his 95th contribution to the knowledge of guests and parasites of the ants and termites. As the title shows, the work is of a philosophical nature and deals with the mental side of ant-life, being in the main concerned with a refutation of the theory recently advanced by A. Bethe, who ascribes to ants and other invertebrates in general, no higher psychological rank than that of mere "reflex-machines."

The introduction reviews in brief the views of various earlier writers on the subject, and indicates the author's position, in that while rejecting Bethe's reflex theory, he also avoids the tendency exhibited by many naturalists to ascribe to ants powers of mind approaching those of man. Next follows a chapter devoted to an analysis of Bethe's theory, and showing Dr. Wasmann's reasons for the rejection thereof. In this connection the author writes: "It appears to me a reliable criterion that the animals concerned are not mere reflex-machines, but are guided, at least in the higher activities of life, by sensory perception and sensation on a foundation of inherited instinct is to be found in this: the possession of special sense organs in combination with a central nervous organ, as well as their manifold and suitable employments through which the animal turns impressions from the outside to use in the necessities of its life."

The succeeding chapter considers the question, "How do ants know one another?" And here much evidence is brought forth to show that the recognition is due to sensory perception, and is not automatic. The antennæ (especially the tips) are concerned in the discrimination, and Dr. Wasmann agrees with Forel that the detection of odour is very largely depended upon therefor. The subject next approached is "How do ants find their way?" Reference is made to the well-known fact that with many species a definite path is followed during journeys to and from the hunting-grounds, while in other species the wanderings are made much at random. Not only are ants able to follow their paths, but they also discern the direction in which the trail leads; *i. e.*, if it is running towards the nest or from it. Bethe has advanced his theory of the

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*Die psychischen Fahigkeiten der Ameisen. Von E. Wasmann, S. J. Stuttgart, Erwin Nagele, 1899.

"polarization of the scent" to explain the objective difference between the going and the returning tracks, without (says Wasmann) telling us in what manner it is subjectively perceived by the ants. This theory is attacked by Dr. Wasmann on the ground of its inapplicability in some instances and contradiction in others. He declares that the phenomena may be explained in a much simpler way by assuming a different form of the scent which marks paths leading in different directions. He further ascribes sensory sensations and powers of impulse to these insects in order to account for their voluntary actions. His account (pp. 31 and 32) of *Formica sanguinea* taking a short cut from one nest to another, instead of following the ordinary path, is very suggestive of a true sense of direction. Some visual perception of changes in their paths is perhaps indicated by the observations recorded a few pages farther on.

Can ants see? The treatment of this query is masterly, and it is impossible to do the author justice in a short review. After showing that those ants which, like *Formica*, have well-developed compound eyes, are possessed of good visual powers, and the ability to use their visual images in various emergencies, he compares them with some other genera, such as *Solenopsis (S. fugax)*, where the eyes, being composed of but four or five facets, are of much less sensitivity, though by no means insensible to light. Now is brought in a very pretty side issue, which bears, however, on the main question, namely, that those guests of the mimicry type which live with ants having well-developed eyes, copy their hosts in a different way from those which dwell among small-eyed forms. Among the large-eyed ants the mimicry by the guest begins in a resemblance of colour, followed by some likeness in build, this latter not extending to an actual copy of the details, but resting largely upon deceptive light reflections. Among guests of small-eyed or blind forms the mimicry begins with a resemblance in sculpture and vestiture, and this is succeeded by a likeness in build, which amounts to an actual similitude between the parts involved to the corresponding organs of the host; it culminates at last in the similarity of antennal structure between guest and host. These points are brought out in two lithographed plates. The conclusions to which they lead are these: In guests of such ants as can see well, the mimicry aims to deceive the sense of sight of the host; in guests of ants which are blind or nearly so, the mimicry aims to deceive the antennal sense of touch.

Regarding the powers of intercommunication, Dr. Wasmann not only contends that they possess these powers, but gives (on pp. 69 and 70) a scheme showing the signals which he has seen used to induce various activities. He holds that these actions point neither to an "intelligent understanding," nor to pure reflex action, but are sufficiently explained through sensory perception and the power of originating impulses.

The next chapter is of a controversial character, replying to the question, "What proof can be brought against our acceptance of psychical powers in ants?" The claim is made that Bethe has, without satisfactory knowledge of the facts and without exercise of necessary caution, set up his new reflex theory too boldly; and that this theory is unacceptable because of its innate indefensibility.

"The different forms of learning* in man and the animals" is the next subject treated. On the ground of biological facts, Dr. Wasmann recognized six divisions, as follows:

I. Independent learning.
  1. Through instinctive exercise of reflex action.
  2. Through sensory experience, by means of new associations of ideas presented thereby.
  3. Through sensory experience and the intelligent application of earlier conditions to new.

II. Learning through the influence of others.
  4. Through influence of the impulse of imitation.
  5. Through human training.
  6. Through intelligent instruction.

Regarding the above forms of learning, he makes, among others, the following generalizations:

In man alone are all six forms found. Other animals possess, according to the grade of their psychical development, either the first alone, the first and fourth, or the first, second, fourth and fifth.

In ants, as well as in the higher animals, the first, second, fourth and fifth are indicated. But the second and fifth forms are more highly developed in some other animals than in ants.

Only the third and sixth forms prove the possession of a real intelligence on the part of the learner. As these cannot be demonstrated in animals, no actual proof of animal intelligence is existent.

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*I can get no better rendering of "Lernens" than this.

The proposition set up by the modern school of animal psychology, that learning through individual experience is a criterion of intelligence, must therefore be condemned as untenable. It is also incorrect to make "learning through individual sensory experience" a criterion of psychical power.

A further discussion of evidence offered on the psychical life of ants occupies many pages. The fact is brought out that many of the most ordinary of their activities bear directly on the subject, while on the other hand numerous apparently intelligent proceedings may be referred to simpler factors. Dr. Wasmann concludes that ants are neither intelligent miniature men nor mere reflex machines, but are organisms possessed of the power of sensory sensations and voluntary action, and that their inherited instincts may be modified in many ways through sensory perception and circumstances of sensation, as well as through the influence of previously gained experience. An application of the Darwinian factors, he says, fails to explain the development of the relations between ants and termites and their respective guests. The fact that ants, in their symbiosis, often raise their worst enemies, is as irreconcilable with the Darwinian form of the theory of descent as with the acceptance of an animal intelligence.

A supplement follows, describing six new species of myrmecophilous Proctotrupidæ. At the request of many readers, the author has added a list of his published works on myrmecophilism and termitophilism, which counts up ninety-four titles, the present contribution being the ninety-fifth.

No student of ant-life or of comparative psychology should fail to read this memoir. It is to be hoped that it will serve to still further stimulate the study of the mental side of ants, and in this line of investigation it sets a model of careful observation and cautious conclusions.

H. F. WICKHAM.

Mailed September 8th, 1899.